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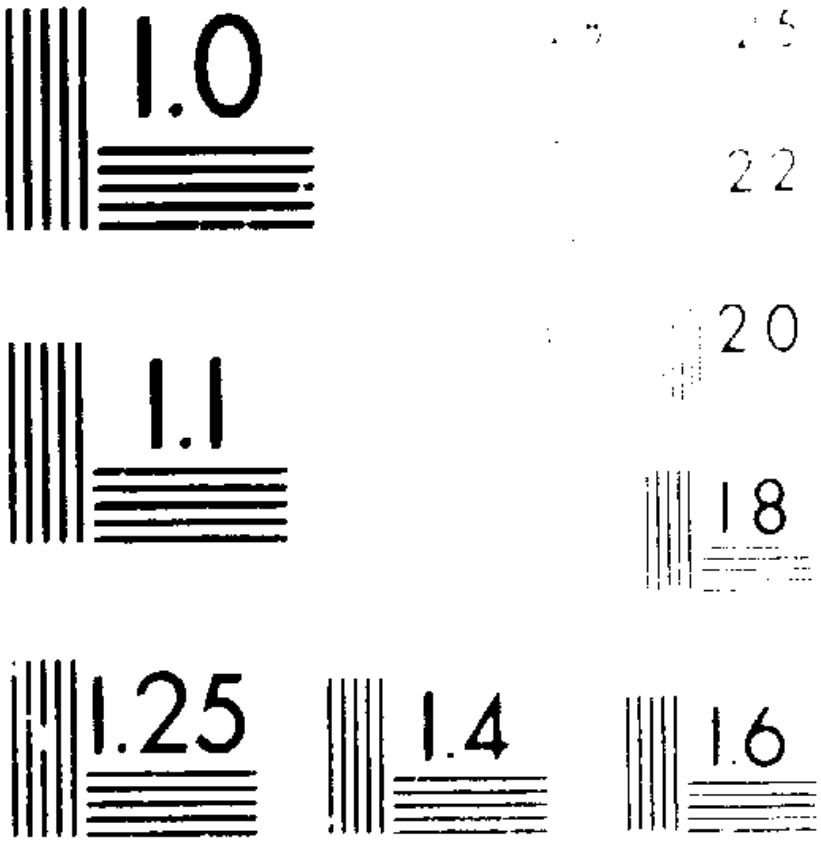
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Prefeasibility Study

for

Establishment of a Glass Containers Factory in Niger/North Nigeria

UNIDO Project No DP/RAF/77/020

Prepared for UNIDO and for

the Niger-Nigeria Joint Commission

by

POLIMEX-CEKOP, Poland

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Warsaw, Poland

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I. EXECUTIVE SUMMARY

The project was initiated by the Niger/Nigeria Joint Commission for Co-operation with the headquarters located in Niamey, Boulevard des Ambassades, Republic of Niger.

The field research in Niger and Nigeria for the prefeasibility study took place during the period April 17 - June 2, 1983. The research team was composed of three Polish specialists: Mr J.Bania (plant technologist), Mr L.Czarciński (team leader) and Mr R.Gajęcki (economist).

The project may be defined as being primarily market oriented but also combines the possibility of appreciation of the local raw-materials basis. In major portion of yearly raw-materials requirements, the glass plant may use local resources. The market research done at the beginning of 1983 proved an existence of the market size in Niger and Northern Nigeria for beer and soft drink bottles, which justifies the construction of the glass plant with production capacity of 60000 t/y.

There is no production of glass in Niger. The existing glass containers production capacity in Nigeria, estimated to be 210,000 t/y in 1983, does not meet present and potential (future) demand.

The market share of Niger is only about 3.5 % of the total combined Niger and Northern Nigeria market. This means that the location of the plant in Niger is possible only under the assumption that a majority of production would be sold in Nigeria market.

In both: Niger and Northern Nigeria, the geological research has not resulted as yet, in sufficiently documented raw-materials deposits for production purposes. Different preliminary evaluations, done so far in both countries, of basic raw-materials resources such as glass sand, limestone, and dolomite, indicate a potential success in searching for necessary deposits.

The conditions of electrical energy and water supply for production purposes seem to be comparable in both countries. Production has to be supported by inside plant generating systems.

Utilities such as heavy and light oil, diesel oil and LPG are locally available in Nigeria from local production, while Niger must still import oil products.

Based upon the analysis of market structure and potential raw-materials deposits, the two alternative locations of the plant may be considered at the pre-feasibility stage: in Niger - the region of Maradi, and in Nigeria - the Kano State territory. An appropriate, concrete Plant location may be determined after the completion of geological surveys of glass sand deposits.

The plant is supposed to produce 60000 tonns of glass or 137,134 million of beer and soft drink bottles per annum. It is going to have two tank furnaces, each equipped with 3 automatic forming machines IS 6 DG (six section double gob). One tank furnace will produce continuously flint glass, while the second coloured glass.

The glass plant has to operate continuously during the whole period of tank furnace campaign based upon three

shifts system. The plant operation needs the total employment of 445 persons.

The minimum permanent foreign assistance is assumed to be 3 persons and should be recommended by technical partner.

The project is supposed to be a joint venture in both countries: Niger and Nigeria.

The major components of the Plant overhead costs are management and administration, foreign assistance and the tank furnaces maintenance. The proportion of overheads in operating costs is in Niger 8.72 % and in Nigeria 14.53 %.

The construction period is assumed to be 2.5 years or 3 years including 6 months of implementation planning.

The construction period ends up with the completion of cold start up of machinery and equipment and of heating up of tank furnaces. The above assumption implies the production program to be 76.5 % of full capacity during the first and one start-up year.

Financial and economic evaluation permitted to develop the major characteristics of the project in Niger and Northern Nigeria.

- Total investment costs

  a) Niger (in CFA) 32,687,683,000 or (in US $) 81,719,207

  b) Nigeria (in Naira) 61,705,400 or (in US $) 80,217,020

  at the exchange rate 400 CFA equals 1 US $ and 1.3 US $ equals 1 Naira.

- Equity participation in total investment is assumed to be 30 %, while technical partner participation in equity to be limited to 20 %.

The amount of loans needed to finance the project is:

- in Niger 22,688,000,000 CFA, or 56,720,000 US $
- in Nigeria 43,705,421 Naira, or 56,817,047 US $

The parameters of the financial project evaluation, calculated for the two locations of the Plant in Niger and Nigeria, are as follows:

	Niger	Nigeria
Internal rate of return (IRR)	12.73 %	14.146 %
Pay-back period - years	5.7	5.0
Rentability of capital	11.65 %	16.14 %
Rentability of investment	3.66 %	4.38 %
Job creation, specific capital requirement	185,928 $/job	182,510 $/job
Simple rate of return	11.62 %	16.24 %

The above shown values of project parameters should be perceived as rather pesimistic as they were developed based upon pesimistic assumptions concerning product price and also production cost.

The calculation does not include an inflation factor. The inclusion of inflation would result in more optimistic values of the project parameters.

With regard to an inflation rate of 12 % per annum, the project seems to be an interesting investment opportunity in both countries. This situation makes the choice of final location of the plant difficult. It should be emphasized, that a full-fledged feasibility study can be prepared only when the promoter of the project is fully identified and the decision on the exact location is taken by the relevant authorities. The present pre-feasibility study has been prepared in order

to supply the appropriate information for the decision makers to make a final selection of the location of the factory. We think, that such selection should be possible when geological survey of glass sand, limestone and dolomite deposits in Maradi region and on the Kano State territory is available. At the present stage of the study the following general conclusion can be drawn: under the assumption of equal raw-materials opportunities in Niger and in Nigeria, the location of the plant in Nigeria would require less effort to make the project economically successful.

II. PROJECT BACKGROUND

The development of glass production in Africa may be considered as relatively advanced in relation to other industries. The market for glass containers and also for flat glass has been increasing, while the existing production does not follow up the development of demand. This situation inspires African countries to promote efforts towards an acceleration of the glass production development.
The following traces of such efforts had been found during the UNIDO mission to Niger and Nigeria.

Nigeria

One of the first investigations concerning the glass production in Nigeria was done by Arthur D. Schmidt International Inc. in 1959[1]. The study was mainly devoted to the analysis of availability of raw materials for glass production in Nigeria. A number of locations were indicated for different raw materials such as: sand, limestone, dolomite and feldspar. Since that time the glass production has grown rapidly. At present four glass plants are in operation in Nigeria:

- Nigel Box Toyo Glass Ltd. (3 furnaces) in Ambara, Owan State
- Delta Glass Co. Ltd. (2 furnaces) in Ughelli, Bendel State

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1) Investigation of the feasibility of glass production in Nigeria, Arthur D. Schmidt International Inc. Report No. 10023, December, 1959. Report submitted to Universal New York, Inc. Empire State Building, New York, N.Y.

- West African Glass Co.Ltd. /1 furnace/ in Port Haracourt, River State
- Ballarpur Nigeria Ltd. /1 furnace/ in Kaduna, Kaduna State,

and one still under construction :

- International Glass Co. Ltd. /1 furnace/ in Aba, Imo State.

The most recent feasibility study of glass production made for Nigeria by Investment Information and Promotion Centre of the Federal Ministry of Industries in 1982 indicates still growing market potential and opportunities for this type of production in the country. Within the Fourth National Development Plan 1981-85 glass production projects have been considered in States : Ondo, Ogun, Lagos, Anambra, Borno, Plateau, Kano, and Bauchi[1/] . The Kano State Government has also shown strong interest in building the glass plant. The glass bottles production has been stimulated by new and expansion projects of existing beer and soft drinks production [2/]. The actual production of glass bottles does not meet demand [3/]. The present study focuses attention on satisfaction of needs within two joint markets : Northern Nigeria and Niger. The study takes in this way into consideration an economic integration potential existing between Nigeria /English spoken/ and Niger /French spoken/ countries.

1/ Fourth National Development Plan 1981-85, The National Planning Office, Federal Ministry of National Planning, Lagos, p. 164-165.

2/ ibid, p. 165-166.

3/ The Seven-up Co. Ltd. imports most of bottles.

Niger

Niger with her approximately 6 millions population represents, in relation to Nigeria, much smaller market potential for glass containers production. Within the zone of French countries Ivory Coast was first to take initiative in promoting glass production. After the Lome Convention, the Centre de Developpement Industrielle (CDI) of CEAO countries undertook the prefeasibility study of glass production in 1978 for three countries: Ivory Coast, Upper Volta and Niger. The study was verified by Brasseries + Glacieres Internationales (BGI) in Paris for the conditions of Niger and positive recommendation was formulated to build the plant in Niger with the capacity of 20 000 T/A and equity composed of contributions of Niger, Upper Volta, Ivory Coast and BGI. No cooperation or link with the Northern Nigeria market was assumed within this study.

