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COUNTRY MONOGRAPH

THE DEMOCRATIC REPUBLIC OF THE SUDAN[1/]

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INTRODUCTION

The Sudan is the largest country in Africa. It lies between latitudes 21° 55'and 3° 53'North and longitudes 21° 48' and 38° 31' East. The total area is about one million square miles.

The rain-fall varies from nothing in the northern desert region to over sixty inches in the Southern tropical mixed deciduous forests.

The Sudan has a population of about 16 millions (see table I). The demographic trend is a growth rate of 2.8% one of the highest in the world.

According to the First Population Census 1955/56, it was estimated the 86% of the population are engaged in primary production which includes agriculture, fishing, animal husbandry, mining and the gathering of forestry products. Their net output constituted some 42% of the Gross Domestic Product in 1969/70 of which agriculture and animal production represented 24% and 13% respectively. The bulk of the output, as in most developing countries, is foodstuffs intended for home consumption. About one-third of the agricultural products is industrial raw materials intended for processing either locally or abroad. Such products constitute 95% of the exports.

The average "per capita" income is about £S 36 (Sudanese pounds) which is about £ 43 sterling. This ranges from £S 6 in some parts of the country to about £S 170 in Khartoum.

I - Urban-Rural Distribution of Population :-

Like other developing countries, the Sudan is undergoing a gradual shift of population from rural to urban areas.

According to the First Population Census 1955/56, 8.5% of the total population by 1956 were living in urban centres (see table 2). At present the people living in urban centres account for about 12% of the total population and this might reach 14% by 1975/76. The Sudan is sparsely populated with an average density of 6 persons/Km2/.

Although the Sudan is not hugely urbanized as other countries (over 85% of the population are living in rural areas), but the degree of urban growth so far reached in urban centres has been sufficient to bring about all the typical problems which follow rapid urban development. The rate of growth (natural increase and internal migration) in major urban centres is given at 5.5% annually (see table 2). Due to this arises a need for more housing, for better housing. The cost of the social acceptable house is beyond the means of substantial numbers of the urban families, and as a result overcrowding (over 6 persons per household) and slums are quite common and in recent years squatter settlements have sprung up on the fringes of certain towns.

This steady growth of population in urban centres has resulted in adverse problems of housing shortage. This has resulted in the following: -

(1) Over-crowding in existing housing stock.

(2) Sharp rises in dwelling rents.

(3) Unauthorised squatter settlement.

(4) Overloading of existing public services and utilities.

(5) In Khartoum, for example, traffic problems and congestion are caused by bad relationship between place of work and of residence.

(6) The practice of low residential densities has resulted in horizontal expansion of towns making the cost of services high.

Under such circumstances, the Government had to take quick measures to solve this problem which was due to inefficiency of the administrative and technical staff and to shortage of necessary funds for housing and related facilities.

Table (1)

Population of the Democratic Republic of the Sudan
In Million Persons (Provisional Estimates) :-

	1964/65	1965/66	1966/67	1967/68	1968/69	1969/70	1970/71	1971/72	1972/73	1973/74	1974/75
Provinces:-											
1. Bahr El Ghazal	I.243	I.280	I.316	I.352	I.393	I.427	I.463	I.499	I.537	I.575	I.615
2. Blue Nile	2.748	2.330	2.910	2.989	3.080	3.156	3.235	3.316	3.398	3.483	3.570
3. Darfur	I.475	I.519	I.562	I.604	I.650	I.694	I.735	I.779	I.825	I.869	I.916
4. Equatoria	I.135	I.169	I.202	I.234	I.270	I.305	I.336	I.369	I.403	I.438	I.474
5. Kassala	I.418	I.461	I.502	I.543	I.590	I.629	I.670	I.712	I.754	I.798	I.843
6. Khartoum	.764	.788	.809	.832	.855	.877	.899	.922	.945	.968	.993
7. Kordofan	2.448	2.521	2.592	2.663	2.746	2.811	2.882	2.954	3.027	3.103	3.181
8. Northern	.986	I.016	I.045	I.073	I.105	I.135	I.161	I.190	I.220	I.252	I.282
9. Upper Nile	I.115	I.149	I.182	I.214	I.250	I.282	I.314	I.346	I.380	I.415	I.450
Sudan - Total	I3.332	I3.773	I4.I20	I4.504	I4.938	I5.312	I5.695	I6.087	I6.489	I6.901	I7.324

Remarks :-

Growth Rate of 2.5% Annually. These are conservative estimates since the Statistics Department now estimates that this growth figure should be 2.8% and total population will be 16,300,000 persons by mid-1970.

Of Total Population of the Sudan:-

Table (2)

1. Rural +	II.992	I2.3I9	I2.628	I2.930	I3.278	I3.560	I3.847	I4.I37	I4.432	I4.73I	I5.035
2. Urban x	I.340	I.4I4	I.492	I.574	I.66I	I.752	I.848	I.950	2.057	2.I70	2.289

---

* + Growth Rate of 2.I% annually.

x Growth Rate of 5.5% annually.

Recently, a separate ministry was established to deal with the problems of housing and related environmental problems. Up till now no housing policy was drawn with the Five-year National Development Plan 1970/71 - 1974/75. This was due to lack of essential statistics such as :-

i) Housing component of the Gross National Product.
ii) Housing investment of gross fixed capital formation.
iii) Import content of housing building materials.
iv) Housing permits issued in different parts of the Sudan with information on housing starts and completions by year and value.

Drawing of a national housing policy is now underway.

The following information on the building plans and activities and future trends in the building sector is taken from the "Report on a Housing Policy for Sudan" by Donald R. Hanson - Inter-Regional Adviser - Housing Policy, Programmes and low-cost construction (Centre for Housing, Building and Planning - United Nations - New York). This should be understood just as a prospective picture of what is going to happen in the Sudan in the next coming five years.

2 - Housing's Part in the Development Programme: -

An economic parameter which seems to hold around the World is that at least 5 per cent of the Gross National Product should be attributed to housing. Another parameter is that 15-20 per cent of the gross fixed capital formation should be invested in housing. The Gross National Product is estimated as £S 500 millions for 1970/71, housing's share of development should be about £S 25 millions, including the public and private sectors. Since the construction investment figures (as a part of capital formation) are determined by using data on imports and sales of building materials and using estimates of costs for traditional houses, and since the great majority of Sudanese houses (including those in the urban areas) are built from materials not passing through official markets. Therefore, calculation of the housing's part as 15-20 per cent of the gross fixed capital formation is assumed as an under-estimation until accurate statistics are obtained. So the 5 per cent of the GNP is used.

The £S 25 millions which should be allocated for housing should be allocated as follows:- (see tables 1, 2 and 3)

i) £S 13.780 millions are for houses in urban, semi-urban and rural areas;

ii) £S 4.596 millions are for land, services and infrastructure for housing;

iii) £S 2.664 millions are for maintenance of houses;

iv) £S 3.000 are for slum clearance and redevelopment;

v) £S 0.960 millions are for emergencies.

According to this it would be necessary to build by private and public means:-

15,994 urban and semi-urban units annually

47,833 rural units (of which about 4000 units will be built on agricultural estates.)

