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Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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PROBLEMS AND POTENTIALS FOR THE BRICK INDUSTRY IN AFRICA 1/

by

Economic Commission for Africa

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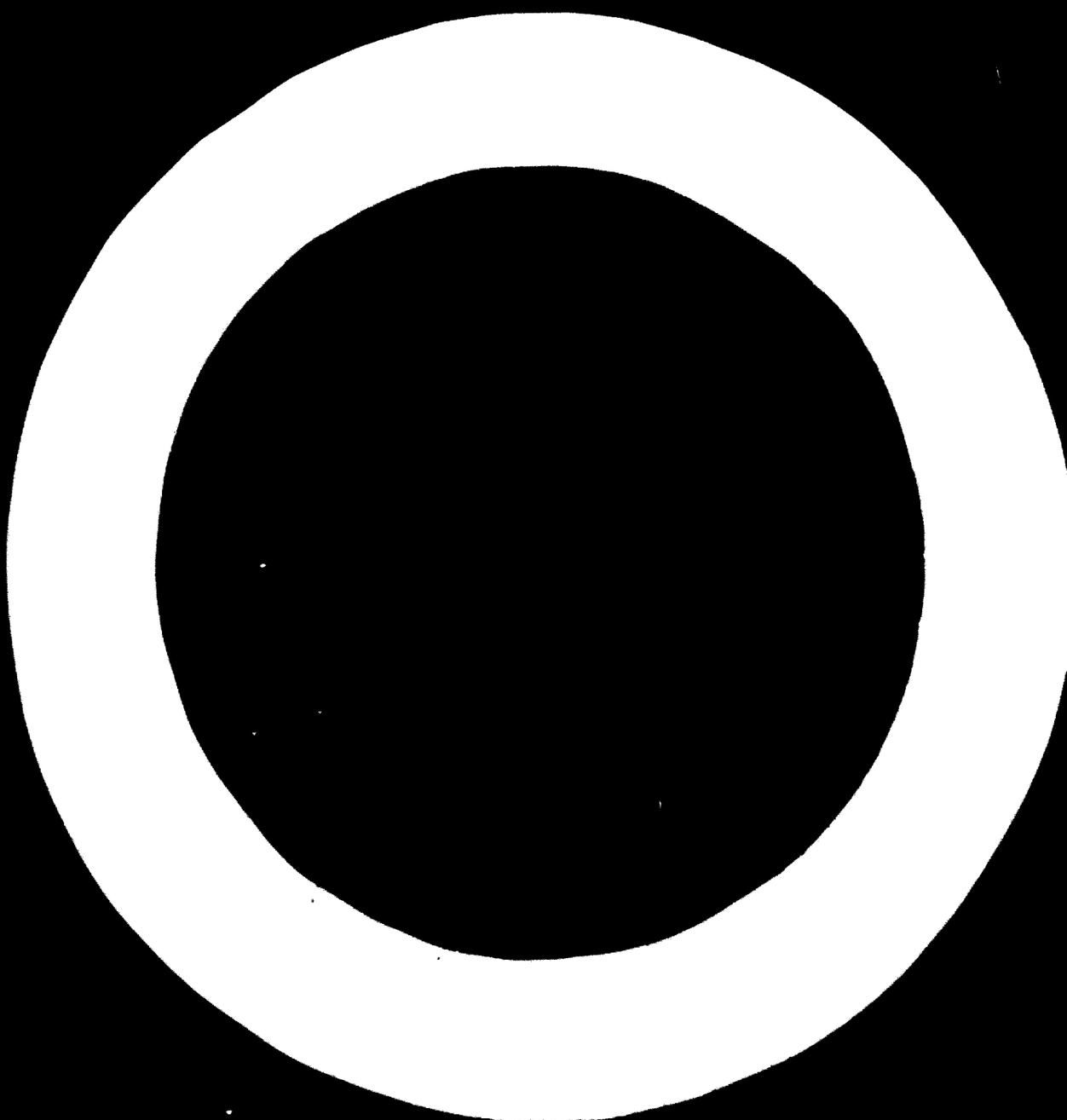


1. Bricks in construction.

1.1. Uses of bricks.

Development of heavy clay building materials has accompanied the development of civilization; these are the oldest artificial building materials in existence. The use of bricks in construction can be traced back more than five thousand years. The oldest known evidence of the use of bricks for buildings is from the Indus valley civilization - the towns Mohenjo-Daro and Harrapa, which had multi-storied houses, paved streets, sewerage-piping, water-piping and swimming pools made entirely of red bricks. Bricks were used also in other ancient civilizations: Egypt, Greece, Roman Empire, Babylon.

The contribution of Africa to the development of the brick industry is significant. The first burnt bricks were introduced as a building material to Africa by Romans, about two thousand years ago. We know of older burnt clay products in Egypt, but these were for uses other than construction — for pottery, with salt glazed paint of different colours. The favourable climatic conditions of Egypt did not require burnt bricks for construction. Sun-dried bricks were sufficient for insulating heat and were easily used for building, besides they were less expensive than fire burnt bricks. The oldest buildings made of bricks were in Africa — in Tipasa (Algeria), Leptis Magna (Libya), and in Tunisia. From the Arabic period there are buildings dating back to the ninth century. Some of the old Arabic buildings are beautifully decorated with multi-coloured enameled ornaments. From the nineteenth century there are several buildings made of burnt bricks still in use in Cameroon, Sudan and other countries.

In brick we find the properties required of building materials but rarely found in combination in other building materials: the ease with which they can be made into any size or shape, the insulating properties, the strength, the resistance to effects of weather, the ease of production on different scales of production, the omnipresent raw-material deposits, the price, and the architectural properties.

Of course, through modern science other building materials have been developed such as concrete blocks, cellular concrete, sand-lime bricks, asbestos cement products, chemical building materials, treated wooden materials; but red clay materials despite this competition continue to play an important role in modern construction.

A modern building essentially consists of the following components: shell, partitions, floors, ceilings and roof. There are appropriate burnt clay products for all these components: bricks and hollow blocks for the walls, hollow partitions bricks and blocks, flooring tiles and slabs, clay pots for ceramic ceilings and roofing tiles. In addition, there are wall covering products both for indoor and outdoor use, glazed or unglazed sun-breakers and piping.

1.2. The consumption of bricks in construction.

For study of the consumption of bricks, there are available complete statistical data from only a few countries. Annex I indicates production of burnt clay bricks in selected countries, both in absolute and per capita figures.

Bricks are used in all kinds of construction: residential, non-residential and other construction-works, mainly in new construction. The maintenance work requires use of only a small percentage of the bricks produced.

Annex II gives a break-down of residential construction in newly constructed buildings by types of structural elements.

Burnt brick is a component of the structural elements in residential buildings as follows:

Table 1: Residential construction in newly constructed buildings: Number of flats and % structures in burnt brick.

		1957	1958	1959	1960	1961	1962	1963	1964	1965
France	A						402.4	506.2	554.1	572.4
	B						27.2%	26.3%	22.8%	22.6%
Netherlands	A									
	B				69%	64%	61%	63%	56%	47%
Norway	A	25.7	26.0	26.0	26.2	27.8	27.2	28.2	28.1	
	B	9.0%	4.2%	3.7%	3.4%	2.2%	2.8%	2.0%	1.7%	
Turkey	A	36.6	38.3	34.9	35.9	31.8	32.4	31.2		
	B	47.3%	47.5%	47.0%	49.8%	49.6%	53.4%	53.9%		
Bulgaria	A					40.8	43.7	43.9	47.4	45.2
	B					77.3%	77.1%	76.1%	67.7%	63.0%
Yugoslavia	A							107.6	117.9	117.9
	B							71.1%	63.9%	70.1%
Hungary	A					16.7	13.2	16.9	15.4	19.8
	B					64.9%	47.5%	32.4%	32.3%	33.3%
Czechoslovakia	A		33.9	45.7	55.3	55.0	58.3	59.0	56.8	58.5
	B		81.7%	78.2%	75.9%	48.7%	40.9%	33.0%	21.1%	20.5%

Note: A = flats in 1000 units; B = % of flats in brick-structure.