The Nigeria/Niger Joint Commission has been in possession of a document concerning an investigation of glass production for Niger and Nigeria. However, the document is limited to the analysis of the Niger market and respective raw material basis with recommendation to make a comparative analysis in Nigeria. In this respect the present study is a logical follow up of the previously made research.

The present study assumes the possibility of Niger - Nigeria economic integration. This means that the joint: Niger + Northern Nigeria market potential serves as a basis for the determination of the plant capacity.

The projected capacity exceeds the demand in Niger only and probably in all BCAO countries[1].

Therefore, the location of the plant in Niger may be considered only under the assumption that most of production will be sold in the Nigerian and other BCAO markets.

It has also to be assumed that the project would be a joint venture, as the amount of investment to be made exceeds probably the possibilities of Niger only.

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1) Niger and other BCAO countries have expanded projects of drinks, transformation of tomato and vegetables and other fruits. This will of course increase demand for glass containers.

III. MARKET AND PLANT CAPACITY

1. The Geographical Scope of the Investigation.

The object of this investigation is the demand for glass containers in Niger and Northern Nigeria. Niger covers an area of 1,267,000 km^2 and has reached a population of 5.845 million in 1982. Nigeria, covering an area of 923,800 km^2 has an estimated population of 90.0 million.

The northern part of the country embodies 10 states: Sokoto, Kano, Borno, Niger, Kaduna, Bauchi, Gongola, Kwara, Plateau and Benue and the territory of the federal capital. The so-described Northern Nigeria accounts for 730,885 thousand km^2 of area or 79.1 % of the whole territory. The estimated population of this area reached 47.53 million in 1982, representing 52.8 % of the whole population.

The above facts show that there is a distinguishable concentration of economic activity in the South. This regards also the beverages and existing glass containers production.

2. The Product Definition.

Glass Containers cover a wide range of products used as packages. An introductory market analysis has restricted the investigation to the demand for bottles for two kinds of beverages: beer and soft drinks. Bottles of similar type are used in both countries:

- for beer: volumes of 0.33 l, 0.6 l, 0.66 l;
- for soft drinks: volumes of 0.29 - 0.33 l.

The coloring of the bottles is: white, green and amber. Beside a visible expansion of beverages production in the last years (in Nigeria in particular), both countries aim at a diversification of the production, including food-processing. This indicates a growth of demand for containers other than bottles, such as jars, glass balloons, phials and others, in the future. In comparing with the demand for beer and soft drinks bottles it is negligable at present and will probably remain so in the near future. According to the bottles (Nigeria) and beverages producers practically all circulating bottles return and the demand for new ones is due to:

- growth of beverages production,
- technological loss at filling up bottles,
- distribution loss.

Returnable bottles are substituted by non-returnable ones and metallic cans. At present 4 % at the most of the produced beverages are sold in cans. A small rise of this share is possible (in Nigeria in particular) due to the market penetration of areas away from towns, the bush in particular. A growth in demand for returnable bottles is also possible, but not before the end of 1984.

These potential new facts do not shake the leading business of returnable bottles used as beer and soft drinks containers neither at present nor in the future.

3. The Market in Niger and Northern Nigeria

3.1. Method of Investigation.

Two separate methods of investigation have been chosen for Niger and Nigeria, taking account of the distinction between them in regard of:

- general level of social and economic development,
- beverages and bottles consumption and production,
- organization of information and statistics services.

Niger has no glassware production as yet and all her demand is satisfied by means of import. The sole beer and soft drinks producer is Braniger in Niamey and Maradi.

An accurate estimate for the demand was therefore possible relying on direct interviews in plants.

Nigeria has a large number of beverages producers.

The market analysis began by analyzing data on production and production capacity from the Federal Ministry of Industry and Trade. However, these were found to be non-reliable and direct interviews together with consultations with a dozen of leading home producers were carried out. A similar procedure was applied for estimating the present and potential production of glass containers in the existing glass-works in the country.

It is important to underline that the latest statistical yearbooks in both countries include information ending on 1979.

The up-dating of the main time series required research and verification of many sources, and also interviewing the producers.

Time series describing the growth of production and beverages consumption per capita were applied to predict future bottles demand. Hence an indirect method of estimating the bottles demand was used deriving from the beverages consumption predictions.
Two preliminary variants of estimation were elaborated.

The first one used the regression analysis, whereas the second was based upon the assumption that the demand will grow at a constant yearly rate lower than the one observed in the past.

The first variant assumed reliability of statistical data before 1979 obtained from official sources in Nigeria.
The second one allowed underestimation of stagnation in the past, resulting in overestimating the empirical growth rate of beverages consumption in the investigated period ending in 1982/83.

The second variant, as more reliable, has been used as origin for estimating the bottles demand including specifics of the bottle market and taking appropriate parameter assumptions.

3.2. The Market in Niger.

3.2.1. Imports of bottles.

The following data on imports of glassware come from three sources:

- OPEN (Office de Promotion de l'Entreprise Nigerienne)
- Direction de la Statistique et de Comptes Nationaux,
- Braniger de Niamey.

Table 1

Imports of Glassware to Niger in the Years 1979-1981 (OPEN)

Name of Article and its Origin	Unit of Measure	1979	1980	1981
1	2	3	4	5
Total Import	tonne	1,765.0	2,033.0	1,794.0
1. Bottles, FBLE				
Glass Balloons	tonne	136.952	36.000	3.772
- France		103.300	-	0.365
- Germany		33.162	36.000	0.013
- Belgium		-	-	3.394
2. Bottles, Ordinary	tonne	941.0	1,027.0	659.0
Glass Shards				
Czechoslovakia		660.0	439.0	149.0
Benin		197.0	485.0	510.0
France		66.0	-	-
United Kingdom		18.0	-	-
Bulgaria		-	103.0	-
3. Ordinary Glass Jars	tonne	166.0	239.0	423.0
France		137.0	201.0	372.0
Belgium		21.0	13.0	24.0
United Kingdom		7.0	18.0	27.0
4. Laboratory, Pharmaceutical and other Glass				
4.1. FBLE Glass	kilogramme	80.0	508.0	316.0
France		80.0	508.0	316.0
4.2. Other Glass	"	13,319.0	14,000.0	65,078.0
France		13,319.0	14,000.0	65,078.0

Table 2

Import of Ordinary Glass Bottles and Jars in the Years 1978 - 1981

/Direction de la Statistique et de la Comptabilité Nationale/

quantities in tonnes, value in millions CFA

Name of Article	1978		1979		1980		1981	
	quantity	value	quantity	value	quantity	value	quantity	value
Ordinary Glass Bottles	246.87	17.382	942.47	137.596	1023.78	130.299	650.88	81.755
Ordinary Glass Jars	-	-	20.029	4.204	8.318	4.870	15.439	3.634
Total	246.87	17.382	962.499	141.800	1032.098	135.169	674.319	85.389

Table 3

Number of Bottles sought in the years 1980-1983

(Braniger de Lacey together with Lomadi)

Unit of Measure	1980	1981	1982	1983	1984[x]
Number of tonnes of Bottles	630.0	920.0	757.0	695.0	634.0
Number of Bottles in millions	1.565	2.300	1.810	1.690	1.550

x) - estimates of the Braniger management

It is hard to derive explicit and exact conclusions from the above. The OPEN statistics are as much erroneous as informations of the Bureau of Statistics. Data in Table 3 concern the bottles demand of the leading producer, but alone.
However, there is no doubt that ordinary glass bottles dominated the imports of glassware to Niger in the years 1972 - 1981.

3.2.2. Demand for Beverages in Niger.

The estimation of the demand was derived from the refreshing drinks market development up to the present. Both imports and exports are negligible and therefore the internal production sold has been used to determine the consumption. Table 4 illlustrates essential data.

Time series from Table 4 have been used to estimate econometric models for development trends in beer and soft drinks consumption per capita, and from there a preliminary future demand for beverages has been predicted. Such procedure seems to be more accurate than the demand estimation based on existing beverages producing plants output capacity.
At present (1983) these are exploited in 63 % in beer and 67 % in soft drinks in Niger.
There is also a possibility of including social and economic factors and facts in our predictions, having influence on the level of beverages consumption.
From many estimated econometric models for development trends in beverages consumption per capita,

Table 4

Beer and Soft drinks Consumption Development

in Niger in the years 1974 - 1983

Years	Home Production in millions of litres		Population	Consumption per capita in litres	
	Beer	Soft Drinks		Beer	Soft Drinks
1974	4.10	2.43	4.707	0.87	0.52
1975	4.26	2.65	4.837	0.88	0.55
1976	4.54	3.02	4.971	0.91	0.61
1977	5.43	3.86	5.098	1.07	0.76
1978	6.50	4.80	5.240	1.24	0.92
1979	7.72	5.96	5.385	1.43	1.11
1980	8.16	6.91	5.543	1.47	1.25
1981	8.46	6.82	5.688	1.49	1.20
1982	9.60	9.89	5.845	1.64	1.69
1983	9.50[x]	10.00	6.007	1.58	1.66

x - Estimated by Braniger de Niamey

Sources: Braniger de Niamey, Annuaire Statistique 1978 - 1979 du Niger

the ones satisfying all statistical requirements have been chosen.

Model of Beer Consumption per Capita (Y_1) per Year in Litres

$$Y_1 = \underset{(10.8826)}{0.09697t} + \underset{(13.1073)}{0.72467}$$

$R^2 = 0.9367$, $s = 0.0809$, $r_1 = 0.2565$, $D = 1.2715$

t for time, 1974 has been taken as t = 1.

R^2 - determination coefficient,

s - standard deviation,

r_1 - autocorrelation coefficient of order 1,

D - Durbin - Watson statistic

number inside the brackets denote the t-Student statistics.

The exponential model as well as generalized exponential models have been found to be worse than the above.