This gives a total number of 63,827 which are required in 1970/71 to meet population and urban growth.

So long for the last year only 12,000 units were distributed in urban and semi-urban centres for low-income groups and 2,000 units in eight major urban centres for high and middle-income groups.

Rural units were not included in last year's policy of the Ministry of Housing on the basis that farmers and nomads will automatically build their traditional houses. Th s of course has to be surveyed in the future to decide exactly what is invested in the housing sector.

Since up till now the housing policy was not put as part of the National Development Plan 1970/71 - 1974/75, the public sector has no share in housing. Only 50 thousands Sudanese pounds are alloted annually for the Ministry of Housing (see table 4(a)) to draw up maps of urban and rural housing construction as well as carrying out research work on selecting new methods of house design and new techniques of building construction and new building materials. The estimates of capital investment of the private sector for the same period is shown on table 4 (b).

Table 3

Annual Increase in Persons Over the Previous Year

	1970/71	1971/72	1972/73	1973/74	1974/75	1975/76
TOTAL	383,000	392,000	402,000	412,000	423,000	433,000
Rural	287,000	290,000	295,000	299,000	304,000	307,000
Urban	96,000	102,000	107,000	113,000	119,000	126,000

HOUSING NEEDS BASED ON THE ANNUAL INCREASE IN HOUSEHOLDS OVER THE PREVIOUS YEAR

TOTAL	63,827	65,333	67,000	68,667	70,500	72,167
Rural	47,833	48,333	49,167	49,833	50,667	51,167
Urban	15,994	17,000	17,833	18,834	19,833	21,000

Urban household size is now 6.8 persons per household due probably to increasing over-crowding. However, for this analysis, 6.0 persons is used on the assumption that if this number of houses were actually built, overcrowding would be decreased.

Table 3 (Cont.)
Household Income Group.

At 2 X Average increase

Housing Needs & Cost based on population and Urbanization Growth

£s./Year	No. of Households %	Aver House Cost £s.	1970/71 No. of Units	1970/71 Total Cost	1971/72 No. of Units	1972/73 No. of Units	1973/74 No. of Units	1974/75 No. of Units	1975/76 No. of Units
URBAN (1)									
0-200	28.30	200	2,420	0.484					
200-300	25.06	500	2,064	I.032					
300-500	24.47	800	2,015	I.6I2					
500-700	I0.45	I200	826	0.99I					
700-4000	III.72	4000	929	3.7I6					
SUB-TOTALS	I00.00	—	8,254	7.833	8,760	9,200	9,720	I0,2I0	I0820
SEMI-URBAN (2)									
0-200	49.48	I00	3,830	0.383					
200-300	22.3I	500	I,730	0.865					
300-500	I7.6I	800	I,36I	I.089					
500-700	5.42	I200	4I9	0.503					
700-4000	5.I8	4000	400	I.600					
SUB-TOTALS	I00.00	—	7,740	4.440	8,240	8,633	9,II4	9,623	I0,I80
SUB-TOTAL URBAN			I5,994	I2256	I7,000	I7,833	I8,834	I9,833	2I,000
RURAL									
0-200	6I.9I	50	39,I90	I.960					
200-300	II.II	250	5,3I0	I.328					
300-500	5.66	500	2,700	I.350					
500-700	0.78	I200	375	0.450					
700-4000	0.54	4000	258	I.032					
SUB TOTALS	I00.00	—	47,833	6.I20	48,333	49,I67	49,833	50,667	5I,I67
TOTALS	I00.00	—	63,827	I8.333	65,333	67,000	68,667	70,500	72,I67
MAINTENANCE	I00.00	—	2,I89,000	2,664					
GRAND TOTAL	I00.00	—		2I,040					

(1) I4 towns of 20,000 persons more total 5I.6% of total urban population - 750,590 persons in I967.
(2) 80 semi-urban areas, of which I2 are not defined as towns, the smallest having 400 persons =703,960 persons is 48.4% of total urban population.

Table 4(a) Capital Investment of Public Sector for 1970/71 - 1974/75

(Unit £3 thousand)

	Total	65/66	66/67	67/68	68/69	69/70	total	70/71	71/72	72/73	73/74	74/75
Ministry of Housing	50	-	-	-	-	50	250	50	50	50	50	50

Investment are allotted for drawing up maps of urban and rural housing construction as well as for carrying research work on new types of house design and building materials and techniques of construction.

Table 4(b) Estimates of Capital Investment of the Private Sector for 1970/71 - 1974/75 (Provisional Estimates)

(Unit £3 Millions)

	Total	1965/66	66/67	67/68	68/69	69/70	Total	1970/71	71/72	72/73	73/74	74/75
Housing	70.80	8.66	8.86	14.24	19.54	19.50	78.8	15.8	15.8	15.6	15.8	15.8

This table was extracted from the five year development plan 1970/71 - 1974/75

3 - Population Growth and Urbanisation :-

Population Growth is, of course, the greatest influence on housing demand, while urbanization influences the kind of houses that are built (according to building codes in urban areas which require certain standards of construction).

Tables 1, 2 and 3 are used for estimating the housing needs of Sudan. These tables indicate the scope of housing within development.

At this stage of development most of the investment is directed to industry, and although no housing policy has been drawn but a great part- of the investment in the building sector would be directed to the housing sector. Due to population growth and urbanisation, the demand for houses would increase annually. It is for the government to decide on the housing share of the Gross National Product and take its part in solving the severe housing problems. This situation is due to the weakness of necessary statistics for establishing a housing policy in the Sudan, it is fortunate that good steps are taken now to improve this.

4 - Housing Finance:-

One of the problems for solving the crucial housing shortage are funds. Another related problem is the lack of institutions facilitating flow of funds to all income groups.

It is undoubtful that how poor the families are, nearly they are all contributing to the National income. As I said before that 86% of the population are engaged in primary production which includes agriculture, livestock, forestry and fisheries and contribute about 42% or more of the Gross National Product and 95% of all exports; yet, such families have little access to 80% of the funds which are invested annually in housing.

With reference to paragraph 2 of this monograph in which the £S 25 millions would be allocated to housing it would be the government's responsibility to try to channel these funds to the families of different income groups. According to this it is estimated that two-thirds of all funds would go into urban and semi-urban housing. As for high-income or "luxury" houses (£S 1,400 - £S 12,000), this would possibly be limited to about 929 units in all the urban centres, 400 units for semi-urban areas and 258 units in rural areas for professional staff

and managers. This should be limited not only to the lack of funds but also because high-cost houses use a higher percentage of imported building materials than low-cost houses.

The Sudan has a Housing Bank (The Sudanese Estates Bank). At present, the Bank handles about 300 - 400 loans a year, having about £S 3.05 millions outstanding, but has over 2,000 loan applicants in the Three Towns Capital (Khartoum, Khartoum North and Omdurman) of the country alone. The Bank could also have other branches throughout the Sudan. The Bank channels funds to low and middle-income families. Due to lack of funds, it could not help so many families. To solve this problem, the Bank should attract some funds which are already invested in the housing sector by private sectors and other institutions. This would interest such investors, because they could invest some of their funds in housing, a capital-appreciating and relatively safe sector, without being directly concerned with the special problems of collection of repayments of loans, etc. Instead the job of housing loans and repayments are placed in the hands of a specialised institution (The Estates Bank).