To the figures indicated in Table 1 must be added the requirements of burnt bricks for partitions, ceramics-ceiling in hollow pots (Hourdis), etc. The figures demonstrate the importance of bricks in modern construction even though they concern only residential construction. Similar statistics for other kinds of construction are not available but it is known that the consumption of bricks for construction on non-residential buildings is considerable. Residential construction amounts to about 48% of total construction in France, 36% in the Netherlands, 31% in Norway, 34% in Turkey etc.

Statistical data about residential and non-residential construction works and newly constructed buildings do not exist for Africa, and the figures about brick and tile production are poor, with the exception of North Africa. This is mainly due to the fact that for the most part the market for bricks in African countries is satisfied by artisan production both in burnt and sun-dried bricks, and the statistics concern themselves with only a small per cent of the total supply. The ECA estimations of burnt brick production are shown in Annex I.

2.1. Brick production in Africa

In Africa brick is the traditional building material, and for a long time various kinds of bricks have been used: handicraft brick, dried in the sun and sometimes improved with straw, called brick in banco or poto-poto. Fired full brick made by handicraft is often used and so is brick made in industrial brickworks, mainly hollow brick, hollow block and tile. In the handicraft brickworks, the fuel most used is wood from the country or wastes from industry and agriculture - coconut shells, peanut shells; and in the industrial brickworks oil, heavy oil and also coal, but rarely wood.

In the handicraft brickworks only the full brick is produced, whereas in industrial brickworks various red qualities are produced: full bricks, hollow bricks, dostras, hollow beams, wall tiles, floor tiles, tiles, drains, etc.

The quality of the bricks in banco is bad and these bricks are estimated to last for only about ten years. The quality of the full handicraft bricks is not good either, because these bricks do not have regular form or dimensions, and only a small quantity of the production is sufficiently burnt. The major part of the production is over-fired or under-fired.

With regard to the character of the production of red articles, it is possible in Africa to make certain distinctions between zones; and they are:

1. <u>The countries of North Africa, the Magheb countries: Morocco, Algeria, Tunisia and Libya</u>. Bricks as well as tiles are widely used in building. The quality of the red products is generally the best; the major part of the production is the hollow brick and the hollow beam. Only in Libya does the handicraft production make full bricks because the speciality of Libya is a significant size production of blocks in natural moss stones, sawn in blocks of 48 x 28 x 18 cm., which are inexpensive.

2. <u>United Arab Republic</u>. Until now red bricks have been prepared by using the mud that appears every year on the banks of the Nile. Now that the High-Dam has been completed, a great part of the mud will be behind this dam. Therefore it is intended in the UAR to build new factories for the production of silica bricks, prepared with sand and lime, steam-treated in autoclaves.

3. <u>The interior of the Continent</u>. This zone comprises Mali, Haute-Volta, Niger, Chad, the Republic of Central Africa, Sudan and part of the Ivory Coast, Ghana, Nigeria, the Cameroons and Congo (Kinshasa). This zone is characterized by the production of solid, non-fired bricks. The production of handicraft bricks that are fired, does not exceed 5 to 10 per cent of the requirements. The industrial brick-works are not numerous and they are generally located in the neighbourhoods of the capital cities.

4. <u>The West Coast Zone</u>. This zone comprises Senegal, Guinea, Sierra Leone, Liberia, Ivory Coast, Ghana, Togo, Dahomey, Nigeria, the Cameroons, Gabon, Congo (Brazzavill) and Congo (Kinshasa). The production of bricks in banco is less important here than in Zone 3. The preference is for the use of burnt handicraft bricks and hollow bricks made in industrial brickworks.

5. <u>East Africa.</u> The characteristic features of this zone, which comprises Somalia, Ethiopia, Kenya, Uganda, Rwanda, Burundi, Tanzania, Malawi, and Zambia, are generally the same as those of the coastal zone.

It is difficult to estimate the production of bricks in Africa. Statistics are only available for the industrial production and occasionally for the handicraft production of burnt articles. The production of bricks is essentially local. The trade in these materials involves only insignificant quantities; almost the entire production is consumed locally. But it must not be concluded that all the African countries are self-sufficient with regard to these burnt clay products. There is undoubedly an unsatisfied demand. It is necessary to calculate the extent of this demand in order to develop cment and clay material industries to fill the gap and to meet the requirements of a sector of the building industry.

Leaving out of consideration the UAR, there are in these three regions 159 industrial or semi-industrial brickworks with a capacity of 1,623,000 tons per year of heavy duty products, plus the handicraft production of whole bricks. In the UAR, the capacity is estimated at 1.14 milliard of red bricks per year, making about 4,000,000 tons per year, plus 2,000,000 m^2 of tiles for roofing, which makes about 80,000 tons of tiles. In 1965, the production of red bricks in the UAR was 1,135,000 pieces and the production of "sand-lime" bricks was 21,000,000 pieces. The foreign trade in bricks is not significant and the African countries are self-sufficient with regard to burnt clay products.

2.2 The present situation for brick production

In the period 1966 to 1968, the ECA thoroughly studied the situation of brick production as well as the possibility of future development in these three areas of Africa - north, west and central. The existing capacity in red products for the countries of these regions are as follows:

Table 2 Capacity of brickworks in North, West and Central Africa.

Country	Number of Brickworks	Capacity in tons per year	Notes
Algeria	52	770,000	In the capacity are included 160,000 tons per year of tiles
Libya	handicraft only	15,000	
Morocco	15	120,000	To this must be added the handicraft capacity of 60,000 t/year
Tunisia	50	220,000	
Sudan	handicraft only	53,000	The new brickworks in Omdurman under construction. No information on the handicraft production
Ivory Coast	2	27,000	A new brickwork at Abidjan under construction, capacity 25,000 tons per year.
Dahomey	handicraft only	2,000	
Gambia	handicraft only		There are no brickworks in Gambia
Ghana	16	74,000	Brickworks of Malam with a capacity of 23,000 tons/year plus 15 mobile brickworkers.
Guinea	4	82,000	3 brickworks projected
Haute Volta	2	14,000	
Liberia	2	10,000	
Mali	1	12,000	
Mauritania	-	-	There are no brickworks in Mauritania
Niger	2	26,000	
Nigeria	2	36,000	
Senegal	3	16,000	Handicraft production of 4,000 tons per year included
Sierra Leone	-	-	There are no brickworks.
Togo	handicraft only	18,000	A scattered handicraft production, irregular.
Cameroon	1	25,000	A new factory under construction at Yaounde, with a capacity of 25,000 tons per year.
Congo (Brazzaville)	2	16,000	
Congo (Kinshasa)	2	32,000	
Gabon	handicraft only		
CAR	1	10,000	
Chad	2 mobiles	45,000	This includes the capacity of a project of mobile brickworks of 12,000 tons per year.

From Table 2, it appears that practically all the African countries have at least one factory which produces bricks of good quality. In some countries, there is only a handicraft production which at least produces full bricks. In many countries brick production is an ancient art, and the traditional methods have been maintained until now. But in some countries, where there is not a sufficiently large market, the simple kilns produce far less than 5,000 units per day, of poor or average quality, and they are generally the main source of burnt bricks. Although the handicraft bricks are of poor quality, not very solid and not regular, they can easily compete with the more solid materials such as the breeze-blocks of concrete and industrial bricks, because of their low price. They are much used in several parts of Africa for the building of cheap dwellings, even in countries which have a significant industrial production of bricks.

There is serious competition from the concrete breeze-block brick industry. The quality of the bricks depends primarily on the preparation and their firing. To produce bricks of the best quality and to make production pay under African conditions, a factory must have a minimum capacity of about 20 to 50 tons per day or 7,000 to 16,500 tons per year.