Model of Soft Drinks Consumption Y_2 per Year in Litres

$$Y_2 = e^{\underset{(16.0571)}{0.141626\ t} - \underset{(15.2610)}{0.835192}}$$

$R^2 = 0.9699$, $s_{ln} = 0.0801$, $r_{1ln} = -0.2452$,

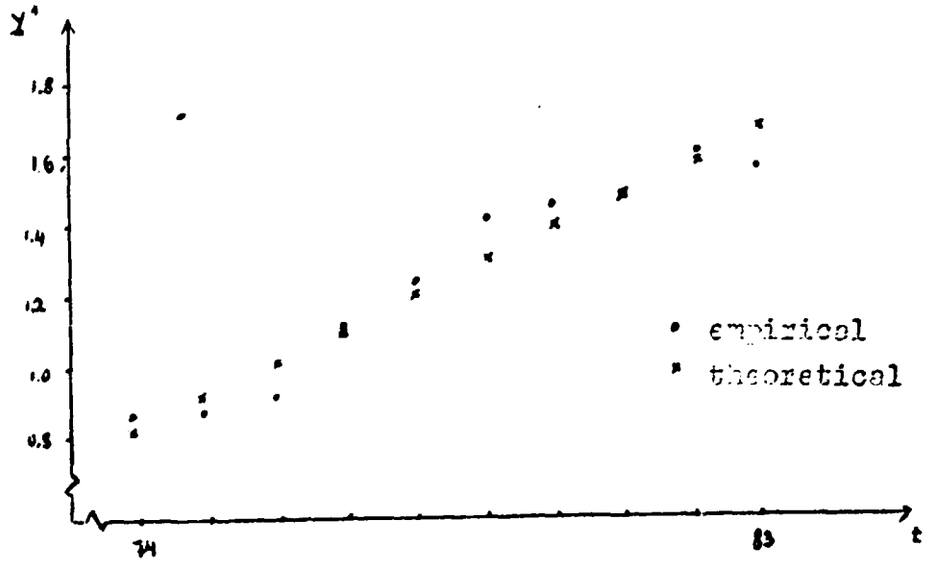
$D = 2.3183$

Satisfactory results from the point of view of prediction requirements have been obtained also in the linear model :

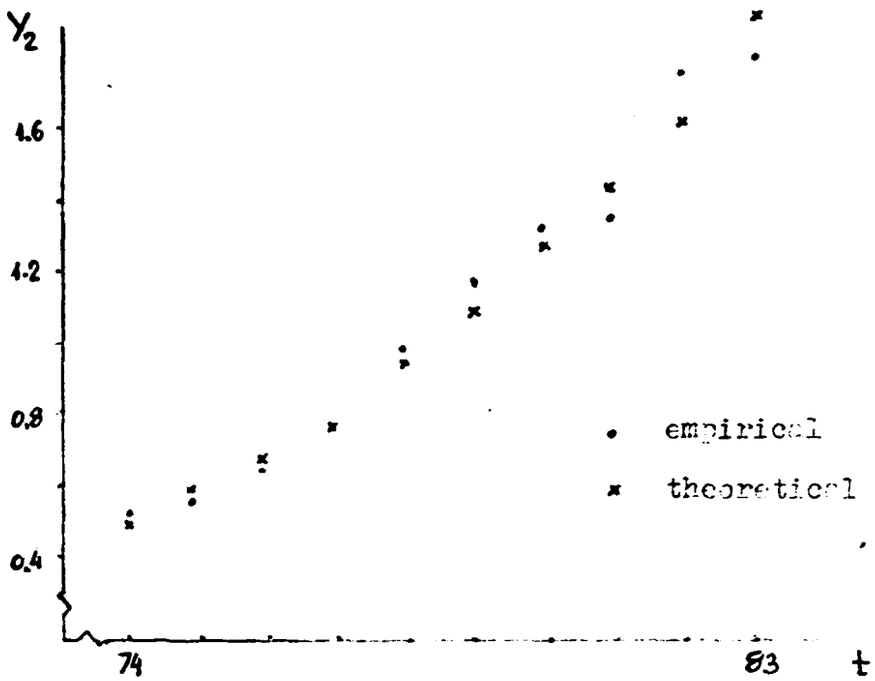
$$Y_2' = 0.138485\ t + 0.265333$$
$$/12.1445/ \quad /3.7501/$$

$R^2 = 0.9485$, $s = 0.1036$, $r_1 = -0.3214$, $D = 2.43$;

s_{1n} and r_{11n} indicate values of the standard deviation and autocorrelation coefficient of order 1 accordingly, calculated from $\ln Y_2$ and t. Models Y_1, Y_2 and Y_2' have been evaluated naturally by means of a computer and the classical method of least squares. Figures 1 and 2 show real and theoretical values calculated from the Y_1 and Y_2 models accordingly.



Picture 1. Empirical and Theoretical Beer Consumption per Capita in Niger in the Years 1974-1983.



Picture 2. Empirical and Theoretical Soft Drinks Consumption in Niger in the Years 1974-1983.

Based upon empirical observations and the evaluated models a mean yearly rate in consumption per capita in the investigated period has been estimated. It has reached the value of r = 8.37 % for beer and r = 13.99 % for soft drinks.

The so-observed rate is quite high and will be hard to keep in the near future, in spite of the still low absolute level of consumption per capita, compared with Nigeria for example.

The general social and economic situation in Niger and its perspectives suggest a sceptical view. However, a considerably high regularity and a visible evolutional nature of the beverages consumption development have to be noted, justifying the application of a similar

rate for the future period.

Rows 3 and 4 in Table 5 show the estimated beer consumption per capita based upon two different assumptions.

Row 4 in Table 5 shows the estimated beer consumption under a pessimistic assumption of a drop in growth rate of the consumption per capita to 60 % of its all years mean value in 1974 - 1983.

The estimations were based on the consumption in 1983 and a consumption growth rate of 8 % per year in total (2.77 % mean population growth per year + 5.23 % mean consumption per capita per year).

Table 6 shows the estimated consumption of soft drinks taking similar assumptions in row 3 and 4 as in Table 5.

The observed mean growth rate of consumption per capita of 13.99 % per year in 1974 - 1983 has been lowered to 8.23 %, and put together with a population growth rate gave 11 % indicating the mean growth rate of soft drinks consumption per year in Niger.

The prediction of the demand for beer bottles was finally reached using the estimated demand for beer based on the mean growth rate of the total consumption of r = 8 % per year (row 4 in Table 5). Similarly, an estimate based on the mean growth rate of 11 % per year (row 4 in Table 6) was taken for soft drinks.

By lowering the observed per capita consumption growth rate for the purpose of forecasting the future we want to reach two objectives:

a) to reflect the major opinions expressed in Niger and Nigeria on the relative slow down of economic development, and

b) to make the study more reliable if it is based on "careful" or pessimistic rather than optimistic assumptions.

This will be seen clearly later on for example in table 13 on page 34. The optimistic econometric extrapolation of demand for soft drinks in Nigeria in 1994 gave the figure of 15,151.104 mln l and corresponded to the annual rate of 23.0 % per year. Figure that we recommend is 5.212.0 mln l - based upon much lower consumption annual rate of 16 %.

Table 5

The Estimated Demand for Beer in Niger in the Years 1984-1994

	Row Name	1984	1985	1986	1989	1990	1993	1994
1	Beer Consumption (p) per Capita (exp) in litres (o)	1.609 1.791 1.974	1.697 1.888 2.079	1.784 1.925 2.186	2.041 2.276 2.511	2.126 2.373 2.621	2.377 2.664 2.952	2.460 2.761 3.063
2	Estimated population in millions Mean Rate r = 2.77 %	6.174	6.344	6.520	7.273	7.474	8.113	8.338
3 I	Estimated Beer Consumption in Niger in millions of litres (p) (exp) (o)	9.934 11.058 12.187	10.766 11.977 13.189	11.632 12.551 14.253	14.844 16.553 18.263	15.890 17.736 19.590	19.285 21.613 23.950	20.511 23.021 25.539
II	Estimated Beer Consumption in Niger in millions of litres r = 8 % per year	10.26	11.08	11.96	15.07	16.28	20.51	22.15

The mean errors of estimation in row 1 were 5.47 % in 1983 and 5.80 % in 1994, and were therefore very low.

(p) - pesimistic, (o) - optimistic, (exp) - expected
(p) and (o) are the lower and upper limits of the interval forecasts made at 10 % significance level.

Table 6

Estimated Demand for Soft Drinks in Niger in the Years 1984 - 1994

Row	Row Name		1984	1985	1986	1990	1994
1	Consumption per Capita in litres	(p)	1.686	1.921	2.186	3.623	5.907
		(exp)	2.060	2.373	2.734	4.818	8.490
		(0)	2.434	2.826	3.283	6.014	11.074
2	Estimated Population r = 2.77		6.174	6.344	6.520	7.273	8.113
3	Estimated Consumption of Soft Drinks in millions of litres Variant I	(p)	10.409	12.180	14.253	26.350	47.923
		(exp)	12.718	15.054	17.826	35.041	68.879
		(0)	15.028	17.928	21.405	43.740	89.843
4	Estimated Consumption at r = 11 % in millions of litres Variant II		11.10	12.32	32.68	20.76	35.52

The mean errors of estimation in row 1 were 9.77 % in 1983 and 16.35 % in 1994, and were therefore almost three times higher than the ones in the estimation of the beer consumption.

(p), (o), (exp) as in the Table 5

3.3 The Market in Northern Nigeria

3.3.1. Main Beer and Soft Drinks Producers

The lack of reliable statistical data unables accurate calculations neither of the volume of production nor the existing production capacity.
According to data available in the Federal Ministry of Industry and Trade there were 36 beer producers and 64 soft drinks producers in Nigeria in 1982. The consulting office Morris Handbury Jackson Le - May Ltd. England, stated that in 1982/83 there were 47 beer producers in Nigeria, and their existing production capacity amounted to 1215 million of litres of beer per year, with a planned expansion to a capacity of 2095 million of litres of beer per year in the nearest few years. A quick growth of beverages production in the last three years is a fact, and the leading beer producers are: Nigerian Breweries and Guinness, whereas the lead in soft drinks is taken by: Nigerian Bottling, Seven-up and Union Beverages.
Our estimations show a production of 990 million of litres of beer and 878 million of litres of soft drinks in 1982 with an existing production capacity of 1095 million of litres per year. This indicates that the existing production capacity in Nigeria is exploited in a higher percentage that in Niger.

3.3.2. Demand for Beverages in Northern Nigeria.

Similarly as with Niger the estimation of the demand for bottles was based on various verified

statistical data on the development of consumption per capita and the growth of population.
Tables 9 and 10 show data on home production and the import of beer and soft drinks in the years 1970-1982.

Contrary to Niger, the import of both beer and soft drinks was the great importance, especially in the period of 1976-1978. In 1978 a formal ban on import of these products has been introduced. None the less duty statistics show that this import, however small, still exists (for example Seven-up imports all of its bottles).

The demand for bottles in Nigeria was evaluated in a similar way as in the case of Niger. A specific prodedure has been taken to separate the market of Northern Nigeria.
Table 11 shows the consumption of beer and soft drinks per capita.