Another alternative is by establishing credit unions or similar saving institutions in places of work where Sudanese employees are paid by wages, there are about 280,000 persons in this category, these savings could be deposited in the Estates Bank. Other techniques of channelling funds could be applied.

Self-help housing as a non monetized form is adopted now in replanning projects. This is mainly applied in the town of Port Sudan which is the only port of the country and one of the major urban centres. The scheme was intended to replan 7 distinct squatting districts (known as Deims). In these 7 districts around the town live 60,000 squatters (out of about 120,000 which are the estimated population of Port Sudan in 1970). So far two of these districts were replanned and their 16,000 inhabitants were rehoused on a self-help basis. The experience gained from them would be adopted in replanning the other districts on the same basis. Work is still progressing successfully and the people are co-operating enthusiastically with the authorities in solving their problems. Similar projects on different parts of the Sudan could be solved on the same basis which proved to be successful. The project of Port Sudan has been successful, because the people were building in

temporary building materials (timber) so that it was easy to transport them to the new site. After the project was finished the people started to improve their houses by building part of them in the same materials they had and part in hollow cement blocks. If the government could give these people loans these projects could be solved by industrialization of small components. There are similar large housing schemes around large agricultural schemes which were executed recently e.g. Suki agricultural scheme in the Blue Nile Province. This scheme is attracting so many farmers and workers which need housing facilities.

In the coming three or four years the government will face the problem of resettlement of the southern refugees village in the Southern Provinces "locally called peace villages".

5 - Building Materials :-

It is undoubtful that no housing project could be executed successfully without the adequate supply of the necessary building materials in the local market. It was estimated (according to the Department of Statistics "Population and Housing Survey") that the cost of the building materials is about 65% to 75% of the total cost of houses.

According to the "Sudan National Income Statistics for the year 1961/61", the estimated investment in houses built in the different regions of the Sudan for the period 1959/60 - 1963/64 is about £S 20 millions annually; and out of this total the building materials cost about £S 14 millions. This investment is bound to increase according to increase in urbanisation, population growth, building maintenance, and urban and slums renewal, etc. (see table 5).

According to the series of reports by the Department of Statistics "Population and Housing Survey", the estimated number of houses built in mud or lesser-durable materials; is about 85% of the houses in 5 of the major towns of the Sudan (Khartoum, Khartoum North, Omdurman, Atbara, Kassala and El Obeid). The total number of houses in these 5 towns is estimated to be 102 thousand houses. The total number of buildings in mud and lesser-durable materials for other regions of the country "mainly rural and semi-urban" is estimated to exceed 95% of the total other buildings (tables 6 and 7) show building materials per centage used in houses in 8 major towns of the Sudan.

This shows clearly the need for building materials and its importance as a component of a successful housing policy and its effect on any planning for economic development. This is shown clearly by the fact that; the estimated investment in building materials (£S 14 millions) is 20% of the total investment of the private and public sectors in housing and this may rise to 30% if we consider other sectors of the building industry. (i.e. civil engineering projects, etc.)

Housing uses 30% of all building materials and even more important it uses more local materials than any other building activity. In the Sudan it was estimated that about 40% of all materials used in modern urban housing are imported. This is a very high percentage (see table 8(a) for the estimated amount of imported building materials for the period 1961 - 1965.

Table 5 Est. Investment in buildings and engineering constructions in the period 1959/60 - 1962/63 (extracted from table I-3 Sudan National statistics 1961/62 by the Department of Statistics).

(UNIT £S) Millions

I T E M	1959/60	1960/61	1961/62	1962/63
Investment in high-income Luxury buildings	14.270	15.230	18.420	20.880
Investment in low-income traditional buildings	2.340	2.410	2.490	2.570
Investment in civil engineering projects (eg. dams, roads etc..)	6.590	9.250	11.190	20.295
TOTAL INVESTMENT	23.200	26.890	32.100	43.745

Table 6

Building Materials Used In Wall construction in
8 major towns of the Sudan

Town	Total number of houses	NUMBER OF HOUSES OF WHICH WALLS ARE BUILT IN :-				
		Straw	Mud	Red Bricks and Stone	Timber	Other
KHARTOUM	61,600	230	24,700	7,570	10	50
Omdurman	28,000	150	25,220	2,630	10,340	—
Port Sudan	15,930	1660	150	2,250	10	2,030
Khartoum North	12,560	120	8,240	2,700	—	490
El Obeid	11,070	2,900	6,600	1,500	—	90
Kassala	11,030	4,530	5,560	660	—	90
Wad Medani	9,830	620	2,630	5,560	—	—
Atbara	8,000	040	6,360	1,500	—	—

Extracted from "Population and Housing Survey 1964/65"
Statistics Department.

Table 7

Building Materials Used in Roof Construction in 8 Major Towns of the Sudan :-

TOWN	Total number of houses	NUMBER OF HOUSES OF WHICH ROOFS ARE BUILT:-				
		* Traditional	Timber	Zink or asbestos	Reinforced concrete	Other
Khartoum	31,600	19,450	7,000	26,630	2,380	
Omdurman	28,000	21,880	5,360	360	370	—
Port Sudan	15,930	1,030	9,800	1,840	1,060	—
Khartoum North	12,650	8,200	2,660	1,200	430	2,200
El Obeid	11,070	7,230	280	2,350	120	70
Kassala	11,030	8,800	390	280	230	1,080
Wad Medani	9,830	5,550	2,920	710	370	1,330
Atbara	8,000	5,970	1,130	450	390	280
						60

** Traditional roof is built in mud and reed and straw.

Table extracted from " Population and Housing Survey 1964/65 "
Statistics Department.

Table 8(a)

Actual amount of import of essential building materials for the period 1961-1965 (extracted from Foreign Trade Statistics - Department of Statistics)

Quantity is in thousand tons
Total price is in £S thousand

Commodities	1961		1962		1963		1964		1965	
	Quantity	Total price	Quantity	Total price	Quantity	Total price	Quantity	Total price	Quantity	Total price
1- Rolled metal	18	806	50	1850	32	1261	86	1544	88.1	2029
2- Cement	72	435	210	1156	288	1553	337	1846	83	600
3- Sawn timbes	57	1145	77	1418	51	1739	48	1706	24.7	936
4- Asbestos sheets & pipes	6.4	223	5.9	220	16.4	419	36	2600	25	1100
5- Paints, glass, etc..	2.8	258	3.6	259	4.3	418	3.2	388	3.9	374

Although the Sudan is rich in mineral resources that coulb be used in building materials industry; no serious step has been taken so far. The building industry still depends on traditional local building materials and traditional construction techniques.

Modernization in construction methods and development in the production of local building materials could have an important impact on import substitution.

Although informations and statistics are very weak and scarce in the Sudan, I will try to give here the condition of raw materials in the Sudan and the possibility of the industry and production of building materials and try to outline and the difficulties facing the building materials industry.