2.3 Substitute building materials

The most commonly used building materials in Africa are "chica" and sun-dried bricks. Chica is a mixture of clay, straw and water. The mixture, after being thoroughly mixed, is allowed to ferment for about a month and is then used as a filling material between wooden poles which are placed vertically about 40 cm. into the ground, as reinforcements. The diameter of the poles vary from 3 to 40 cm. Poles larger in diameter are used at certain intervals and at corners as columns. The longer the fermentation period, the less the tendency of the chica mixture to shrink and crack on drying. Chica has a very low resistance to rainfall; when wet, it looses practically all its strength and disintegrates.

The second walling material which is commonly used in Africa is sun-dried brick. Nowadays another walling material which is being introduced in Africa is the stabilised soil block, stratified by cement.

The viability of construction made of chica is about 7-10 years and depends in general on the quality of roofing and the presence of termites. Because sun-dried bricks are used in construction in areas of heavy rain and in such countries as Niger and Upper Volta, the viability of such construction is also very low - about 10 years. The damages to buildings are not as apparent with chica construction as repair is continually made. In the front of the house, a place is reserved for brick-making and bricks are always available for maintenance purposes.

Firstly, the cheapest material is chica in areas where wooden branches or poles are available; secondly, comes the sun-dried brick; and, thirdly comes the burnt brick or concrete block. It is not easy to express the price relation among these three kinds of building materials, but perhaps the best way to express it would be: a low-cost house cost approximately, under the same external conditions, 800, 1,200 or 1,700 US$ per unit respectively, if chica, sun-dried bricks or burnt bricks are used; but these figures vary from country to country.

The most commonly used building material in Ethiopia, for example, is chica. A survey carried out in 1961 on housing in Ethiopia showed that 90.4 per cent of the houses in the capital city, Addis Ababa, had chica walls. In countries like Niger, the most commonly used building material is sun-dried brick and the percentage of houses in Niamey made of this material could be estimated at 90 per cent at least.

In the Sudan, a low-cost one-family house with walls of stone or burnt artisan bricks costs $2,500 to construct and the same house constructed of sun-dried bricks only $1,280. In hard building walling materials there is competition between burnt bricks, concrete blocks and natural stone, but the last one in particular countries only, such as Libya, Ethiopia etc.

If the prices of bricks are compared with the prices of concrete breeze-blocks for the same building unit, that is, for instance, for $1m^2$ of wall, it is always seen that the most expensive material is the full brick, whereas the hollow brick has the same cost price as the hollow concrete block as is shown in Table 3:

Table 3. Prices of bricks and breese-blocks for $1m^2$ of wall in US $ with a wall thickness of 20 cm. or 9" without plaster and mortar, in 1965

	Ghana	Ivory Coast	Niger	Nigeria	Mali	Togo	Upper Volta
Breese-blocks:							
full	3.1-4.5	3.0	8.5-14.2				8.5-14.2
hollow	2.1-3.6	2.2-2.7	7.8-10.8		2.6-3.6		7.8-10.8
Bricks:							
full	-	5.7	-	9.8	5.8		6.2
hollow	3.8-4.0	1.9-4.0	2.4-2.6	2.3-3.0	2.2-2.3	0.7	2.8- 3.9

Which of the two competing materials is used - bricks or breese-blocks - depends mainly on the scale of the construction. In order to obtain a reasonable price for bricks, it is necessary that the brickworks be of a certain capacity, generally of the range from 8 to 16,000 tons per year. The average price of bricks in Africa is $18 per ton. The transport cost is about 6¢ per ton per kilometer, which means that a distance of 300 km. from the brickworks, the price of the bricks is doubled when bricks are transported; whereas for the concrete blocks it is necessary to transport 150 kg. for 1 ton of blocks because sand, gravel and water can be found in the neighbourhood of the construction site. This means that it is possible to have firmly established brickworks in the building centres, where it is possible to sell within a periphery of 50 to 80 km. from the place of production since at a distance of more than 50 to 80 km. from the brickworks, breese-blocks are less expensive than bricks. With the increasing transport distances the percentage of wasted bricks is increased and this is considerable.

There should be taken into consideration also the social profitability aspect. This concerns the input structure of both competitive building materials, bricks and concrete blocks, as well as the transport problems. The input structure for one cu.m. of walling material is as follows:

Table 4. The input-structure of bricks and concrete blocks

		Bricks		Concrete Blocks	
		Solid	Hollow	Solid	Hollow
Average density	Tons per cu.m.	2.0	1.2	2.1	1.4
Consumption for 1 cu.m. construction work of:					
- fuel (heavy oil)	Kg.	120	72	25	17
- electric energy	Kwh	64	38	28	19
- manpower	Working hours	10	6	8	6
- materials	Kg.	2,100	1,260	2,381.5	1,588.7
of which:					
Clay	kg.	2,100	1,260	55	37
Limestone	kg.			218	146
Gypsum	kg.			7.2	4.8
paper	kg.			1.3	0.9
Sand and gravel	kg.			2,100	1,400
By concrete blocks the clay, limestone and gypsum refers to cement	kg.			180	120

Brick prices are rather the same in African countries. In AnnexI, Table 4, will be found the prices in the West African Sub-region; this price level and production programme is approximately the same in the Central and East African Sub-regions. Table 5 shows the production programme and prices in Tunisia, which is representative also for Morocco and Algeria. Table 4 shows, in addition. the price and dimensions of concrete parpens, which are given by way of comparison with bricks.

There is often an error in comparison of price of bricks at the construction site with the increase of concret-blocks produced by specialized manufacturers. Usually, the contractor produces the concrete blocks himself and this has its economic impact. There is reduction of transport cost and elimination of broken blocks, which represents about 20 per cent of price of the blocks. This arrangement allows a better organization of employment. The work of block-making is done in otherwise free working periods. Soemtimes by this method, duplication of taxes is avoided and there is an increase of profit to the contractor.

In this respect, to meet the spread demand for bricks by means of establishment of several building centres, each under mimimum brickworks-size requirements, the brick project of the mobil-brick factory in Chad is of great interest; this project having one set of mobil equipment and two stabil centres for brick-burning, with the following characteristics in US $:

Output total	4,250 tons per year.	
Employment	17 persons	
Productivity	250 tons per employee per year.	
Unit investment	$41 per ton of output	
Investment total	$174,395	
Depreciation	$ 20,660	25.49%
Salaries and wages	$ 16,204	19.99%
Charges sociales	-	-
Profits	$ 10,087	12.44%
Value added	$ 46,951	57.92%
Maintenance	$ 10,533	12.99%
Interest	$ 3,281	4.05%
Assurance, div.	-	-
Fuel	$ 5,671	7.00%
Electricity	-	
Water	-	
Raw materials	-	
Interest short term	$ 1,256	1.55%
Petrol	$ 13,368	16.49%
Interm. consumption	$ 34,109	42.08%
Gross business output	$ 81,060	100.00%
Price of bricks before taxation	$ 19.1 per ton	

For further details see Annex III.

In the period 1966 to 1968, the ECA studied thoroughly the possibility of development in the future of construction and as a result, brick production, for three sub-regions of African-North, West and Central Africa. The estimations of future brick production are based on several methods and were checked by various indicators, such as the brick consumption in pieces per $1,000 of investment in building activities. The prognosis for the building industry, of cement and brick consumption in three African sub-regions is shown in Annex IV.