Contrary to the gentle and evolutional growth of beverages consumption in Niger, a visibly expansive, exponential growth of both the total consumption and per capita can be observed in Nigeria, in particular in the period of 1980 - 1982. The empirical mean growth rate of beer consumption per capita per year reached a value of 17.40 % in the years 1970 - 1982, and for the soft drinks consumption per capita 27.98 %

Accordingly ($\frac{11.11}{1.62} - 1. = 0.1740$; $9.85/0.85 - 1 = 0.2798$), see figures in table 11)

Models of the development trends have been evaluated to establish the mean growth rate per year, including

Table 9

Home production and Import of Beer to Nigeria in the Years 1970-1982

Year	Home Production in millions of litres	Import in millions of litres	Import in millions of Naira	Total Supply of Beer in millions of litres
1970	105.233	1.522	0.548	106.755
1971	131.350	2.991	1.107	134.341
1972	164.937	3.313	1.259	168.067
1973	214.828	3.272	1.279	218.100
1974	231.282	6.418	2.759	237.700
1975	293.747	80.453	31.930	374.200
1976	367.480	147.920	48.620	515.400
1977	292.383	190.545	72.424	482.928
1978	483.063	13.805	5.522	496.868
1979	500.272	5.505	2.477	505.777
1980	520.881	8.220	3.699	529.101
1981	818.517	-	-	813.517
1982	990.000	-	-	990.000

Sources: Annual Abstract of Statistics, 1981 edition, Table 6, 17, Quarterly Industrial Production Data Revised, years 1979, 1980, 1981, Import Statistics, Federal Office of Statistics, Lagos, Field Research and Own Estimates.

Table 10

Home Production, Import and Total Supply of Soft Drinks in Nigeria in the Years 1970 - 1982

Year	Home Production in millions of litres	Import in millions of litres	Import in millions of Naira	Total Home Supply in millions of litres
1970	33.852	x	x	33.852
1971	50.196	1.237	x	51.433
1972	56.962	0.667	x	57.629
1973	93.964	1.059	x	94.623
1974	119.320	0.395	x	119.679
1975	140.109	1.241	x	141.350
1976	182.255	3.640	x	185.895
1977	191.004	58.766	x	249.770
1978	209.130	24.743	21.142	233.873
1979	158.619	-	0.057	158.619
1980	323.377	-	0.900	323.337
1981	515.110	-	x	515.110
1982	878.000	-	x	878.000

Sources same as in Table 9.

Table 11

Beer and Soft Drinks Consumption in Nigeria

in the Years 1970 - 1982

Year	Beer in millions of litres	Soft Drinks in millions of litres	Population in millions	Beer Consumption per Capita in litres	Soft Drinks Consumption in litres
1970	106.755	33.852	66.086	1.62	0.51
1971	134.341	51.433	67.739	1.98	0.76
1972	168.067	57.629	69.432	2.42	0.83
1973	218.100	94.623	71.168	3.06	1.33
1974	237.700	119.679	72.947	3.26	1.64
1975	374.200	141.350	74.770	5.00	1.89
1976	515.400	185.895	76.640	6.72	2.43
1977	482.928	249.770	78.556	6.15	3.18
1978	496.868	233.873	80.563	6.17	2.19
1979	505.777	158.619	82.621	6.12	1.92
1980	529.101	323.377	84.732	6.24	3.82
1981	818.517	515.110	86.897	9.42	5.93
1982	990.000	878.000	89.118	11.11	9.85

Sources: Tables 9, 10, Mid-Year Population Projections States 1963 - 2000, National Population Commission, January, 1978 and Own Calculations.

the dispersion of empirical observations from year to year, and for estimation purposes.

From many models tested on a computer by the classical method of least squares the ones proved to be best statistically are presented.

Model of the Development Trend in Beer Consumption per Capita (Y_1^N) in Nigeria in the Years 1970-1982 in litres

$$0.146717\ t + 0.495546$$
$$(10.8489) \qquad (4.6166)$$
$$Y_1^N = e$$

R^2 = 0.9145

s_{ln} = 0.1824

r_{1ln} = 0.5639

D = 0.8424

The model with the generalized exponential from Y_1^N proved to be better in agreement with empirical data.

$$0.369402\ \ln t + 0.07199\ t + 0.334337$$
$$(2.0049) \qquad (2.1594) \qquad (2.6849)$$
$$Y_1^N = e$$

R^2 = 0.9390

s_{ln} = 0.1616

r_{1ln} = 0.3760

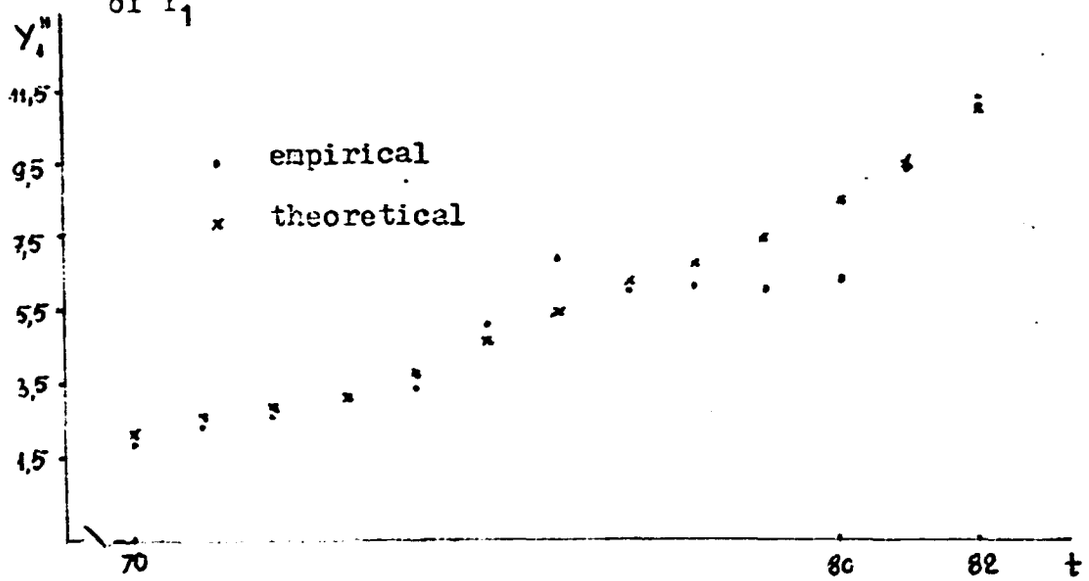
D = 1.2077

This indicates that one may consider the existence of an unsteady growth rate of beer consumption per capita of the form:

$$r(t) = e^{0.360402 \frac{\ln t}{t} + 0.078199} - 1$$

The t-Student statistics in the $Y_1^{N'}$ model, however showing the significance of parameters on the level of 10 %, are lowered compared with the Y_1^N model. Errors of estimation based on the Y_1^N model were lower than the ones in the $Y_1^{N'}$ model.

Picture 3 shows empirical and theoretical values of Y_1^N



Picture 3. Beer Consumption per Capita in Nigeria in the Years 1970-1982.

Model of the Development Trend in Soft Drinks Consumption per Capita in Nigeria in the Years 1970-1982 (Y_2^N) in litres

$$Y_2^N = e^{\underset{(10.0063)}{0.202776\ t} - \underset{(4.30448)}{0.692365}}$$

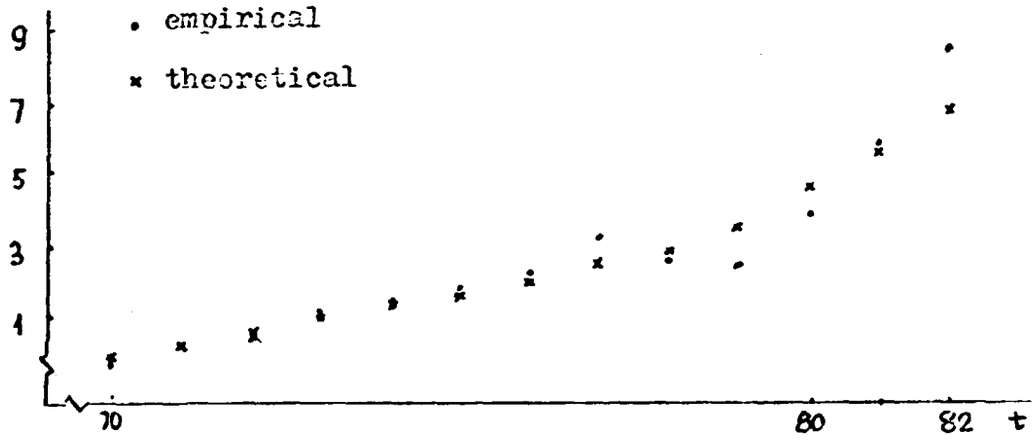
R^2 = 0.9010

s_{1n} = 0.2733

r_{1ln} = 0.3411

D = 1.1969

Picture 4 shows empirical and theoretical values in accordance with the estimated model Y_2^N .



Picture 4. Soft Drinks Consumption per Capita in Nigeria.

Table 12 shows preliminary variants of estimated demand for beer in the Years 1983 - 1994. The optimistic, pessimistic and expected estimates were evaluated at a level of significance of 10 %, similarly as in Niger. Estimations shown in row 4 were obtained by lowering the mean rate of beer consumption per capita per year from the observed 15.80 % to 9 % and adding the mean population growth rate of 3 %, i.e. the total mean consumption growth rate was taken to be 12 % per years, as compared to the observed 18.70 %.

The mean errors of estimation in row 1 of table 12 were found to be 22.89 % in 1983 and 33.12 % in 1994.