6 - Raw Materials: -

a) Sand and Clay

Sand and clay are very widely used in buildings in the Sudan. Building in sand and clay and other lesser-durable materials constitutes more than 85% of buildings in the major towns and more than 95% in rural and semi-urban areas. Sand and clay deposits that are suitable for use in buildings are almost everywhere in the Sudan (especially along the Nile basin and in the Gezira area.

Sand and clay are mixed together in mud buildings. The best mix is about 65% sand and 35% clay. The buildings are built in a traditional way i.e. either by hand or by making mud bricks out of this mix and then left to dry by the sun heat and then used immediately. No serious research is done modernizing these traditional methods. Little research is starting now to introduce new mixes with lime or cement or thatch to reinforce the mix against cracks.

Protection against rain is done traditionally by mixing clay with fermented animal dung and then after that the walls and roofs are plastered with it. This of course has to be renewed frequently.

Mud houses are desired in rural areas because they are cheap and have good thermal properties to protect the in-doors of houses from the outside severe heat. Construction of mud houses does not need any special skill. (See tables 6 and 7) These tables show the percentage of different building materials used in houses in 3 major urban centres.

b) Natural Stones :-

i) - Sandstones :-

Found almost in all parts of the Sudan. Most prominent deposits are the Nubian Hills and Markhiyat Hills near Omdurman Town.

ii) -Granite :-

Available in all parts of the Sudan.

iii) -Marble :-

There are numerous marble deposits in almost all the provinces of the Sudan. Most of these deposits tend to be dolomitic with MgO content varying between 3 - 20% or more. Many small occurrences of marble deposits, particularly near towns, are used for the production of burnt lime. Only two deposits are exploited for the Portland Cement industry in the Sudan. These are :-

1) - Niyefer er Rugeig deposits near Rabak (next to Kosti Town) on the White Nile district. This deposit is exploited by the "Nile Cement Factory at Rabak.

2) - Atbara limestone deposit on the western bank of the Nile between Atbara ed Damer town. This exploited by the Maspio Cement Factory which is located between the same towns on the eatern bank of the Nile.

Other reserves are between BARBER town and Abu Hamad on the eastern bank of the Nile, and parallel to the railway line. There are also some reserves in the Red Sea Hills.

The limestone and marble reserves in the Sudan are tremendous, but no particular studies of any sort were made on the reserve estimates.

c) - Gypsum :-

Gypsum occurs in the Red Sea Hills coastal plain as an evapourite member of the marine sediments of the area. There are several exposed occurrences along the coastal plain north of Port Sudan town. Most of these deposits were recorded but only one was studied. This was Khor Eit gypsum deposit, which is the nearest to Port Sudan, at about a distance

of 42 miles north of it. It is at the surface and covers about 5.5 sq. km. The approximate estimates are more than 30 million tons at this deposit.

There are many other sizeable deposits to the north of this area but they were not studied.

d) - Asbestos Deposits:-

Many asbestos deposits are recorded in the Sudan. The most important are:

i) - Qala'a en Nahal deposit in Kassala Province (in eastern Sudan) at about latitude 13° 30'N and longitude 35° 00' East.

ii) - Ingessana Hills deposit in the southern region of the Blue Nile Province at latitude 11° 10'N and longitude 33° 35' East. At present studies are concentrated in the Ingessana locality. No final evaluation is yet given, but the results obtained till now are promising. (See table 8(a) for imports of asbestos sheets and pipes).

e) - Vermioulite Deposits :-

This material when heated to about 1000° c and over expands to about 6 - 20 times of its actual volume. This material could be used in the production of light-weight concrete components which have good protection against heat transmission.

The most important vermiculite deposits are located at a site some sixteen miles to the south of Tohamium railway station in the Red Sea Hills, approximately at latitude 18° 30' n. and longitude 36° 31' E. The occurrences are rather irregular and no reserves were estimated nor any specific studies made on them.

f) - Iron Ore :-

The task of exploration of minerals is undertaken by the Sudan Geological Survey dept. of the Ministry of Industry and Mineral Resources. The private sector pays a minor role in these activities. Sudan being a vast country approximately 1 million sq. miles made mineral exploration a very difficult job.

In spite of these difficulties there are more than two hundred mineral occurrences recorded throughout the country. In general information about such deposits are scanty and incomplete. Most of the information on mineral resources are extracted from the Geological Department files.

Many iron ore occurrences are known in the Sudan and of these the most important deposits are :-

i) - Fodikwan Iron Ore Deposit :-

Fodikwan Iron Ore Deposit in the Red Sea Hills in Kassala Province (Latitude 21° 48' N. and Longitude 37° 41') and about 176 miles North of Port Sudan.

The mineralization was described as being in metasediments (intercalated) with some volcanics. It is composed of magnetite and haematite plus few other iron minerals. Deposit estimated to be about 3 million tons having about 60 - 70% Fe.

Close to this Fodikwan iron deposit another deposit was discovered and roughly estimated as 100 million tons of ore having approximately 40% Fe. Of this only 14315 tons were exported in the years 65-67 but this stopped now due to Suez Canal closure.

ii) - Sufaya Iron Ore Deposits:-

This is around Sufaya village about 190 miles N.W. of Port Sudan. Reserve is estimated from 7 to 20 million tons. The area is still under exploration by the Government. The most important localities are:-

1) Ahnkur (latitude 21° 12' N. and longitude 36° [illegible] E.)

2) Adaraweib (latitude 21° 20' N. and longitude 36° 20' E) plus other minor occurrences. These occurrences have an iron content of 60% - (this is not exploited).

iii) - Abu Tulu Iron Ore Deposit:-

This deposit is located in Dar Messeriya in Kordofan Province at latitude 11° 41' N. and longitude 28° 40' E. The deposit occurs in pre-cambrian metasediments. Estimated reserves are about 31 million tons of iron ore containing about 61% Fe.

Several other localities have been recorded but there is no information about the size of deposit.

e) - Timber Resources: -

Sudan like many developing countries is lacking in scientific information and statistics about many of its natural resources. Most statistics, available now, are preliminary and somehow "approximations". These statistics have to be recheck d and refined.

Preliminary reports (Such as FAO Report No. 1291 - Forestry Administration in the Sudan by J.K. Jackson) show that:-

i) 23½% (=585,000 sq. Km.) of the total area of the country is covered by forests.

ii) 1½% is for agricultural purposes.

iii) 27% is pastoral lands.

iv) 29% deserts.

v) 19% unused land (water, swamps, rivers, etc.)

If we consider that forests also have an effect on pastoral lands (27% of the total area), then forests have an effect on 50½% of the total area of the country. It has an effect of 10% of the Gross National Income. Nevertheless the Sudan imports what amounts to £S 2 millions annually of sawn timber.