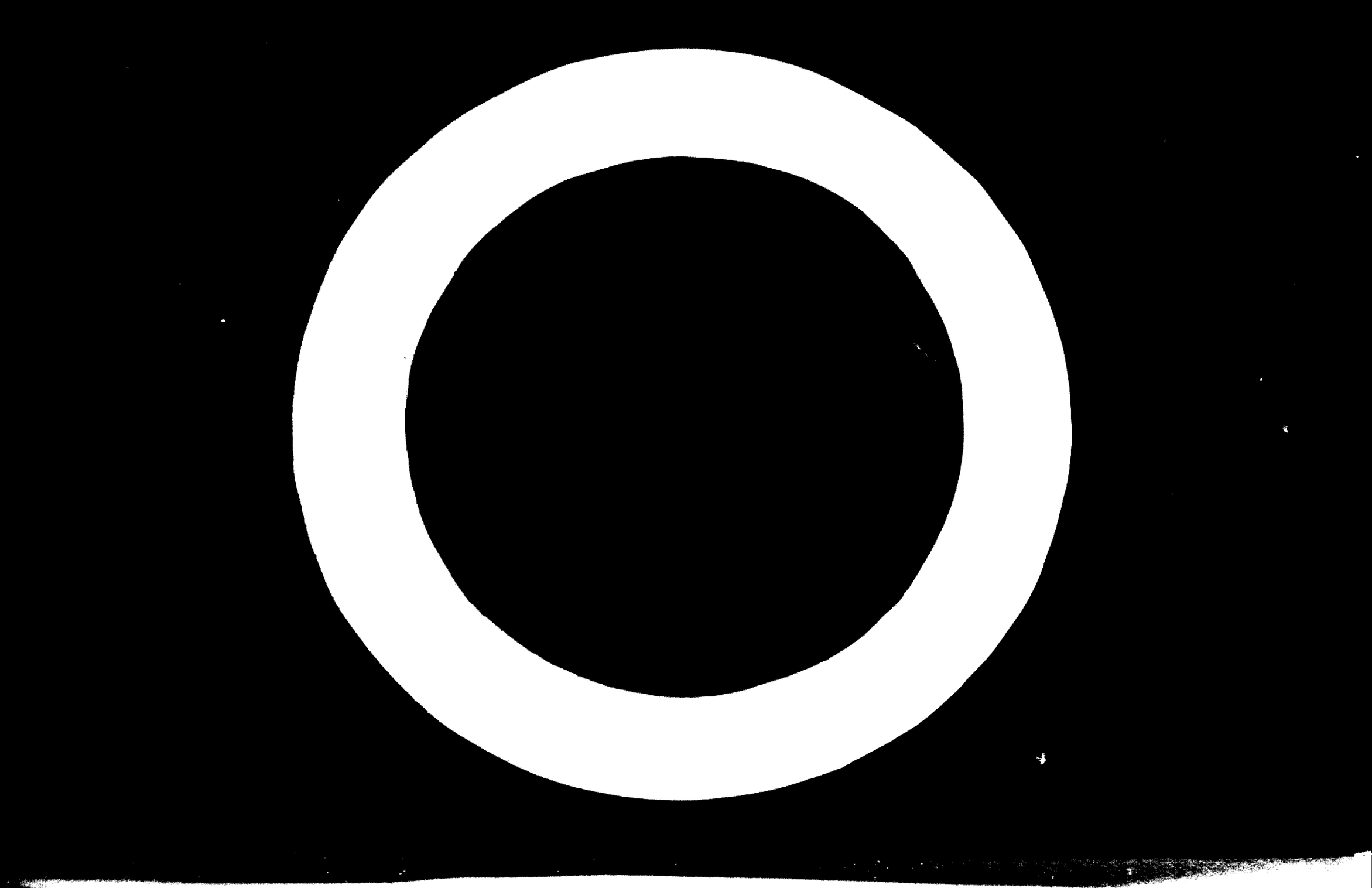


Table 1. The Production of burnt clay bricks

Table 1. The Production of burnt clay bricks in selected countries

ANNEX I

In million pieces:	1937	1948	1950	1955	1958	1959	1960	1961	1962	1963	1964	1965
Belgium		2,757	2,004	2,4 3	2,210	2,151	2,250	2,349	2,286	2,105	2,174	2,084
Denmark					480	646	691	737	748	689	779	749
Finland				189	152	132	130	144	161	167	211	197
France			1,394		2,000	1,994	2,011	2,140	2,328	2,556	3,012	3,083
Italy		',025	1,458	2,801	3,344	3,579	3,580	3,992	4,215	4,467	4,400	
Canada	154	320	375	489	541	551	470					
Germany FR		2,061	4,123	5,812	5,409	6,114	6,222	6,223	6,326	5,929	6,227	6,141
Netherlands	882	972	1,192	1,439	1,517	1,542	1,615	1,578	1,582	1,596	1,892	2,061
Norway			98	109	84	86	91	93	98	92	93	90
Austria	290	382	568	799	804	873	940	1,016	991	1,006	1,095	1,064
Greece					530	510	700	1,000	1,200	1,500		
UK	7,300	4,598	5,928	7,163	6,440	6,967	7,283	7,414	7,289	7,139	7,954	7,868
Spain				1,057	2,004	2,764	2,957	3,129	3,633	4,134	4,619	4,810
Sweden	344	339	357	377	301	353	363	361	383	405	409	396
Turkey							812	807	817	797	834	
USA	4,191	5,842	6,333	7,902	6,489	7,336	6,943	6,682	6,886	7,427	7,867	8,212
Albania	37		14	58	76	125						
Bulgaria	65	125	237	444	575	758	931	1,083	1,074	951	1,086	1,194
Yugoslavia	639	723	977	799	1,072	1,094	1,267	1,483	1,242	1,461	1,841	1,940
Hungary	647	253	796	1,198	1,421	1,659	1,770	1,776	1,712	1,656	1,843	1,851
Germany DR		647	1,356	1,963	2,187	2,344	2,272	1,797	1,697	1,392	1,460	1,410
Poland	1,804	975	1,235	2,590	2,794	3,214	3,102	2,969	2,626	2,566	2,741	3,516
Romania	200	118	371	738	900	990	650	841	1,062	1,152	1,068	1,050
USSR	8,666	6,122	10,204	20,825	23,544	26,829	28,480	29,233	28,364	35,211	35,900	37,000
Czechoslovakia	1,128	924	865	1,475	1,748	1,987	1,996	1,983	1,803	1,449	1,525	1,547

Table 2. The Production of burnt clay bricks in selected countries
In pieces per capita

ANNEX I

.	1937	1948	1950	1955	1958	1959	1960	1961	1962	1963	1964	1965
Belgium		322	232	274	244	236	246	256	248	227	232	220
Denmark					106	142	151	160	161	147	165	157
Finland				45	35	30	29	32	36	37	46	43
France			33		45	44	44	46	50	53	62	62
Italy		22	31	58	68	73	72	80	84	88	86	
Canada	14	24	27	29	31	32	31	26				
Germany FR		45	88	118	106	118	117	115	116	107	111	108
Netherlands	103	99	118	134	136	136	141	136	134	133	156	158
Norway			30	32	24	24	25	26	27	25	25	24
Austria	43	55	82	115	115	124	133	143	139	140	152	147
Greece					65	62	84	119	142	172		
UK	159	94	120	147	128	134	139	140	136	133	147	144
Spain				36	67	92	98	102	118	133	147	152
Sweden	55	49	51	52	41	47	49	48	51	53	53	51
Turkey							29	28	28	27	27	
USA	32	40	42	48	37	41	38	36	37	39	41	42
Albania	3		12	35	42	50	80					
Bulgaria	10	18	33	59	74	97	118	136	134	118	133	146
Yugoslavia	41	45	60	46	59	60	69	80	66	77	95	99
Hungary	71	28	85	122	144	167	177	177	170	164	182	182
Germany DR		34	74	109	126	136	132	105	99	81	85	83
Poland	53	41	50	95	97	110	104	99	87	84	88	112
Romania	13	7	23	43	50	54	35	45	57	61	56	55
USSR					114	127	133	134	128	157	158	160
Czechoslovakia	78	75	70	113	130	146	146	144	130	104	108	109

Table 3. The production of burnt clay bricks in Africa

ANNEX 1

1000 tons	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974/5
Burundi															
Ethiopia	65	68	72	76	80	83		105							
Kenya															
Madagascar															
Malawi															
Mauritius															
Rwanda															
Somalia															
Tanzania															
Uganda															
Zambia															
Cameroon															
Tchad						18									
Congo B.															
Congo K.							22								
CAR							8								
Gabon		Small-scale production													
Algeria	555	565	187	259	379	439									
Libya		Small-scale production			14	16									
Morocco	119	124	134	138	115	96									
Tunisia	81	86	92	102	107	115									
Sudan		Small-scale production													