Table 12

Estimated Demand for Beer in Nigeria in the Ears 1983-1994

Row	Row Name	1983	1984	1985	1986	1990	1994
1	Beer Consumption (p)	7.768	8.808	9.959	11.228	17.607	26.044
	per Capita (exp)	12.802	14.825	17.167	19.880	35.752	64.274
	in litres (0)	17.835	20.842	24.376	28.533	53.896	102.544
2	Estimated Population	91.395	93.732	96.128	98.586	109.067	120.669
3 Variant I	Estimated (p) Beer Consumption	709.957	825.591	957.339	1106.924	1920.343	3150.517
	in Nigeria (exp)	1170.039	1389.577	1650.229	2355.104	3899.363	3777.581
	in million of (0)	1630.030	1959.562	2380.129	3380.190	5878.275	12404.645
4 Variant II	Estimated Beer Consumption in Nigeria r=12% per Year	1108.0	1242.0	1390.0	1558.0	2451.0	3856.0

Table 13

Estimated Demand for Soft Drinks in Nigeria in the Years 1983-1994

Row	Row Name	1983	1984	1985	1986	1990	1994
1	Soft Drinks (p)	3.298	3.815	4.365	4.933	6.399	4.456
	Consumption per Capita (exp)	8.555	10.478	12.833	15.718	28.880	64..992
	in litres (0)	13.812	17.141	21.302	26.504	51.362	125.528
2	Estimated Population	91.395	93.732	96.128	98.586	109.067	120.669
3 Variant I	Estimated Soft Drinks (p)	301.421	357.588	419.599	486.325	697.920	537.834
	Consumption (exp)	781.884	982.124	1233.611	1549.575	3149.855	7844.469
	in Nigeria in mln of l. (0)	1262.348	1606.660	2047.719	2612.923	5601.900	15151.104
4 Variant II	Estimated Soft Drinks Consumption r=16 %	1018.0	1181.0	1370.0	1590.0	2870.0	5212.0

Table 13 shows estimated demand for soft drinks evaluated on similar principles. Row 4 (variant II) assumes that the mean consumption growth rate per capita will reach 16 % per year in the period under investigation (the empirical growth rate in the period of 1970-1982 had a value of 25.55 %, and the consumption rate per capita reached 22.48 %). Thus the above assumption is not only conservative, but even pessimistic relying on statistical data from the whole investigated period.

It is important to note that the mean errors of estimation in row 1 of Table 13 lied between 34.22 % in 1983 and 51.86 % in 1994, and were therefore relatively high.

Tables 14 and 15 show estimated demand for glass for bottle production and Table 16 the resulting quantity of the non-satisfied demand.

Variant II appeared to be visibly close to the pessimistic estimates derived from econometric models in all cases and therefore has been finally chosen as origin for estimation.

The market of Northern Nigeria has been described by the size of its share in the whole market. A preliminary value of $M_c = 0.33$ (33 %) has been taken basing on interviews with leading beer and soft drinks producers.

The northern part covers 80 % of the whole territory and over 52 % of the population and therefore a growth of its share in the market of 0.6 % per year has been assumed.

Parameters of the estimated demand for bottles:

n - number of rounds (trips) of one bottle in one year and

s - the percentage of technological loss at filling up; loss at turnover have been determined basing on interviews with beverages producers.

The latter quoted the following values for parameters:

- beer: number of rounds in a year from 6 to 15;
  total loss, that is technological at filling up plus distribution loss, from 4 % to 10 % related to full year production.
- soft drinks: number of rounds in a year from 8 to 15;
  total loss, that is technological at filling up plus distribution loss, from 3 to 8 % related to full year production.

Explanation of the table 14 (table 15 follows the same logic)

Row 1: demand for beer in mln l computed based upon the constant growth rate r=8% per year. Initial consumption in 1983 assumed is K_{83} = 9.5 mln l.

Row 2: as row 1, r=12%, $K_{83} = K_{82} \times (1.12) = 990 \times 1.12 =$ = 1108 mln l.

Row 3: The beer market share of Northern Nigeria in the total Nigeria beer market is assumed to increase from $M_c = 0.33$ to $M_c = 0.40$ over the period of 1983 - 1994 with the yearly average change of $\Delta = 0.06$.

Row 4: The demand for beer in Niger and Northern Nigeria: (Row 1 + Row 2 x Row 3) in mln l.

Row 5: Number of bottles to be filled N_B is computed based upon the formula: Demand for beer (row 4) in mln l divided by average capacity of one beer bottle 0.66 l.

Row 6: Demand for bottles D_B results from our following formula:

$$D_B = (N_B + \Delta N_B) \times \frac{S}{100} + \frac{N_B}{n} ,$$

where: N_B - number of bottles to fill

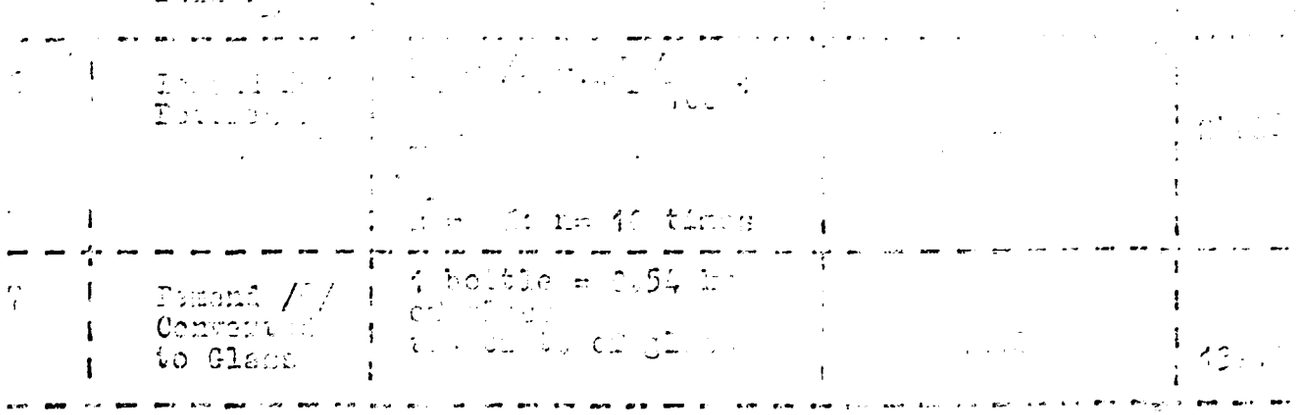
ΔN_B - the yearly increase in demand for bottles $N_{Bt} = N_{B,t} - N_{B,t-1}$

S - percentage of losses: technological losses at the filling stage plus returns losses

n - number of rounds (trips) of one bottle a year

Row 7: Demand converted to glass D_G is computed based upon the demand for bottles and the weight of an average bottle:

$D_G = D_B \times 0.54$ kg of glass per bottle



[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	45.24	[illegible]	[illegible]	95.24	[illegible]	[illegible]	167.2	[illegible]	[illegible]	[illegible]
[illegible]	24.96	[illegible]	44.53	51.42	[illegible]	75.55	90.30	106.69	125.44	[illegible]

Estimated Demand [illegible]

Soft Drinks

Row	Row Name	Assumptions for Calculations	[illegible]	[illegible]	1980
1	Niger	r=11[illegible] N_{B3} = 10.3	[illegible]	[illegible]	10.3
2	Nigeria	r=16[illegible] N_{B2} = 870	1010	1181	1370
3	Northern Nigeria	Share in Whole Market M_c = 0.33 0.40 M_c = 0.06 mln of l.	3[illegible]	397	469
4	Niger + N.Nigeria	mln of l.	3[illegible]6	408	481
5	Number of Bottles to fill N_B	1 bottle= 0.31 l	1117	1316	1552
6	Demand for Bottles	$P_B = /N_B + N_B/$ $\frac{s}{100} + \frac{N_B}{n}$ s=4% n=10 mln of units	44.7	72.54	85.68
7	Demand for Bottles Converted to Glass	1 bottle= 0.4 kg th. of t.	17.9	29.02	34.27

Table 15

[illegible]	[illegible]	1986	1987	1988	1989	1990	1991	1992	1993	1994
	[illegible]	13.68	15.18	16.85	18.70	20.76	23.04	25.58	28.39	35.52
[illegible]	1370	1520	1844	2139	2481	2878	3339	3873	4493	5212
[illegible]	469	553	653	770	908	1071	1262	1487	1752	2062
408	481	657	668	787	927	1092	1285	1512	1780	2099
1015	1552	1829	2155	2539	2980	3512	4145	4877	5742	6771
72.54	85.68	144.36	190.0	243.8	306.9	381.1	468.6	571.1	692.2	836.2
29.02	34.27	57.70	76.0	97.5	125.8	152.6	187.4	228.4	276.9	334.5

Demand for Glass for Bottles

Production in Niger and Northern Nigeria

Table 16

Year	Demand in thousands tonns	Estimated Output Capacity in Northern Nigeria	Non-Satisfied Demand for Glass in thousands tonns
1983	30.1	10.0	20.10
1984	42.12	20.0	22.12
1985	59.23	25.0	34.23
1986	90.45	45.0	45.45
1987	117.50	50.0	67.50
1988	148.90	50.0	98.90
1989	185.60	50.0	135.60
1990	228.102	50.0	178.102

3.4. Glass container Industry in Nigeria

	Name	No of furnace	Location
In operation	Metal Box Toyo Glass Ltd.	3	Agbara, Ogun State
	Delta Glass Co.Ltd.	2	Ughelli, Bendel State
	West African Glass Company Ltd.	1	Port Harcourt, River State
	Ballapur Nigeria Ltd.	1	Kaduna, Kaduna State
Under construction	International Glass Company Ltd.	1	Aba, Imo State

The total installed capacity estimated by Metal Box Toyo Glass[x)] in 1982 was for beer and soft drinks

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x) Industry News, Vol. 1, No 2, August 1982, p. 6-7

bottles - 440 million bottles/annum and estimated demand for beer and soft drinks bottles - 360 million bottles/annum. The above mentioned estimation seems to be overestimated for production capacity and underestimated for demand. The major producer of bottles - Metal Box, produced in 1980/81 - 183 mln of bottles which was equivalent to 77748 tonns of glass. Delta Glass which started production in 1980 planned to produce approximately 120 million bottles per year- equivalent to appr. 55000 tonns of glass. Completely new factory - Ballapur Nigeria, started production in May, 1983. Yearly capacity was planned to be 30,000 tonns of glass ie. approximately 70 million soft drinks bottles. West African Glass constructed more than 20 years ago was badly damaged during the Civil War. It was rebuilt in collaboration with foreign investors, but not moderenised. At present, having old, poor machinery, the factory can produce approximately 20 million bottles per year.

Capacity of the proposed plant

Bottles	Production pieces of bottles 10^6	Glass tonns
Beer	22.856	11656
Soft drinks - green	45.711	19199
- flint	68.567	28798
Total	137.134	59653

The Plant is assumed to be equipped with two tank furnaces of yearly capacity:

- tank furnace No 1 - green bottles - 30855 t/year
- tank furnace No 2 - flint bottles - 28798 t/year

Total 59653 t/year

that is 130 t/day each furnace.[1)]

1) The derived capacity of the proposed plant of 60,000 t/year reflects a careful consideration of growth of unsatisfied demand shown in table 16, the 3 years construction period 1984 - 1986, as well as the size of furnaces to be competitive economically with already existing ones in Nigeria.