The following estimates show the annual output of the Sudan's Forestry Department:-

A- Northern Sudan:- (1 cu. m. = 35.1 Ft^3)

Figure g.1

Species	Annual output in cubic m.
Sunt (Acacia Nitotica)	7200
Haraz (Acacia Albida)	5000
Mahogany	5000
TOTAL	17200

B- Southern Sudan:-

Figure g.1

Species	Annual output in cubic m.
Mahogany (Khaya generalensis)	2500
Mahogany (Khaya grandefoeidlia)	800
Be	1250
Vuba	126000
Mountainous Forests	1000
Other species	4000
TOTAL	137550

Annual total Sudan output = 17200 + 137550 = 154 750 cubic m.

In hardwoods the Sudan produces locally 25000 cubic meters (this an average of 10 years production 1957/58 - 1966/67). Sudan reached self-sufficiency in hardwoods and the surplus meets part of the shortage in imported softwoods (before 1965 they used to import very few amounts of some species of hardwoods, see figure g.3).

The Sudan imports two types of timber:

1) - Softwoods e.g. Moski, and whitewood.

2) - Hardwoods e.g. Teak, Beach and soft Uganda.

The percentage of softwood was 83% of the total timber imported into the Sudan from Romania, Hungary, Sweden and Russia. Now the Sudan does not import any hardwoods.

Figure g.3

Year	Hard wood in cu. m.	Soft wood in cu. m.	Total in cu. m.
1963	472	72538	73008
1964	143	86825	86968
1965	668	43705	44373

Total consumption of soft woods in the Sudan is estimated to reach 123,000 cubic meters in 1981.

For imports of sawn timbers for the past and for the coming five years (1970 - 1975) see tables 8(a) and 8(b).

Podocarpus is the only coniferous species of the Sudan. It grows in the Imatong Hills of the Equatoria Province, Southern Sudan. The annual production is 400 cubic meters.

The Forestry Department is planning to plant large areas with conifer and curpressus species that produce soft wood. The Imatong mountains and Jabel Marra in Western Sudan (Darfur Province) are the only two suitable places for growing conifers. 3565 areas of coniferous species were planted in both areas. 71000 areas of coniferous species (20000 area in Jebel Marra, and 51000 areas in the Imatong area) are projected for planting in the afforestation programme of the Forestry Department. These two plantations will start production on a small scale in 1977 and will reach full production in the year 2000.

Table 8(b)

Plan of the Sudan Imports of essential building material for the period I970 - I975

Commodities	I969 Actural		I970 estimated		I97I estimated		I972 estimated		I973 estimated		I974 estimated	
	Quantity	Total £S thousand	Quantity	Total £S thousand	Quantity	total £S thous.	Quantity	total £S thous.	quantity	Total £S thous.	Quantity	Total £S thous
I. Rolled metal in thousand tons	69.8	4047	I30	4550	I62	5670	I74	6090	I88	6580	200	7000
2. Cement in thousand tons	4.6	47	—	—	—	—	—	—	—	—	—	—
3. Sawn timber in thousand tons.	27.3	II55	32.5	I300	35	I400	50	2000	62.5	2500	75	3000

estimated quantity of Rolled metal (thousand tons) for I975 is 220 and estimated total price is £S 7700 000
" " " sawn timber for I975 is I00 thousand tons and the estimated total price is £S 4000 000

This table is extracted from volume II, part I of the five-year development plan.

• The Sudan has reached self-sufficiency in the product-ion of cement.

Unfortunately this afforestation programme is not progressing according to plan due to shortage in funds.

Accordingly by the year 2000 the major part of softwood requirements would be met locally, but self-sufficiency will not be reached because the areas suitable for growing coniferous species are limited. It is possible to cut down part of the imports in softwoods by using some home-grown hardwoods (as happening now) and also to try to test many of the unknown species of local timbers, which are not utilized yet; to determine their properties for usage in the building industry.

In Rural areas and urban areas the people use round local timbers (unsawn) in their traditional houses. The following figure g.4 shows consumption of round timbers in the present and future:

Figure g.4

Year	Rural areas consumption in cubic m.	Urban consumption in cubic m.
1962	1,071,000	12,000
1971	1,358,000	12,600
1981	1,703,000	13,400

This table was extracted from reports at the Forestry Department.

About 20 millions stacked cubic meters of fuel-wood are consumed by the people here. This is about £S 20 millions. It is the main fuel in the Sudan which as yet has no oil, no coal and only very limited development of its water power resources.

(See Annex 2 for the properties of some species of local timbers.)

7 - Building Materials Industry in the Sudan :

The Sudan is rich in natural resources but still imports large amounts of building materials. The large amounts of building materials produced locally are very traditional and need improvement to cope with the new requirements of the building industry. By good planning, the Sudan could be self-sufficient in most, if not all, of the essential building materials. In this section of the monograph I am going to outline the building materials industry in the Sudan; its present and its future.

a) - Cement :-

Cement is one of the most important building materials in the Sudan. (Table 8(a)) shows the Sudan's import of cement. This was the case when there was only one cement factory. Table 8(b) shows that the Sudan has reached self - sufficiency in cement for the next five years to come. Of course, the demand for more cement would rise with increase in housing and other buildings projects but this could be thought of and solved in time. Figure a.1 below shows amount of cement consumed by the building industry in the period 1962-1965:-

Figure a.1

Unit Tons

	1962/63	1963/64	1964/65
Imported amount of cement	122575	326690	181237
Local production of cement (Atbara Factory)	46060	115860	44266
Total in tons	168635	442550	225503

(This table was extracted from the Department of Statistics reports.)

These figures together with tables 8(a) and 8(b) show that the imports are uneven and irregular, which shows that Sudan's foreign trade (especially for building materials) is badly planned. At the same time this reflects the irregularity of the building industry (at times you find so many projects going on at the same time; and at times it is static).

Now there are two factories working in the industry of portland cement:

i)- Maspio Cement Factory at Atbara in the Northern Province:-

This was the first cement factory ; it produces "Portland cement".

---------- Actual output 160,000 tons annually

---------- Maximum output 180,000 tons annually

ii) - Nile Cement Factory at Rabak in the Blue Nile Province:-

This was erected recently. It lies on the eastern bank of the White Nile near Kosti town at "RABAK" railway station.

---------- Actual output 80,000 tons annually

---------- Maximum output 100,000 tons annually

The actual output of the two factories satisfies the local demand. Sometimes there is shortage in some parts of the Sudan but this is due mainly to transportation problems.

There are studies carried out now to a production line to be added to the Maspio Cement Factory at Atbara to produce white cement.

b) - Corrugated Zinc Sheets :-

Zinc is imported in the form of flat (plain) sheets and then corrugated in the Sudan. There is only one factory in Khartoum North town which corrugates these sheets. It satisfies the local demand. It produces about 25 to 40 tons daily (one shift). The maximum output is about 100 tons daily. Delay in production occurs due to transportation problems of the raw materials from Port Sudan to Khartoum.

c) - Reinforcement Steel :-

The Sudan is very rich in mineral resources, especially in iron ore; but still this is not industrialised. This was mainly due to lack of funds. Another problem is the vastness of the country and the difficulties of transport and communications resulting from lack of proper roads, railway lines, etc., which are a very important factor in any mineral deposit exploitation and/or industrialisation. The notes listed before in section 7 paragraph (f) of this monograph give details of the iron ore deposits in the Sudan.