1000 tons	1960	1961	1962	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
UAR	2,815	2,575	2,676	3,330	3,628	3,996										
Dahomey						2										
Gambia						-										
Ghana						4										
Guinea						22										
Ivory Coast						3										
Liberia						10										
Mali						12										
Mauretanie						-										
Niger						4										
Nigeria						25										
Senegal						14										
Sierra Leone						-										
Togo						18										
Upper Volta						6										

Table 4. Dimensions and cost of bricks in West Africa in 1963-65

ANNEX I

	MALI			UPPER VOLTA[1]			NIGER[2]			IVORY COAST[3]	
	$1,000 apiece	kg/apiece	$/T	$1,000 apiece	kg/apiece	$/T	$1000 apiece	kg/apiece	$/T	$1000 apiece	kg/apie
	1	2	3	4	5	6	7	8	9	10	11
Hollow bricks											
5.5x11x22 - 3 holes				48.6	2.3	21.1					
7.5x15x33 - 3 holes				81.0	4.1	19.8					
5.0x20x33							54.6	3.0	18.2		
7.5x20x33							72.8	4.0	18.2		
10x20x33							91.0	5.0	18.2		
15x20x33 - 6 holes				147.7	7.0	21.1	136.5	7.5	18.2		
20x20x33							182.0	10.0	18.2		
10x20x40 - 8 holes	101.1	10.0	10.1	174.2	10.0	17.4					
15x20x40 - 12 holes	141.8	12.0	11.8	208.6	12.0	16.9				124.0	12.0
3"x9"x6"											
x9"											
x12"											
4"x9"x6"											
x9"											
x12"											
6"x9"x3"											
x6"											
x9"											
x12"											
8"x9"x12"											
2"x9"x12"											
Solid Bricks											
5.5x11x22 normal				48.6	2.3	21.1				44.6	2.3
5.5x11x22 repressed				56.7	2.3	24.7				60.7	2.3
2"x5"x10"	48.6	3.5	13.9				46.6	2.3	20.3		

1/ The figures should be increased by a 14 per cent production charge.
2/ The selling price is calculated on the sale of 75 per cent of the total production.
3/ Prices (excluding charges on turnover).
4/ The price is inclusive of charges, but exclusive of transport costs.

Table 4. Dimensions and cost of bricks in West Africa in 1963-65

ANNEX I

	MALI			UPPER VOLTA[1]			NIGER[2]			IVORY COAST[3]	
	$1000 apiece	kg/apiece	$/T	$1000 apiece	kg/apiece	$/T	$1000 apiece	kg/apiece	$/T	$1000 apiece	kg/apiece
	1	2	3	4	5	6	7	8	9	10	11
Voutes 1/1				121.5	4.25	28.6					
1/2											
Hollow ceiling pots 15cms				162.0	8.1	20.0					
20cms				178.2	10.4	17.1	115.5	5.0	23.1		
Dalles 10x10x3							20.2	0.54	37.4		
Marseilles tiles 17½"x11"											
Ornamental bricks											
3"x4"x8½" solid											
hollow											
Solid cement blocks											
7x20x40				465.9	11.0	42.4	465.9	11.0	42.4	99.3	
10x				506.4	16.0	31.7	506.4	16.0	31.7		
15x				567.1	25.0	22.7	567.1	25.0	22.7		
20x				729.2	32.0	22.8	729.2	32.0	22.8		
4"x9"x18"											
6"											
Hollow cement blocks											
10x20x40	162.0	11.0	14.7	486.0	11.0	44.2	486.1	11.0	44.2	122.5	11.0
15	182.3	15.0	12.2	546.9	15.0	36.5	546.9	15.0	36.5	145.8	15.0
20	222.9	25.0	8.9	668.4	25.0	26.7	668.4	25.0	26.7		
8"x9"x18"											
6"											
5"											

1/ The figures should be increased by a 14 per cent production charge.
2/ The selling price is calculated on the sale of 75 per cent of the total production.
3/ Prices (excluding charges on turnover)
4/ The price is inclusive of charges, but exclusive of transport costs.

Table 4. Dimensions and cost of bricks in West Africa in 1963-65

ANNEX I

	Ivory Coast 3/	GHANA 4/			NIGERIA 4/			TOGO 4/		
	$/T	$1000 apiece	kg/apiece	$/T	$1000 apiece	kg/apiece	$/T	$1000 apiece	kg apiece	$/T
	12	13	14	15	16	17	18	19	20	21
Hollow bricks										
5.5x11x22 - 3 holes										
7.5x15x03 - 3 holes										
5.0x10x33										
7.5x10x33										
10x10x33										
15x10x33 - 6 holes										
20x10x33										
10x20x40 - 8 holes	17.8									
15x20x40 - 12 holes	17.8									
[illegible]		70.0	2.7	25.9						
"		81.7	4.1	19.9						
"		105.0	5.4	19.4	81.8	4.0	20.5			
[illegible]		81.7	4.1	19.9						
"		105.0	5.9	17.8						
"		140.0	9.1	15.4	93.2	5.0	18.6			
[illegible]		81.7	2.7	30.3						
"		105.0	5.9	17.8						
"		140.0	10.9	12.9						
"		163.3	12.7	12.9	116.8	7.5	15.6			
[illegible]					175.0	10.0	17.5			
[illegible]					175.0	12.0	14.6			
Solid bricks										
5.5x11x22 normal	19.4									
5.5x11x22 reinforced	26.4							5.3	1.54	3.4
[illegible]					81.8	3.0	27.3			

1/ The figures should be increased by a 14 per cent production charge
2/ The selling price is calculated on the sale of 75 per cent of the total production
3/ Prices (excluding charges on turnover)
4/ The price is inclusive of charges, but exclusive of transport costs.

Table 4. Dimensions and cost of bricks in West Africa in 1963-65

ANNEX I

	IVORY COAST[3]	GHANA[4]			NIGERIA[4]			TOGO[4]		
	$/T	$1000 apiece	kg/apiece	$/T	$1000 apiece	kg/apiece	$/T	$1000 apiece	kg/apiece	$/T
	12	13	14	15	16	17	18	19	20	21
Dreins 1/1	60.8	105.0	3.6	29.2						
1/2		70.0	2.3	30.4						
Hollow ceiling pots 15cm					326.8	10.0	32.7			
20cm										
Slotts 10x10x3	60.8									
Marseilles tiles 17½"x11"		105.0	3.6	29.2						
Ornamental bricks										
3"x4"x8½" solid		70.0	3.2	21.9						
hollow		70.0	2.3	30.4						
Solid cement blocks										
7x20x40										
10										
15										
20		210.0	32.0	6.6						
4"x9"x18"		233.3	21.4	10.9						
6"		233.3	32.8	7.1						
Hollow cement blocks										
10"x20x40	11.1									
15	9.7									
20										
4"x9"x18"		186.7	13.5	13.8						
6"		210.0	24.0	8.8						
9"		233.3	30.0	7.8						

1/ The figures should be increased by a 14 per cent production charge.
2/ The selling price is calculated on the sale of 75 per cent of the total production.
3/ Prices (excluding charges on turnover).
4/ The price is inclusive of charges, but exclusive of transport costs.