Prices for produced bottles[2)]

Bottles	Nigeria	Niger
Beer bottle	0.23 ₦	120 CFA
Soft drink bottle	0.20 ₦	104 CFA

2) In the middle of 1983 prices loco factory in Nigeria ranged for beer bottle 22 - 25 k, and for soft drink bottle 19 - 20 k. During the same time the price in Niamey of beer bottle was 150 CFA, and of soft drink bottle 105 CFA.

Production programme at prices loco factory

Bottle	Production x 10^6 pcs	Nigeria unit price ₦	Yearly revenue 10^3 ₦	Niger unit price CFA	Yearly revenue 10^6 CFA
beer	22.856	0.23	5256.8	120	2742.816
Soft drink	114.278	0.20	22857.4	104	11885.848
	137.134	x	28144.2	x	14628.664

Cost of sales are assumed to be 0.5 % of yearly sales in Nigeria and 1 % of yearly sales in Niger.

IV. MATERIALS AND INPUTS

4.1. Raw materials

Most glasses may be considered as composed of oxides. The principal glass-forming oxides are: silica, SiO_2, boric oxide B_2O_3 and phosphorous pentoxide P_2O_5. When these glasses formers are combined with two or more modifying oxides and fluxes, such as soda, Na_2O_2, potash, K_2O, lime CaO, magnesia MgO, barium oxide BaO, lead oxide, PbO, alumino Al_2O_3 etc., they comprise the bulk of commercial glasses.

It is possible to produce glasses of a very wide variety of compositions but the range of compositions suitable for commercial use is relatively small. The requirements for commercial production include reasonable cost, ease of melting and fining, viscosity suitable for working and forming without devitrification, reasonably low liquidus or crystallization temperature and resistance to chemical attack. The importance of these requirements varies according to the forming process, and to the value and use of the finished product.

In general glasses are composed of:

(1) - glass forming oxides (silica, boric oxide),

(2) - stabilizing oxides, alumina, calcia, magnesia,

(3) - fluxes (soda, potash, and fining agents).

The approximate range of commercial compositions is shown below:

glass formers	- min 55	max 94 %
stabilizers	- 2	max 30 %
fluxes	- 1.5	max 22 %

The extremes, of course, represent unusual combinations of oxides. The common glasses used for window and bottles have silica contents generally between 70 and 75 % and alkali fluxes between 12 and 17 %. The common stabilizing oxides, alumina, lime, magnesia make up the remaining constituent.

The proposed compositions of flint and green glasses for bottles production is as follows:

Oxides	Flint glass	Green glass
silica SiO_2	72.9 %	71.5 %
alumina Al_2O_3	1.5 %	1.5 %
sodium oxide Na_2O	14.5 %	14.9 %
calcium oxide CaO		
magnesium oxide MgO	10.5 %	11.2 %
barium oxide BaO	0.5 %	0.3 %
iron oxide Fe_2O_3	0.05 %	0.3 %
chromic oxide Cr_2O_3	-	0.2 %

The raw materials requirements to produce glass with the above composition are shown below.

raw materials	for flint glass	for green glass
glass sand	62.70 %	61.73 %
soda ash	20.00 %	20.10 %
aluminium oxide	0.90 %	1.22 %
limestone	15.70 %	15.74 %
barite	0.70 %	1.02 %
decolouring agent:		
cobalt oxide, selenium	trace	-
colouring agent:		
bichromate of potassium, graphite	0	0.19 %

Raw materials for glassmaking are, as a rule, never perfectly represented by ideal chemical formulas because they invariably contain some impurities. For this reason, percentage compositions calculated from chemical formulas can not be strictly accurate, although the accuracy should remain within prescribed limits.

There are standards defyining percentages of impurities acceptable in different raw materials.

Glass Sand - SiO_2 - max. 98.5 % but Al_2O_3 - max. 0.8 %,
Fe_2O_3 -max. 0.05%, FiO_2 - max. 0.08 %,
CaO - max. 0.2 %, SO_3 - max. 0.02 %.

Soda ash - Na_2CO_3 - min. 99 %, but Fe_2O_3 - max. 0.006 %
NaCl - max. 0.7 % and Na_2SO_4 - max. 0.04 %.

Limestone - CaO - 54-55 %, but Fe_2O_3 - max. 0.06 %,

Barite - $BaSO_4$ - min. 82 %, but Fe_2O_3 - max. 0.2 %, MnCu - max. 0.003 %

Aluminium oxide - Al_2O_3 - min. 97.8 %, but SiO_2 - max. 0.25 %, Fe_2O_3 - max. 0.05 %, Na_2O - max. 0.7 %.

As glass sand constitutes the majority of the raw production batch, the quality of sand is the most important. The iron content largely determines whether local sand can be used or not.

The quality of glass sand deposits depend not only upon a correct chemical composition, but also on the grains size. If the grains are too large, melting becomes slow, but if grain size is too small there may be trouble with dusting the furnace both inside and outside.

Furthermore, the quality of sand must be reliably stable or must be made so by pre-mixing or preprocessing. This is also true for any other raw-material used.

Raw-materials used for glass-making fall into two natural classifications:

1. - naturally occuring minerals that may be purified or beneficiated in some manner after extraction from earth,
2. - commercial heavy chemicals.

Into the first category falls: sand, limestone, barite, while to the second one soda ash, aluminium oxide, and decolouring and colouring agents.

Raw-materials of the second category have to be imported, as there is no production of chemicals in Niger and Nigeria. It will probably be also necessary to consider import of barite from abroad.
As far as glass sand and limestone are concerned, there are production of limestone in Nigeria and there are large potential deposits of glass sand in Nigeria and Niger. Unfortunately sand deposits in northern part of Nigeria and in Niger have not been investigated properly and in sufficient details.

Nigeria

The Geological Survey Department of Federal Ministry of Mines and Power in Kaduna has been the basic source of informations concerning investigations of sand deposits in northern part of Nigeria. The available reports contain however only written statement that in different regions glass sand deposits exist.
The list of reviewed documents follows:

Silica sand:

1. Geological survey of Nigeria (GSN) - report no 1381 dated 1964 "A summary of the principal known deposits of glass sand in Nigeria", compiled by J.E. Wandby-Smith specified silica sand deposits in Northern Nigeria in following areas:

   a) Bida, Niger Province - from river terraces near Bida, ideal fraction 42÷58 %, high iron content,

   b) Mokwa Area, Niger Province - from river terraces in this area, badly graded.

From river Awan and Jebba bridge - contained too much fine materials.

Mokwa Bida - Ferry and Lafiagi - too much coarse materials.

c) River Kaduna, near Kaduna - near Road Bridge and river Kaduna 2 miles up stream from the village of Birnava - iron content 1.14 %.

2. GSN - Report no 1279, dated 1961 informs only that analysis of 4 samples taken from Mokwa Area and 4 samples taken from river Kaduna revealed content of SiO_2 between 85.33 and 96.86 % and of Fe_2O_3 between 0.81 and 1.46 %.

3. GSN - Report No 1363 done by Colonial Geological Surveys, Imperial Institute, London S.W.
The analysis of the samples taken in 1951 from Jaom Iva Coal Mine, Enugu where the sand deposits are considered to be unlimited, did not gave satisfactory results.
The sand is badly graded and Fe_2O_3 content is the maximum permissible for the manufacture of high class of domestic production.

Potash Feldspar:

3. GSN - Report No 1430, P. Antolini, Senior Geologist, ITA specifies the feldspar occurrences in Lokoja area (Kwara State) area:

a) Lokoja - Okene road, two deposits in Osara Forest Reserve, remote from any habitation:

- 4 1/2 miles on a bearing of 125° true north from milepost 16 on the Lokoja - Okene Road. The melting test gave positive results, the button was of good quality, perfectly white, transparant and glazed.
The mineral composition of the sample gave the following results: Al_2O_3 - 17.88 %, Fe_2O_3 - 0.07 %, K_2O - 11.34 %, Na_2O - 3.97 %, CaO - - 0.18 %. Several thousand tons of loose feldspar blocks are available.

b) 2 miles south of milepost 7 on the Lokoja - Okene road; large blocks of a potash feldspar of the highest quality, including in places large quarz segregations and rare mica were found on the slopes. About 1000 tonns of feldspar occur on the surface as scree and in situ.

Chemical analysis and the melting test done by D.J.O'Leary (GSN Laboratory Report No 1399) gave satisfactory results for 5 samples treated:

I) Outcrop No 1, Osara Forest Reserve
II) Outcrop No 2, Osara Forest Reserve
III) Udarechu, Okene area
IV) Mile 16, bridge marked 16/14 on the Okene - Oguda Market Road,
V) Macroperthite, unknown locality, Okene area.

The melting point: 1250° - 1300°; carried out on cones fired on electric furnace which reached

temperature 1370° in 5 hours, an average increase of 260° per hour.

The Okene area feldspar reserves are considered as sufficient to satisfy Nigerian requirements for many years.

4. GSN - Report No 10023 prepared by Arthur W. Smidt International Inc. in 1959 indicates the feldspar deposits in North-Eastern part of Northern Region without more precise indications of places and reserves.

Limestone

1. GSN - Report No 10023 (mentioned above) indicates resources existing in Calabar in the South-East corner of Eastern Region of Nigeria. The chemical analysis carried on a sample gave the following results:

Calcium Oxide	55.4 %
Magnesium Oxide	0.45 %
Iron and Aluminium Oxides	0.23 %
Insolubles	0.63 %
Loss in Ignition	43.29 %

The limestone is of a good quality. It can be quarried and shipped in lump for crushing and screening at the glass plant.

Nota: There are probably more limestones deposits, namely in Sokoto and Bauchi, however available

documents give only very preliminary informations and further analysis have to be carried on.

Existing glass works in Nigeria purchase limestone from Jateura Marble Industry, Lokoja, Kwara State. Limestone has been commercially produced in Nigeria since 1973 with 1980 production volume of 2,336.4 metric tonns (1979 production was 1,725.4 metric tonns).

Dolomite

1. GSN - Report No 10023 (mentioned above). There are known deposits of various grades of dolomite and dolomite limestone in the Western Part of Nigeria; deposit with 25 % Magnesium Oxide is located in Abuja, and dolomite limestone with 15 % Magnesium Oxide near Kwakuti. Both locations are close to the railroad from Lagos to Minua (about 200 miles from Lagos by rail).

   Nota: Existing glass-works in Nigeria purchase dolomite from W.P. Syndicate, Jos State.