The Sudan still imports all the reinforcement steel it needs. (Table 8(a) and table 8(b))give an idea about the Sudan's import statistics of rolled steel.

There are studies carried now on the feasibility of the production of reinforcement steel from scrap iron and iron ore. These studies will not be put to results before 1975 (the end of the Five-Year Development Plan).

d) - Nails :-

There are two factories working in nail production ; these are:

i) - Nilein Nails Factory at Khartoum North :-

---------- Actual output	1200 tons annually
---------- Maximum output	2000 tons annually

This produces normal needle-like nails and zinc fixation nails.

ii) - Port Sudan Nails Factory at Port Sudan :-

---------- Actual output	450 tons annually
---------- Maximum output	900 tons annually

It produces only normal needle-like nails. The two factories satisfy the market in normal needle-like nails.

The country imports about 260 tons annually of screw nails.

e) - Hinges, Locks and "windows' and doors' stays":-

There are no factories in the country. But there are three factories now under construction. The Sudan's imports of these materials are as follows:-

Figure e.1

Type	Year	Amount in £S
Locks and keys	1968	12,765
Hinges and stays	1968	8,300
Locks and keys	1969	11,443
Hinges and stays	1969	11,353
Locks and keys	1970 (till Oct.)	8,099
Hinges and stays	1970 (till Oct.)	10,708

The Sudan is still going to import such materials.

f)- **Paints**

There are three factories working in Paints industries all of them in Khartoum.

i) Rainbow Paints Factory:-

This produces paints and other chemical by-products and auxiliary chemicals. The actual output of this factory is 3000 tons of all types of paints for timber, metals etc.(a year)

ii) Nile Paints Factory:-

This factory started in March 1969. The factory produces 750 tons annually.

iii) Kronos Paints Factory:-

Its actual output is one ton daily.

The last two factories are not working regularly due to financial problems. Due to this the country has been importing paints for a time (See figure f.I below). But if these factories work with maximum capacity they could satisfy the local demand.

Figure f.I

Year	Quantity in tons
1967	1570
1968	2451
1969	998
1970	527

g)- Red Bricks (Fired Clay Bricks):-

Bricks (whether sun-dried or fired clay bricks) are fundamental building materials in the Sudan. The traditional methods of brick manufacture and brick laying are fairly well-established across the country. However no improvements are introduced to the method of manufacture. Bricks are still made and moulded by hand and fired in traditional native kilns.

The total consumption of fired clay red bricks in the Sudan by the building industry is estimated to be over 250 millions common bricks annually. Bricks are used widely in the building industry for boundry walls, load-bearing walls and for partitions. (See tables 6 and 7).

The use of fired clay bricks in the Sudan, as a locally used building material, would be among the main factors influencing the economic development of the Country. It reduces the building costs, saves foreign currency and improves the in-door comfort of the hot-arid desert type of climate prevailing in the Sudan.

Clay, which is the main component material in the manufacture of bricks, is available widely throughout the country. Red bricks industry in the Sudan still depends on traditional techniques. Clay is mixed with zibala (animal dung) then fermented by mixing it with water and leaving it for a few days. Then the mix is moulded in steel or timber moulds into bricks and then left to dry. Then after it dries, it is burnt in traditional native kilns. Due to large demands there are many defects in the local bricks :-

i) The fermentation period of the mix should last for a week, but locally they seldom allow this period more than 24 hours.

ii) The mix of clay and zibala is, usually, carelessly done.

iii) The bricks are not well burnt because it is difficult to raise the temperature in such native kilns over 800°c. Due to this about 20% to 30% of the bricks are damaged.

iv) Bricks sizes are not the same.

It is clear that the bricks industry in the Sudan needs improvement and mechanised brick factories should be introduced. There are studies now on the feasibility of a brick factory in the Khartoum area. This will be fruitful very soon aiming to produce better bricks by controlling properties of the available clay, the method of manufacture and the firing techniques.

h) - <u>Particle Board</u>:-

In 1966 the particle board industries limited established its plant in Khartoum North with an annual capacity of approximately 7000 M^3. This figure is based upon 19 mm, 240 x 120 cm. boards of 700 kgm/m^3.

The raw material mainly used at present is various species of Eucalyptus grown in Gezira.

The product is a flat pressed single layer type, 240 x 120 cm. board. The thickness of the boards range from 5 mm. to 19 mm. The adhesive used is a urea-formaldehyde resin. No additives such as water repellants, insecticides, fungicides or fire retardant chemicals are used. Boards are sold without further

treatment such as veneering or the application of a suitable coating for future painting.

Locally produced chipboard is completely unsuitable for exterior use. Its principal applications are for interior use, i.e. under conditions where exposure to temperature and moisture are not severe; because the bonding material (urea-formaldehyde resin) deteriorates under exposure to sun and moisture (the resin breaks down after exposure to heat or to heat in the presence of moisture).

i)- The local wood-working industry is infamiliar with the use and applications of particle board.

ii)- Other board meteriels, when available in the local market, sell at competitive prices with particle board. (See figure h.I. below)

Figure h.I
Average Retail Prices of Board Materials in Khartoum

Type of Board	Dimensions Length x Width	Thickness	Price in £s /board	/m^2	Date
Particle board	240xI20 cm	5 mm	I.000	0.350	July 70
Particle board	240xI20 cm	6mm	I.050	0.365	July 70
Plywood	7x4 ft	3 mm	I.300	0.500	July 70
Plywood	7x4 ft	4 mm	I.350	0.520	July 70
Masonitee	8x4 ft	(I/8") 3.5mm	I.080	0.365	Jan. 70
Celotex	8x4 ft	(I/2") I2.5mm	I.480	0.500	Jan. 70

Masonite and Celotex have not been available in the market for some time. The prices in January I970 were lighter than in previous months.

____ This table was extracted from the report "Locally Manufactured Particle Board" by F.O.F. Shahwan (Ph.D.) and others.

Other feasibility studies are being carried now on other building materials such as :- plywood and asbestos cement sheets but no result has been reached till now.

See Annex I for rates of building materials in Khartoum which gives an idea about rates of different building materials in the Sudan.

8- Prefabrication in the Sudan :-

Thereis no experience in prefabrication in the Sudan.. The building industry still depends on traditional construction methods. Heavy prefabrication, for a country like the Sudan, is very expensive. This needs :-

a)- very heavy and complicated equipments which are very expensive for a country like the Sudan;
b)- transportation of heavy - prefabricated units is very difficult and expensive; considering thecondition of roads;
c)- transportation of such units needs very special and heavy trucksand needs heavy cranes in the factory and on-site;

It is doubtful, whether; the local market would guarantee the practicability of large production of the same units or not. Also in ocmparison to labour costs, heavy prefabricated units would not reduce the building costs.

It would be useful at the present stage of development to introduce small industries for the production of small units and for on-site precasting. This could be easily adopted because most of the labour are not skilled and they could easily learn to fix such units.