Table 5. The Price-List of Bricks in Tunisia
(Union Générale Briqueteries de Djemmal)

ANNEX I

		Tunisia		
		$1000 pieces	kg/piece	$/t
Hollow bricks	4,5-10,5-21,5-3 holes	15,7	1,00	
	6,5 -6 holes	22,0	1,40	15,7
	10,5-21,5-30 -8 holes	74,8	4,50	16,6
	10,5-21,5-30 -10 holes	77,0	4,90	15,7
	15 -20 -30 -12 holes	105,3	6,70	15,7
	15 -20 -15 -12 holes	51,1	3,25	15,7
Solid smooth bricks	4,5-10,5-21,5	104,8	2,00	52,4
" " "	perf. - " -	62,9	2,00	31,5
" " "	6,5-10,5-21,5	144,0	3,00	48,0
" " "	perf. - " -	76,2	3,00	25,4
" " non polic	6,5-10,5-21,5	129,6	3,00	43,2
Partition bricks				
with 4 cavities	4,5-21,5-30	45,8	2,60	17,6
" 8 "	6,5-21,5-30	56,6	3,60	15,7
Triplisol	15-22-30	141,3	7,80	18,1
"	15-22-22	120,1	5,80	20,7
"	15-22-15	83,3	3,90	21,4
"	15-22-7,5	46,2	2,00	23,1
U12 bricks	12-13,5-25	99,0	5,20	19,0
U12 solid half bricks	12-6,75-25	88,9	3,21	27,7
U18 bricks	18-13,5-25	157,1	8,40	18,7
Circular claustras	6,5-12,5	49,0	0,65	75,4
Semi-circular claustras	"	29,4	0,325	90,5
Square claustras	14-14	76,2	1,40	54,4
Flue pipes	16-20-33	314,1	10,00	31,4
Floor tiles	10-20	44,0	1,05	42,1
" "	20-20	66,0	2,20	30,0
Special hollow flooring blocks				
with hollow tubes	35-30-17	152,4	8,50	17,9
Hollow tubes for special hollow flooring blocks	4-11-30	47,6	1,35	35,3
Roger hollow flooring				
blocks of	13-33-30	115,0	7,00	16,4
"	16-33-30	133,3	7,50	17,8
"	19-33-30	151,5	8,00	18,9
	30-33-30	247,2	12,80	19,3
Brilumfer hollow flooring				
blocks of	11-20-30	71,9	4,00	18,0
"	13-20-30	90,9	5,00	18,2
"	15-20-30	105,2	5,60	18,8
Cap type of hollow flooring				
blocks of	12-20-20	55,5	2,70	20,6
	12-20-30	79,2	4,00	19,8
	16-20-20	73,9	3,50	21,1
	16-20-30	105,6	5,00	21,1
	20-20-20	98,4	4,00	23,1
	20-20-30	132,0	6,00	22,0
Brilumfer small slabs	4,5-15-30	66,7	2,60	25,7
" " "	6,5-13-30	49,5	2,20	22,5

Table I:- **Residential construction in newly-constructed buildings, break-down by type of structural elements in percentage in selected countries**

Annex II

in % Country	Type of Structure	1957	1958	1959	1960	1961	1962	1963	1964	1965
France	wood						0.1	0.1	0.1	0.2
	natural stone						6.3	6.2	5.8	4.2
	artificial stone						22.7	21.0	18.9	19.5
	solid bricks						6.0	4.1	3.4	3.7
	hollow bricks						21.2	21.4	19.4	19.4
	concrete panels						3.1	3.1	4.7	8.0
	monolithic steel-concrete						5.2	5.1	6.0	5.4
Netherland	wood				-	2	1	1	1	1
	bricks				69	64	61	63	56	47
	steel-concrete				24	29	25	27	29	32
	steel framework				2	1	2	2	2	2
	other "				3	4	10	5	11	18
	other materials				2	-	1	2	1	3
Norway	wood	68.1	66.0	64.8	64.3	64.1	64.9	62.1	65.9	
	bricks	9.0	4.2	3.7	3.4	2.2	2.8	2.0	1.7	
	concrete	6.6	12.1	14.5	16.1	16.5	16.4	16.0	23.1	
	other materials	16.3	17.7	17.2	16.2	17.2	15.9	19.9	9.3	
Turkey	stone	25.3	21.4	21.1	20.5	20.5	21.0	19.1		
	bricks	47.3	47.5	47.0	49.6	49.6	53.4	53.9		
	green bricks (unburnt)	12.7	12.0	10.0	13.0	13.9	11.4	7.8		
	wood	6.6	6.5	10.5	9.5	7.3	4.6	3.8		
	steel-concrete	4.4	9.7	10.6	5.9	6.2	6.7	10.3		
	other materials	3.7	2.9	0.8	1.5	2.5	2.9	5.1		

in % Country	Type of Structure	1957	1958	1959	1960	1961	1962	1963	1964	1965
Bulgaria	wood					1.6	1.1	0.9	0.9	0.6
	bricks and stone					77.3	77.1	76.1	67.7	63.0
	monolithic steel-concrete					18.4	17.8	19.0	24.1	24.7
	panels					1.2	2.3	2.9	6.7	10.2
	other					1.5	1.7	1.1	0.6	1.5
Yugoslavia	wood							5.0	3.4	3.9
	bricks and stone							71.1	63.9	70.1
	unburnt bricks							7.2	4.8	5.1
	skelet steel and steel concrete							9.1	10.0	12.8
	other							7.6	17.9	8.1
Hungary	bricks					64.9	43.1	27.8	24.1	16.7
	brick-blocs					-	4.4	4.6	8.2	13.6
	lightweight concrete agreg					17.9	39.1	42.5	46.1	42.9
	panels					0.3	0.2	1.3	2.7	6.1
	monolithic concrete					1.2	3.2	2.1	2.3	3.0
	steel-concrete framework					6.2	6.3	5.8	15.4	11.6
	other materials					9.5	3.9	4.9	1.2	6.1

in % Country	Type of Structure	1957	1958	1959	1960	1961	1962	1963	1964	1965
Czechoslovakia	bricks		65.8	61.3	54.1	42.5	37.0	29.9	20.3	19.5
	brick-blocs		15.9	16.9	12.8	6.2	3.9	3.1	0.8	1.0
	concrete blocs		7.4	9.2	5.3	5.1	6.1	9.8	0.9	1.9
	panels				9.2	13.5	25.3	10.7	18.0	17.8
	monolithic concrete				0.7	3.6	2.7	6.5	3.1	1.5
	monolithic framework		2.4	2.6	0.7	1.3	1.7	0.6	0.8	0.6
	other		7.9	10.0	17.2	27.8	33.3	39.4	56.1	57.7

MOBILE BRICKWORKS PROJECT - CHAD

ANNEX III

	Product		Clay
Bricks and floor slabs	3,425T + 15%	=	3,940
Slabs or large tiles	564T + 25%	=	705
Claustra	260T + 30%	=	340
Total	4,279T + 17%		4,985

Investments:

		Frs.	$
43 mlns:	Lorry	1,100,000	4,456
	Water	200,000	810
	Van	850,000	3,443
	Drying	2,500,000	10,128
	Machines and trailer	12,000,000	48,612
		16,650,000	67,449

	Frs.	$
Engineering	1,700,000	6,887
Sheds	3,000,000	12,153
Brick kilns	2,800,000	11,343
Sandstone Kilns	4,500,000	18,230
Accommodation for watchment and office	300,000	1,215
Fencing	900,000	3,646
	13,200,000	53,474

For two centres:	Frs.	$
2 x 13,200,000 -	26,400,000	106,946
+	16,650,000	67,449
I =	43,050,000	174,395

	Frs.	$
Labour	4,000,000	16,204
Labour	3,166,000	12,825
Miscellaneous	840,000	3,403

		Frs./month	$/month	$/year
Quarrying, Crushing cutting and drying assistants	12 at	5,000	20.3	243.1
Assistant driver	1	4,800	19.4	233.3
Driver	1	8,000	32.4	388.9
Watchman	2	10,000	40.5	486.1
Expert	1	150,000	607.6	7,291.8
	17			

		Frs.	$
Fuel (400 cubic metres at 150 frs./m^3)	60.8 US$	600,000	2,431
54 tons of cotton seed	x 15,000 frs./ton	810,000	3,281
		1,410,000	5,712
Motor fuel		3,300,000	13,368
Maintenance		2,600,000	10,533
Amortisation		5,100,000	20,660