Glass sand in Kano State

1. The proposed location of the plant is Kano State. In 1971 "Preliminary Report on a Survey for Glass Sands around Kano, Kano State" was done by W.C. Mbonu (geologist) with the following indications of deposits:

Kogin Kano

a) Chiromowo bridge area

b) Tabara dridge area

Kogin Chalawa:

a) Kogin Watan: Dawaki - Lambu Road

b) Kogin Matari: Watari Bridge area (Gwarzo Road)

c) Chalawa George area (water works section)

Samples taken from the above mentioned location seem to be acceptable but the content of iron is too high (1.2 - 2.9%). No evaluation of the deposits sizes were given.

2. The Kano State Government indicates the existance of large deposits of glass sand in the area of Gumel, Kazaure and Babura (North of the Kano State). Geological survey has not been done yet or, if so, not disclosed to the mission during the visit of the Kano State Covernment.

Niger

Silica sand

Over 10 years ago the Polish mission identified glass sand deposits in Dallol Bosso in the region of Birni - N'Gaoure near Bosso. The sand is of a good quality with low content of iron. Other deposits exist in the region of Malbaza, but no evaluation of them are known.

During the travel from Maradi to Niamey the present mission selected three additional potential places of

deposits worthwhile to look more closely at. All of them are located along the road Maradi - Niamey:

a) Gagana, approximately 80 km West of Guidan Roumji,

b) 40 km West of Dogondouchi,

c) 70 km West of Dogondouchi.

Limestone

The limestone deposits exist in the region of Malbaza - Madana towards the North and North-West. These deposits are exploited by the Malbaza Cement Factory and are large enough to aliment both: production of cement and glass for many years.

The limestone deposits were geologically surveyed in 1962. Within the survey the Malbaza and Keita deposits were more closely evaluated and two other near located potential deposits were indicated. First, South-West of Garadaoua, 12 km South-East of Keita, and second, in the region of Tamaska between Tahoua and Keita. An average compositions of limestones from the two (1) and (2) Malbaza samples are given in the following table.

%	CaO	Al_2O_3	Fe_2O_3	SiO_2
(1)	54.27	0.45	0.54	1.05
(2)	50.56	1.37	0.84	4.81

Dolomite

Deposits of dolomite were found near Ayeron and the production of marble has been started. The size of

deposits is not known. Because of this, and also because of the distance from Ayeron (near Mali frontier) to the potential location of the plant in Maradi - the limestone would be the reasonable substitute for dolomite.

Feldspar

Deposits of feldspar had been identified in the region of Tillabery and Tera. Based upon the report made by Politechna in 1964 these deposits are suitable for production of ceramic products. It would be important to test whether they are also suitable for glass production.

Important conclusion

In both countries exist probably essential raw materials for glass containers production, and in both countries the same remaining components of a glass batch will have to be imported. However, the detailed geological survey should be done before the next step concerning the glass production study is taken. This survey should take into consideration the proposition of a potential location of the plant:

in Niger - the region of Maradi

in Nigeria - the region of Kano State.

4.2. Estimates of costs of production inputs

The estimation of costs of material inputs was made based upon the assumed programme of production and prices estimated by the research team for localy

available inputs and based upon international prices for those inputs which will have to be imported.

At the final stage of editing of this report, we had the opportunity to study the "Investigation of Raw Materials for the Production of Glass Containers in South Niger and North Nigeria" - the UNIDO project DP/RAF/77/020 prepared by KHD Humboldt Wedag AG. The basic conclusion of the report is that .. " ... basicaly no more than soda ash and other minor components will have to be imported....."[1] for production of glass in Niger and North Nigeria. The report in general gives more detailed arguments for assumptions we took in the report.

1) Investigation of Raw Materials ....., op. cit. p.64

Niger

4-1 Production costs: material inputs

10^3 CFA

Item	Quantity	Unit	Description	L	F	Unit Cost c/	Cost F	Cost L	Cost Total
1	2	3	4	5	6	7	8	9	10
1			Raw materials						
1.1	48235	t	Sand	x		2.50		120,588.-	120,588.-
1.2	12192	t	Limestone a)	x		22.04		268,712.-	268,712.-
1.3	15553	t	Soda ash b)		x	55.0	855,415.-		855,415.-
1.4	828	t	Aluminium Oxide		x	120.0	99,360.-		99,360.-
1.5	670	t	Barite		x	130.0	87,100.-		87,100.-
1.6	0.3	t	Decolourizing agents		x	4420.0	1,326.-		1,326.-
1.7	75	t	Colorants		x	520.0	39,000.-		39,000.-
			(1) Subtotal				1,082,201.-	389,300.-	1,471,501.0

Niger

Table 4-1 cont.

10^3CFA

1	2	3	4	5	6	7	8	9	10
2			Auxiliary materials 2 % of the value of raw materials	x				29,430.-	29,430.-
			Subtotal (1+2)				1,082,201.-	418,730.-	1,500,931.-
3.			Utilities						
3.1	1760	t	Mazout[c]		x	165.-	2,904,000.-		2,904,000.-
3.2	4860	t	Light oil[d]		x	200.-	972,000.-		972,000.-
3.3	8800	t	Diesel oil		x	189.-	1,663,200.-		1,663,200.-
3.4	18	t	LPG		x	390.-	7,020.-		7,020.-
			Subtotal 3				5,546,220.-		5,546,220.-
			Total 1 + 2 + 3				6,628,421.-	418,730.-	7,047,151.-

a) estimation based upon 50 % of the cement price 1983

b) estimation based upon important prices of soda ash from GFR, GDR 1981/1982 increased by 40 % (Ministere de Commerce, Niamey)

c) based upon "Projet d'unite de transformation de la tomate", CFEH, Niamey, Février, 1983

d) based upon informations of Ministère de Travaux Publics et de L'Urbanisme, Service Central de L'Electricite.

e) If not otherwise stated, unit prices are estimated based upon European prices + estimate of transport costs.

Nigeria

4-1 Production cost estimate: materials and inputs

N

Item	Quantity	Unit	Description	L	F	Unit cost	Cost		
							F	L	Total
1	2	3	4	5	6	7	8	9	10
1			Raw materials						
1.1	48253	t	Sand	x		7.-	-	337,645.-	337,654.
1.2	12192	t	Limestone	x		120.-	-	1,463,040.-	1,463,040.
1.3	15553	t	Soda ash		x	220.-	3,421,660.-	-	3,421,660.
1.4	828	t	Alluminium Oxide		x	200.-	165,600.-		165,600.
1.5	670	t	Barite		x	300.-	201,000.-		201,000.
1.6	0.3	t	Decolouring agents		x	8,500.-	2,550.-		2,550.
1.7	75	t	Colorants		x	1,000.-	75,000.-		75,000.
			Subtotal (1)				3,865,810.-	1,800,685.-	5,666,495.

Nigeria

Table 4-1 cont.

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1	2	3	4	5	6	7	8	9	10
			Auxiliary materials 2 % of the value of raw materials	x				113,330.-	113,330.
			Subtotal (2)					113,330.-	113,330.
			Utilities						
.1	17600	t	Mazout (heavy oil)			58.-		1,020,800.-	1,020,800.
.2	4860	t	Light oil	x		150.-		729,000.-	729,000.
.3	8800	t	Diesel oil	x		133.-		1,170,400.-	1,170,400.
.4	18	t	LPG	x		275.-		4,950.-	4,950.
			Subtotal (3)					2,925,150.-	2,925,150.
			Total (1 - 3)				3,865,810.-	4,839,165.-	8,704,975.

Note: Prices of raw materials in Nigeria are based upon the field research in this country.

V. LOCATION AND SIZE

5.1. Potential location of the plant

Within the present study the two following alternative locations of the plant were considered. Limit in Maradi - Niger and second in the Kano State. Taking into consideration the fact that available data on known kaolin deposits are actually not sufficient the two above mentioned locations seem to combine together raw materials and market orientation. Maradi is the center of Maradi Department with 47.3 mln/km²/year and with the rainfall of 582.7 mm/year, average temperature 27.1°C /min. 19.2°C, max. 35°C/ with 1000 water sources in the department and the population of approximately 1 mln. Maradi is situated close to Niger/Nigeria frontier. This may facilitate the supplies of utilities from Nigeria and also the sale of bottles to Nigerian market. As the capital of the Department represents reasonable /relatively/ social, administrative and economic infrastructure.

Kano /population of 0.441 mln in 1979/ is the capital of Kano State /population 8.6 mln in 1979/. The rainfall in Kano was in 1978 939.4 mm with average yearly temperature max. daily 33.1°C, and min. daily 19.9°C. Kano is a relatively strong in North of Nigeria industrial center and presents reasonable infrastructural potential. Interesting to mention is that the Kano State Government has been strongly interested in building

a glass plant in this State.

During the meeting held in Kano with the mission, the Government refused to give more details on raw materials availability and other important informations, making at the same time impressions that such data were in his possession. The mission was informed that these informations and for going cooperation would have been granted, if the objective of the mission had been the feasibility study of the glass plant in the Kano State. As no sufficient cooperation was granted by the Kano State Government, it is difficult to propose any more precise location of the plant. However the three crucial points to consider are: transport, water and manpower. In fact both in Niger and in Nigeria, water for the plant is assumed to be delivered from the plant owned water wells. The general water availability from deep water drilling is favorable both in Maradi region and on the Kano State territory. The transport in both cases is not a limiting factor as sufficient quality roads are available in both countries. In both cases electrical energy is assumed to be locally generated. The manpower training will be necessary also in both potential location. Maradi region seems to be an optimal location from the Niger point of view, while Kano State territory from the Nigeria point of view.

5.2. Cost of location

The estimated costs of location of the plant are given in Schedule 5-1 for Niger and Nigeria respectively.

ANNEX

5-1. Location and land: investment costs

10^3 CFA

Item	Quantity	Unit	Description	L	F	Unit Cost	Cost		
							F	L	Total
1	5.7	ha	Plot for plant construction	x		15000		85,500.-	85,500.-
			Total					85,500.-	85,500.-

Nigeria

5-1. Location and land: investment cost

Item	Quantity	Unit	Description	L
1			Land	
			It is assumed that land is owned by the local government	
	1	plot	The yearly rent for implementation period of 3 years	x

F	Unit cost	Cost		
		F	L	T
	30000		90,000.-	90,000.-

VI. PROJECT ENGINEERING

The project engineering described in the first part of this chapter is based upon the study made by Vitroceramprojekt - Warsaw, which is the leading Polish development center of glass and ceramic industries. The second part includes the estimation of investment and civil engineering costs.