Annex I

BUILDING MATERIALS RATES IN KHARTOUM ON. 1971

I T E M	UNIT	RATES
1. CEMENT:-		
White	ton	28.000-34.000
Grey	"	13.000
2- STEEL:-		
Reinforcement round bars	"	135.000-140.000
Square	"	141.500
3- FLAT SHEETS:-		
3/23 thick	M^2	1.860
1/8 "	"	2.320
3/16 "	"	3.280
1/4 "	"	4.710
4- EXPANDED METAL:-		
2'x8'x1/2" mesh	"	.570
2'x8'x1/8" "	"	.785
4'x8'x1/2" "	"	.900
4'x8'x3" "	"	.900
8'x8'x3 "	"	.910
5- METAL ANGLES:-		
2x2x 3/16"	MR	.360
2x2x1/4"	"	.465
1 3/4x1 3/4x3/16"	"	.310
1 1/2x1 1/2x1/4"	"	.340
1 1/2x1 1/2x3/16"	"	.260
1 1/2x1 1/2x1/8"	"	.175
1 1/4x1 1/4x3/16"	"	.214
1 1/4x1 1/4x1/4"	"	.146
6- T-Section:-		
1 1/2x1 1/2x3/16	"	.600
1 1/4x1 1/4x3/16	"	.400

ITEM	UNIT	RATE Rs
7- ELECTRON:-		
I2 cm. deep	MR	2.250
I4 " "	"	2.75
I6 " "	"	2.900
8- LIME:-		
White	M3	I4.000
Coloured	"	20.000
Gravel	"	.950
Sand	"	.800
Saffaia	"	.400
Silt	"	.400
Granite stone	"	3.000
Sandstone	"	2.000
9- Timber (Muski)	"	50.000- 60.000
White	"	40.000
Mahogany	"	45.000- 60.000
I0- Red Bricks :-		
Common	per I000	4.200
Fair faced	"	4.500 - 6.500
Cement bricks	"	I2.000 -20.000
II-Cement Blocks :-		
Walling 40 X 20 cm	"	60.000
" 20 X 20 cm	"	30.000
Roofing	"	70.000
I2-Mud Bricks :-	"	I.500 - 2.000
I3- Clerestra Blocks :-		
Size " 20 X 20 cm "	"	50.000 -80.000
Round 29 X 29 cm	"	60.000
Square 35 X 35 cm	"	70.000 -80.000
Glass Blocks I5 X I5	"	750.000
I4- Fibre Glass:-	M2	I.500
I5- Rubberoid (2-ply) :-	"	.I50
I6- Bitumen :-	"	.I20
I7- Flintkote :-	"	.200 - .300
I8- Asbestos Sheets :-	"	.880
I9- G.I. Sheeting or Flat :-	"	
Gauge 24	"	.630
" 26	".55	.550
" 28	"	.480
Masonite	M2	.350
Celotex	"	.500
20- Chipboard :-		
Thickness 2.5 cm	"	I.000
" I.0 cm	"	.840

ITEM	UNIT	RATE £S
20- CHIPBOARD:-		
Thickness 6. cm.	M^2 1000	.670
" 4. "	"	.360
Plywood (3mm)	"	.410
Veneered plywood	M2	.450 - .650
Polythene Sheets	"	.340
21- Polystering :-		
1 cm thick	"	.280
2 cm thick	"	.500
3 cm thick	"	.750
4 cm thick	"	.940
5 cm thick	"	1.250
7 cm thick	"	2.170
10 cm thick	"	4.000
20 cm thick	"	5.000
Accoustic tiles	"	.700-800
22- Transparent glass:-		
6 mm.	"	4.000
4 "	"	2.400
3 "	"	1.200
2 "	"	.800
Patterned glass	"	2.200 - 4.00
Mirror	"	3.000
Luxaflex	"	14.000
Marble (2cm. thick)	"	12.000
23- Glazed Tiles:-		
White	"	1.600
Coloured	"	3.000
P.C. slabs 5 cm. thick	"	2.000 - 3.000
24- P.C. Tiles 20x20x2 :-		
Grey	"	.550
Black	"	.60
White	"	.70
red	"	.60
Patterned	"	.60
20x20x skirting	"	.60
25- Terrazzo tiles:-		
20x20x2 with grey cement	"	1.400
" " white "	"	1.800
Size 30x30	"	2.500 - 3.000
Skirting 20x10x2	"	2.000
Mosaics	"	1.800
Vinyle tiles	"	2.500

I T E M	UNIT	RATE £S
Oil paint steel	per gallon	2.835
" " timber	" "	2.540
Pumastic	" "	3.I20
Distemper	" "	I.450
Varnish	" "	I.350
Soligmum	" "	.550
Floor Polish	" "	2.I00
26- Electric		
Air Conditioning Units:-		
I HP	per unit	275.000
2 HP	" "	375 - 400
Air Coolers:-		
BA 2200	" "	II0.900
" 4000	" "	I6I.840
" 4043	" "	I68.440
" 5500	" "	2I2.460
" II000	" "	5I7.470
" I5000	" "	579.470
Fans:-		
Ceiling fans	" "	I5.000 - 20.000
Wall fans	" "	I6.C00 - 27.000
Conduits	" " "	.035 - .045
Electric heater (medium)	2.8 litre	42.000
27- Bath room set:-		
White (4 pieces)	No.	95.000
Coloured "	"	I80.000
W.C. eastern	"	I3.000
" " western	"	I8.000
Bidet	"	I9.000
Wash hand basin (big size)	"	8.000
" " " medium "	"	6.000
" " " small "	"	4.000
Shower unit	"	I0.000 - I5.000
Shower (2 taps shower and mixer)	"	5.000 - 7.000
Sink (glased)	"	I0.000
Kebal sink	"	23.000
" " with drain	"	32.000
" " " 2 drains	"	48.000
Gully trap	"	I.650
Floor trap	"	2.000
45x45 C.I. cover (medium)	"	I.200
30x30 C.I. cover	"	I.I00
Grilled cover I5xI5	"	.200

J O B	UNIT	RATE
28- Asbestos pipe:-		
4" dia.	per MR	.400-.600
6" "	" "	.600-.800
29- Cast Iron:-		
2 - 6"	" "	.300-.600
G.I. Pipe:-		
2	" "	.500
1½	" "	.433
1¼	" "	.333
1	" "	.250
¾	" "	.185
½	" "	.245
Copper:-		
1"	" "	.320
¾"	" "	.160
1"	" "	.110
2"	" "	.400
Polythene:-		
2"	" "	.400
1½"	" "	.320
1½"	" "	.160
1"	" "	.110

Annex 2

Properties of some Species of Local Timbers:

1 - Neem (Azadirachta indica):

This is a native of the dry open forests of Burma and of the Deccan in India. It has been extensively cultivated in the Sudan as a roadside tree for shade and as an ornamental tree in gardens and as source of fuel as well.

It is evergreen and will grow on most types of soil and will tolerate high temperatures and rainfall as low as 18 inches. It can reach a height of 80 feet and a breast height girth of 8 feet. It branches early so that the clear bole is short.

Direction of grains is generally irregular. Neem is a mahogany-like wood, pale to medium red in colour when freshly surfaced. It darkens on exposure to the sun, like Cuban mahogany.