ANNEX III

		Frs.	$
Repayment of Loans:			
Annual interest:	Long-term	810,000	3,281
	Short-term	300,000	1,215
Annual repayment:	Long-term	1,500,000	6,077
	Short-term	1,700,000	6,887
Provisional earnings:			
	bricks	11,987,000 (3,500 Frs/t)	48,559 (14.2)
	slabs	5,076,000 (9,000 Frs/t)	20,963 (36.5)
	claustras	2,860,000 (11,000 Frs/t)	11,586 (44.6)
	Total	19,923,000	80,708
Loan: 18 mlns. over 15 years at 4.5%			72,918
5 mlns. over 3 years at 6.0%			20,255

Working Account

	Frs.	$		Frs.	$
Labour	4,000,000	16,204	Bricks	12,000,000	48,612
Fuel	1,400,000	5,671	Slabs	5,100,000	20,660
Motor Fuel	3,300,000	13,368	Claustras	2,900,000	11,748
Maintenance	2,600,000	10,533			
Long-term	810,000	3,281		20,000,000	81,020
Short-term	310,000	1,256			
Amortisation	5,100,000	20,660			
Results	2,490,000	10,087			
	20,000,000	81,020 (81,060)			

Table 1: Consumption of Cement and Bricks in Selected African Countries

ANNEX IV

	Population (millions) 1965	1980	GDP (millions $) 1965	1980	Per Capita GDP ($/year/capita) 1965	1980	Investments for Construction (million $) 1965	1980	Consumption of Cement (1000 tons) 1965	1980	Consumption of Bricks 1000 t/year 1965	1980	1000 pieces (1 piece = 3.5 kg) 1965	1980	Per Capita Consumption of Cement 1965	1980	Per Capita Consumption of Bricks 1965	1980	Consumption per US$1000 of Investment for Construction: Cement kg/$1000 1965	1980	Brick pieces/$1000 1965	1980
Dahomey	2,35	3,35	140	366	[illegible]	[illegible]	7,9	38	59	257	2,0	38	570	9,7[illegible]	25	77	[illegible]	[illegible]	7,[illegible]	6,763	72,3	255,6
Gambia	[illegible]	[illegible]	[illegible]	56	79	110	0,8	7	9	39	-	8	-	2,[illegible]	28	80		4,07	11,250	5,571		386,6
Ghana	7,70	10,13	1,565	3,407	[illegible]	207	177,3	512	585	2,173	3,5	234	1,000	66,[illegible]	[illegible]	[illegible]	0,13	5,51	2,961	4,244	5,6	130,6
Guinea	3,40	5,03	[illegible]	[illegible]	72	112	7,9	76	80	456	2,2	[illegible]	6,343	23,407	23	91	1,82	4,66	10,126	6,000	802,9	308,3
Ivory Coast	3,85	5,38	553	2,446	[illegible]	455	96,9	336	264	1,890	3,0	215	857	61,426	69	353	0,22	11,42	2,724	4,335	8,8	140,9
Liberia	1,05	1,20	263	726	250	595	41,8	138	116	190	10,4	30	2,971	8,571	109	153	2,83	6,50	2,775	1,377	71,1	62,1
Mali	4,58	6,40	357	657	78	101	22,0	90	17	133	12,0	26	3,428	7,428	4	21	0,75	1,15	773	1,478	155,8	82,5
Mauritania	0,76	0,89	[illegible]	300	152	382	30,7	55	7	33	-		-	2,[illegible]	9	37		2,57	228	600	-	41,6
Niger	3,37	4,47	356	705	90	152	21,3	107	13	85	3,6	43	1,029	12,285	4	18	0,32	2,63	610	794	48,3	114,8
Nigeria	58,00	55,20	4,[illegible]	10,400	78	110	297,9	1,580	1,147	5,282	25,0	496	7,143	133,[illegible]	20	58	0,12	1,49	3,850	3,352	24,0	89,5
Senegal	3,47	4,48	700	1,500	[illegible]	337	45,7	230	205	1,087	14,0	130	4,000	37,407	59	228	1,15	8,08	4,486	4,552	57,5	162,7
Sierra Leone	2,70	3,45	228	[illegible]	84	162	16,5	100	73	470	-	60	-	17,142	29	128		4,68	4,424	4,700		171,4
Togo	1,64	2,37	143	322	87	140	7,9	42	42	156	18,0	28	5,143	8,000	26	66	3,14	3,38	5,316	3,714	651,0	190,5
Upper Volta	4,70	6,01	[illegible]	[illegible]	47	105	13,4	110	35	202	6,3	35	1,800	10,285	7	32	0,38	1,60	2,602	1,836	134,3	93,5
Algeria	11,30	18,30	2,170	4,000	[illegible]	[illegible]	127,[illegible]	[illegible]	620	1,700	20,0	300	91,[illegible]	[illegible]	64	93	[illegible]	11,28	5,[illegible]	2,733	778,9	330,7
Libya	1,60	2,50	[illegible]	4,[illegible]	500	1,680	97,0	580	470	1,600	32,0	600	3,400	171,400	[illegible]	580	5,89	48,57	4,845	2,777	97,2	300,1
Morocco	13,40	20,40	2,[illegible]	4,[illegible]	180	205	170,0	737	810	2,000	56,0	480	22,407	135,140	66	102	0,18	6,86	4,765	2,788	161,3	136,1
Tunisia	4,30	6,00	[illegible]	2,150	[illegible]	316	102,0	397	400	1,050	13,0	480	32,[illegible]	131,135	93	154	7,57	20,77	3,922	2,645	316,5	365,4
Sudan	13,50	20,70	1,170	2,400	98	128	95,0	384	430	1,000	[illegible]	480	[illegible]	131,402	36	48		6,35	4,526	2,604		342,2
Cameroon	5,40	7,23	[illegible]	1,707	125	233	33,0	175	73	500	20,0	96	5,714	27,407	15	75	1,14	3,79	2,210	3,000	173,2	155,8
Chad	3,25	4,19	215	[illegible]	[illegible]	150	17,0	77	9	70	18,0	110	5,143	31,407	3	17	1,58	7,50	529	909	302,5	408,1
Congo B.	0,85	1,11	130	355	150	320	13,0	40	40	200	10,0	22	2,857	6,285	55	180	3,38	5,66	3,109	5,000	219,8	157,1
Congo K.	15,10	22,04	1,[illegible]	2,907	78	131	62,0	421	211	2,000	22,0	455	6,285	130,000	14	91	0,42	5,90	3,402	4,751	101,4	308,8
Central African Rep.	1,30	1,80	140	400	108	240	11,0	58	16	160	8,0	32	2,285	9,142	12	87	1,75	4,57	1,455	2,759	207,8	157,6
Gabon	0,45	0,59	170	565	405	965	37,0	32	32	60	[illegible]	17	[illegible]	4,857	70	102		8,23	865	1,875		151,8
Total	[illegible]	[illegible]	[illegible]	[illegible]	117	190	1,558,0	6,[illegible]	5,[illegible]	22,113	300,0	5,[illegible]	271,120	1,[illegible]	36	87	1,31	5,50	3,[illegible]	3,300	139,9	216,4

Table 2: Breakdown of Costs of Brickworks Proposed by ECA for three African Sub-regions up to 1980

ANNEX IV

	Dahomey	Gambia	Ghana	Ivory Coast	Liberia	Mali	Mauritania	Niger	Nigeria	Senegal
Proposed total capacity 100 t/years	32	8	160	190	20	12	8	17	440	115
Amortization	75,2	18,6	491,8	596,4	48,8	32,9	18,6	40,6	1,298,8	345,6
Maintenance	24,2	6,1	154,4	185,3	16,0	10,9	6,1	13,3	408,8	109,8
Interest	28,5	6,4	192,5	227,9	21,0	11,5	6,4	15,4	505,4	135,6
Insurance and miscellaneous	5,7	1,3	38,5	45,6	4,2	2,3	1,3	3,1	101,1	27,1
Wages and contributions	109,9	35,0	409,9	489,0	59,2	64,7	35,0	57,1	1,203,0	308,3
Profits	111,0	21,5	898,4	1,075,6	86,4	37,4	21,5	60,7	2,310,1	624,3
Fuel	42,2	10,6	229,0	268,8	26,4	35,3	10,6	47,9	824,8	162,3
Electricity	41,3	8,9	125,7	167,0	16,4	30,7	20,1	40,1	637,6	145,5
Gross turnover	438,4	108,4	2,540,2	3,055,6	278,4	225,7	119,6	278,2	7,289,6	1,858,5
Value added	296,1	75,1	1,800,1	2,161,0	194,4	135,0	75,1	158,4	4,911,9	1,278,2