It is also moderately heavy (average weight is about 45.5 lb/cubic ft.) at 12% moisture. 80 % of the material is sapwood. Neem can be sawn without difficulty. It will give a smooth finish unless the grains are disturbed. Its strength properties are similar to teak but it is more resistant to shock. It is repugnant to most wood-broing insects. It is very difficult to impregnate with preservatives. It could be used in cheap buildings and furnitu e and fences. It is found almost all around the Sudan.

2 - Hareg (Acacia Albida):

One of the many species of acacia. It has a wide distribution in the central belt of the Sudan along river banks or where the water table is high. It reaches 60 ft. high and has a clear bole of 15-20 feet.

General Description

It is a pale yellow brown wood. It is variant in colour from log to log.

Average weight is 38 lb/cubic ft. at 12% moisture content. Sometimes difficult to distinguish between heartwood and sapwood.

Except for hardness of resistance to shock it is below the average in strength properties. It could be easily impregnated with preservatives. Timber is not attractive in appearance. Grains are irregular in direction with large knots.

Uses:-

It is used mainly for carpentry and shuttering. Especially selected material from mature trees of this species would be suitable for building after being treated; if used in exposed position.

Heglig (Balanites Aegyptiaca):-

It is a small tree (hard, heavy and tough) with thorns. It grows on clay soils in dry areas. There is no distinction between hardwood and sapwood. The grains are somehow irregular in direction, although better in this respect than (haraz) and Talh (acacia seyal). Heglig is a heavy but rather attractive wood (straw-yellow in colour). Its average weight is 48 lb/cubic ft. at about 12% moisture content.

It could be easily treated with preservatives. It is used for fences and posts.

4- Sunt (Acacia Nilotica):-

It grows mainly along the Nile in the Blue Nile Province. It also occurs in Northern and Central Sudan and the Red Sea Province. It grows on heavy black or dark grey alkaline soil in riverain basins.

General Description:-

Sunt is the most attractive of the species of acacia, with a warm reddish-brown heartwood. Grains are interlocked and rather irregular; although sometimes straight in direction. Knots are of common occurrence.

Sapwood and heartwood are well defined. Sunt is a heavy wood averaging about 58 lb/cubic ft. at 12% moisture content.

Sunt is difficult to saw, it is twice as hard and as tough as teak and 50% stronger in other mechanical properties. It is highly resistant to decay.

Its strength and stability and resistance to decay render it suitable for heavy construction and buildings provided it is not readily attacked by termites. Used locally for village buildings and fuel.

5- Talh (Acacia Seyal) :-

It is a small tree upto 40 ft. high. It grows in the dry savanah forests throughout the Sudan. The tree is with many branches and fire-resistant. It produces gum with good quality but inferior to gum arabic.

General Description :-

Appearance variable from tree to tree, but it is typically pale-yellow to medium brown. Grains are interlocked and often irregular with occasional knots. It has an average weight of 53 lb / cubic ft. at 12% moisture content (it is 30% heavier than teak). The timber is hard, tough and shock resistant and can be easily impregnated with preservatives. If the tree could be grown with fewer knots and reasonably straight grains; it can be very suitable for buildings and heavy construction.

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All the informations on the properties of the above species of local timber were extracted from the following series of reports at the Forestry Department- Khartoum :-

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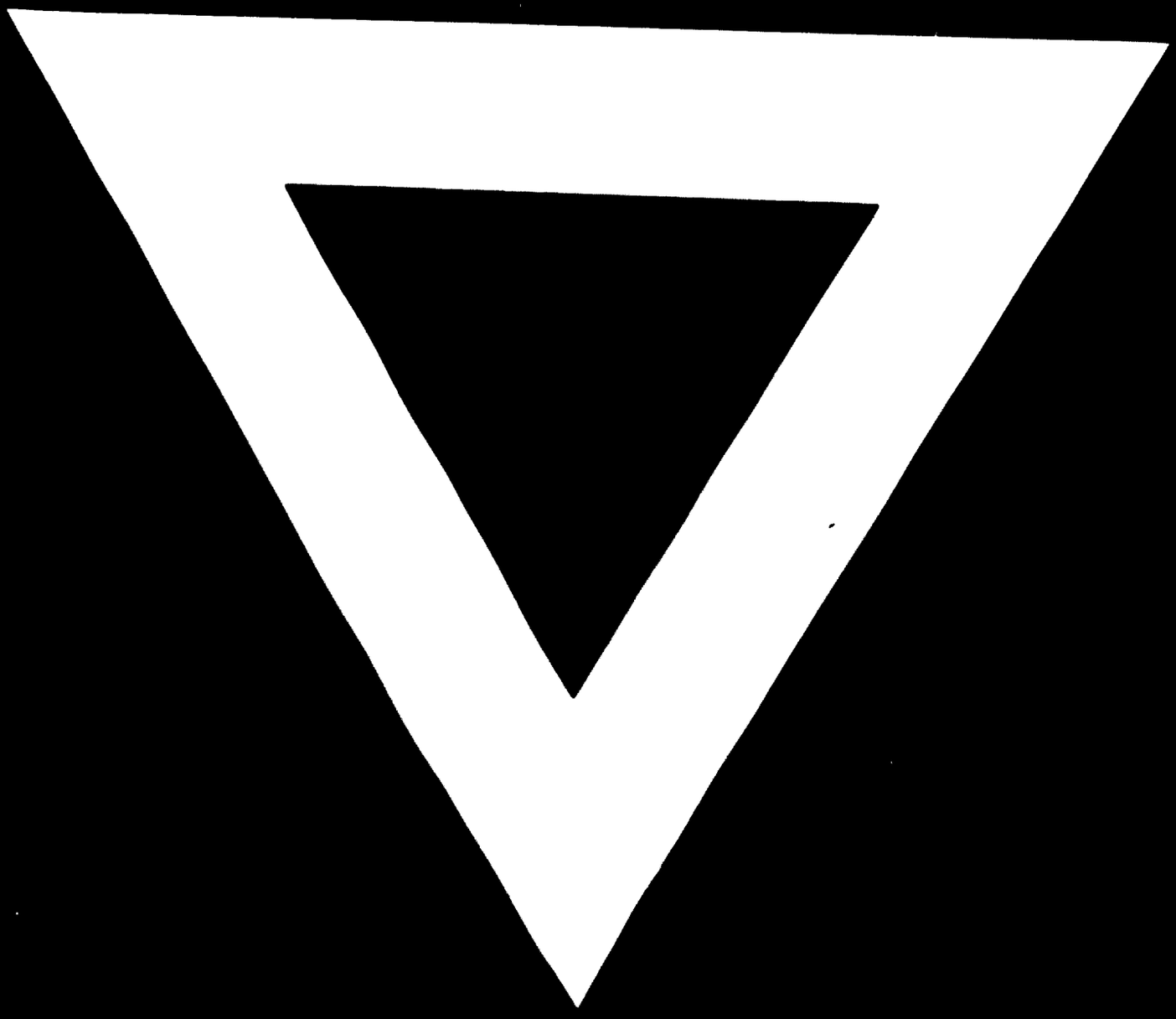

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