Table 2: Breakdown of Costs of Brickworks Proposed by ECA for three African Sub-regions up to 1980 (cont'd)

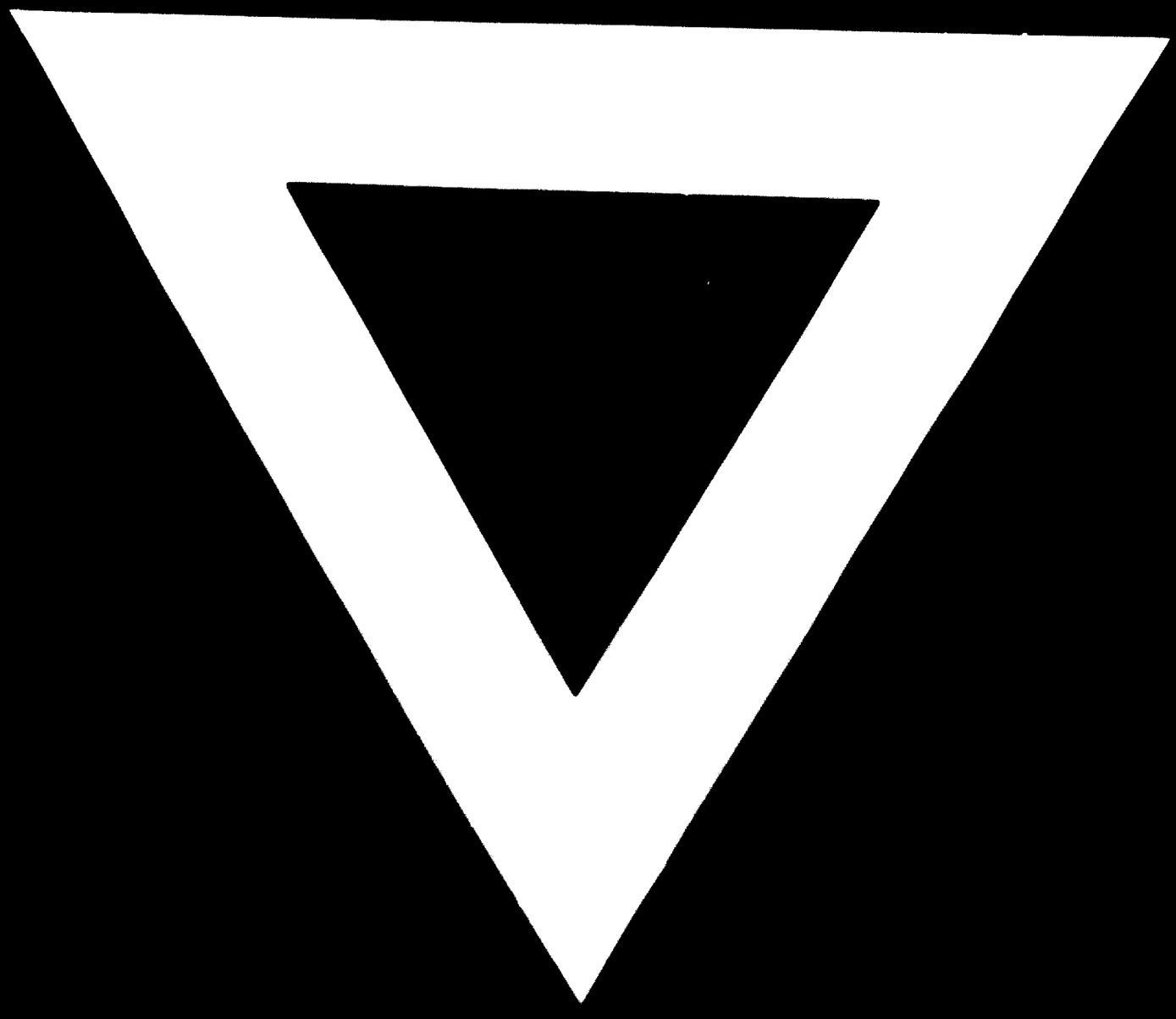
ANNEX IV

	Sierra Leone	Togo	Upper Volta	Algeria	Libya	Morocco	Tunisia	Sudan	Cameroon	Chad
Proposed total capacity 100 t/years	60	10	25	80	150	140	150	190	75	75
Amortisation	146,4	21,4	56,0	179,2	312,0	312,0	312,0	414,4	188,4	174,0
Maintenance	48,1	7,0	18,3	78,4	136,5	136,5	136,5	181,3	82,4	76,1
Interest	63,0	7,4	20,5	78,4	136,5	136,5	136,5	181,3	82,4	75,1
Insurance and miscellaneous	12,6	1,5	4,1	16,0	27,0	27,0	27,0	36,0	23,6	21,8
Wages and contributions	177,6	42,1	94,9	238,0	333,5	333,5	333,5	492,6	130,9	143,9
Profits	259,2	25,6	75,9	380,8	663,0	663,0	663,0	880,6	400,4	369,8
Fuel	79,2	13,2	66,0	122,4	139,5	169,2	240,3	207,5	85,5	189,0
Electricity	36,5	14,1	28,6	188,1	192,0	186,4	173,9	304,0	213,6	242,4
Gross turnover	922,6	132,3	364,3	1,181,3	1,940,0	1,964,1	2,022,6	2,697,7	1,207,2	1,292,1
Value added	683,2	89,1	226,8	798,8	1,308,5	1,308,5	1,308,5	1,787,6	719,7	687,7

ANNEX IV

Table 3. Breakdown of Costs of Brickworks Proposed by [illegible]A for three African Sub-regions up to 1980

	Congo B.	Congo [illegible]	[illegible]	Gabon	AFRICA West	AFRICA North	AFRICA Central	Three Sub-region
Proposed total capacity 1000 t/years	10	[illegible]	30	[illegible]	1,[illegible]	[illegible]	[illegible]	[illegible]
Amortization	[illegible]	1,[illegible],5	[illegible]	[illegible]	[illegible]	[illegible]	1,[illegible]	[illegible]
Maintenance	[illegible],4	[illegible]	[illegible]	21,0	1,[illegible]	[illegible],2	[illegible]	2,[illegible]
Interest	[illegible],4	[illegible],0	26,3	[illegible],0	[illegible]	[illegible]	[illegible],2	2,[illegible]
Insurance and miscellaneous	2,[illegible]	[illegible]	[illegible],3	[illegible]	[illegible]	[illegible]	204,[illegible]	[illegible]
Wages and contributions	[illegible],4	[illegible]	[illegible]	[illegible]	3,[illegible]	[illegible]	1,027	[illegible]
Profits	35,[illegible]	[illegible]	[illegible]	[illegible],0	5,[illegible]	3,[illegible],4	3,[illegible],4	[illegible],336.4
Fuel	11,4	1,[illegible],0	75,6	20,4	1,[illegible],3	[illegible],0	1,[illegible]	4,211,[illegible]
Electricity	22,[illegible]	1,[illegible],0	4[illegible],0	[illegible]	1,[illegible]	944,3	1,[illegible]	4,142,[illegible]
Gross Turnover	128,4	[illegible],8	433,6	320,4	[illegible],8	[illegible].805,[illegible]	11,[illegible]	[illegible],490,0
Value added	78,0	4,2[illegible]	250,9	137,4	[illegible],4	6,[illegible]	6,[illegible],3	24,533.3



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