Part I: Project engineering

6.1. Description of the Plant

The Plant incorporates the following objects:

- melting and forming department
- annealing dept., painting dept. and ready-made products store
- batch house and raw-materials store
- electric power supply station
- fuel station
- circulation water station
- waste gases extraction chimneys
- social welfare and canteen
- administrative and first aid room building
- gate-house
- ready-made products store
- roads and squares
- other auxiliary objects

6.2. Data specifying Plant size

- 2 glass tank furnaces of continuous operation
- 6 automatic machines type IS-6 BD-DC (3 automatic machines at each furnace)
- 2 automatic machines for painting
- 6 annealing lehrs
- 2 kilns for ornament firing

6.3. Production assortments - bottles

- for beer - 0.6 l capacity, 510 g weight
- for soft drinks: sprite, schweps, coca, pepsi, fanta, mirinda, tonic, orange, lemonade — 0.29 - 0.3 l capacity, weight 390 - 420 g

6.4. Kind and colour of glass

- soda-lime-glass - green (tank No 1) for: beer, sprite, schweps bottles
- soda-lime glass, flint (tank No 2) for: coca, pepsi, fanta, mirinda, orange-lemonade, tonic bottles.

6.5. Production capacity of the Plant

6.5.1. Basic data:

- beer bottle of 0.6 l weight = 510 G
- soft drinks bottle of 0.3 l - weight = 420 G
- number of automatic machines for beer bottles (green) production - 1
- number of automatic machines for soft-drinks (bottles (green) production - 2
- number of automatic machines for soft drinks bottles (flint) production - 3
- number of effective days of automatic machines operation a year - 320

beer bottle forming rate - 62 pcs/min.

- soft-drinks bottles forming rate - 62 pcs/min.
- percentage of waste products - 20 %[x)]
- continuous, 4 shifts operation cycle of the Plant.

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x) relatively high waste products level has been assumed due to high percentage share of screen printing bottles; it has also been calculated as the total waste at the forming and printing stages.

6.5.2. Production scale

Kind of bottles	Net production capacity (10^3 pcs/ /year)	Total weight of production (t/year)	Total volume of bottles (HL/year)
- for beer	22,856	11,656.0	137,136.0
green, for soft-drinks	45,711	19,199.0	
- colourless, for soft-drinks	68,567	28,798.0	342,834.0
Total:	137,134	59,653.0	479,970.0

Total tonnage of green bottles (tank No 1)

- net 30,853.0 t/year

Total net tonnage of flint bottles (tank No 2)

- 28,798.0 t/year

Total net tonnage of the Plant production

- 59,653.0 t/year

6.5.3. Percentage share of bottles in colours

The quantity analysis of green and flint bottles proportion carried out on the basis of some biggest beer and soft-drinks manufacturers in Nigeria and Niger, indicates as follows:

1. beer bottles are in their majority green
2. the percentage proportion of flint to green

bottles suitable for soft drinks in particular manufacturers are as follows:

- Drinco Industries Ltd. - Kaduna
  - flint 60 %
  - green 20 %
  - amber 20 %
- Arewa Bottlers - Kaduna
  - flint 66 %
  - green 34 %
- Nigerian Bottling Co.
  - flint 63 %
  - green 37 %
- Union Beverages
  - flint 100 %

In view of above data the arrangement of furnaces and automatic machines for the bottles production in proposed project has been set as follows:

- beer bottles - green in 100 %
- soft drinks bottles - green in 40 %
- soft drinks bottles - flint in 60 %.

If the other proportion of green to flint bottles is required, periodical change of glass melt in one of the furnace is provided for.

On the basis of annual production capacity net, calculated in § 6.5.2., the daily production output of each of the furnace has been defined as 130 t/24 hours

(taking into consideration coefficient for periodical fluctuation of glass melt yield).

6.6. Manufacturing process description

6.6.1. Delivery, unloading and storing of raw-materials

Umbrella roof for the sand and raw-materials store will be positioned close to the batch house. Delivery of the raw-materials is to be effected by road transportion. storing in bulk, or in heaps on pallets (raw-materials in bags).

6.6.2. Raw materials processing

Sand

Drying is the only sand treatment, and no equipment for any other processing is provided for. However, from obtained, although incomplete, geology data relating to this material, it appears, that due to the contents of oversize and undersize particles, clay fraction and high percentage of Fe_2O_3, one or several of the following conditioning methods is to be applied disintegration, screening, rinsing, magnetic separation, raw material bedding, etc.

The specific conditioning method, as well as the scope of respective equipment will be specified after selection of sand deposit for the glass-works purposes (scale of deposit, chemical and granulometric compositions of material). The sand treatment should be carried within the mine area.

Cullet

Crushing of cullet in the crushing mill is assumed

Other raw materials

Other raw materials are assumed not to require additional processing.

6.6.3. Preparation of batch of raw materials

Two batch preparation lines are provided for in the batch house. One for the green glass, the other for flint glass. Each line incorporates: bucket elevators, set of silos located above the weighing hoppers, collecting conveyor for transportation of weighed raw-materials, and mixer. Batch house is equipped with the passenger-freight lift for vertical transportation of raw materials in bags. The weighing hopper is fitted under each silo, weighing and feeding appropriate portion of raw material on collecting conveyor.

The said portions are supplied to the disc-rake type mixer for mixing, and then,in the form of batch, conveyed by means of belt conveyor on the trestle bridge to the tank furnaces hall.

The whole batching cycle is automatically controlled, however manual control is also available.

The system of raw materials weighing, mixing and transportation to the tank furnace department is equipped with the electrical locking system avoiding wrong preparation or wrong feeding of the batch into furnaces.

6.6.4. Transportation and feeding of the batch

The supply of batch (from the outlet of mixer) from the batch house to the melting and forming department is carried out by means of belt conveyor, located inside the covered trestle bridge, and reverse conveyor delivered batch to batch hoppers located on both sides of furnace.
Feeding of batch to the furnace is arranged by means of batch charger located below each batch hopper.

6.6.5. Processing, transportation and feeding of cullet

Cullet is used in the glass melting process as the catalytic agent, utilizing by the same glass broken in the process of selection, production, etc.
The cullet share is determined as 30 % by weight in relation to the other raw materials concerned. Two separate cullet stores (for green and flint glass) are provided for. Only cullet produced in the plant is taken into consideration. The said cullet is to be collected mechanically from underneath of forming automatic machines, selection stands as well as the printing department, and transported by means of mechanical trolleys to the cullet processing stand in the production building.
After being crushed, the cullet is to be mechanically supplied to the cullet hopper. Under the hopper there is weighing hopper suitable for weighing of the relative portions of cullet. The weighing unit is located close to the belt conveyor supplying

batch to the melting department.
The portions of cullet are being dosed on the batch and conveyed to the tank furnace department.

6.6.6. Glass melting

The melting process is to be carried out in two tank furnaces of 130 T/24 H each, one provided for the production of green glass, while the other for the flint glass.
Both furnaces are of the same design fired with the heavy oil. Each of the tank furnace is composed of melting end, working end, and is equipped with three feeders and the device suitable for recovery of heat from the waste gases.
The melting process will be controlled and inspected by the control-measuring equipment. The tank furnaces as well as the forming automatic machines will be located on the 0,00 level in the melting and forming department.

6.6.7. Products forming

The liquid glass from the working end of the tank furnace will flow through the forehearth and feeder to the automatic machines. The forehearth will be fired with the light oil. Both tank furnaces will be equipped with the same type of forming machine, i.e. I3-6 BB-DG, three of them for each furnace.

The IS type of automatic forming machine was chosen from available machines for the following reasons:

- it enables increase of production capacity by installation of the additional forming stations,
- it enables universal production of bottles of various types and various shapes,
- it is generally used world-wide, including Nigeria (Metal Box Toyo Glass, Balapur) enabling by the same, joint management of spare parts, moulds, etc.
- it may be used for the wide-opening products, such as jars by installation of additional equipment type P-B, if so required. Each automatic forming machine will be supplied with glass by means of feeder.

The finished products will be delivered to annealing lehr by means of metal apron conveyor and pusher. The construction of forming department, as well as the clearance of tank furnaces axis shall have to be designed in the way enabling further production increase by installation of the fourth automatic forming machine at each furnace.

6.6.8. Annealing, sorting and packing

The ready made products will be annealed in the annealing lehr fired with the light oil. Each automatic forming machine cooperates with one annealing lehr of the belt width 1.8m. At the end of each annealing lehr the set of equipment suitable for

automatic products control (such as: dimensions control, breakages, etc.), and visual inspection are provided for. The palletizer is also provided. The palletized products are to be covered with the plastic foil, which is shrink wrapped in the electric, chamber oven. From the oven the pallets are transported by means of mechanical trolleys to the store. The annealing, sorting and packing departments, as well as the finished products store are located at the 0,00 level.

6.6.2. Overprint and its firing

The part of products is to be subject to printing on the automatic devices for paint-screen process. The products on the pallets, not wrapped with the foil, will be delivered from packing stand to the printing devices by means of mechanical trolleys, and then manually supplied on the printing machine transporting unit. Tri-colour printing is available. Then the products are mechanically conveyed and pushed into the tunnel kiln, electrical heating. At the kiln output products are manually sorted and put on the pallets. Then pallets are wrapped with the foil and shrink in the electrical oven as described in § 6.6.8. and stored in the store. The production capacity of the painting department enables painting and firing of approx. 40 % of the forming department output.

6.6.10. Storing and despatch of finished products

Pallets with the products on them are transported from production lines to the ready-made products store by means of fork lift trucks and stored there in 3 levels. The pallets with products may be also stored on the stockyard outside the production building. Pallets are loaded on trucks and trailers, by means of fork-lift trucks, and further supplied to the end-users.

6.7. Basic processing data

6.7.1. Chemical composition of glass

The following approximate chemical composition of glass melt is sugested:

		Flint glass
silica	- SiO_2	- 72.9 %
aluminium oxide	- Al_2O_3	- 1.5 %
sodium oxide	- Na_2O	- 14.5 %
calcium oxide	- CaO	
magnesium oxide	- MgO	- 10.5 %
barium oxide	- BaO	- 0.5 %
iron oxide	- Fe_2O_3	- 0.05 %

		Green glass
silica	- SiO_2	- 71.5 %
aluminium oxide	- Al_2O_3	- 1.5 %
sodium oxide	- Na_2O_3	- 14.9 %

calcium oxide	- CaO	- 11.2 %
magnesium oxide	- MgO	
barium oxide	- BaO	- 0.3 %
iron oxide	- Fe_2O_3	- 0.3 %
chromic oxide	- Cr_2O_3	- 0.2 %

6.7.2. Annual requirement of the raw materials

The estimated annual requirement of the raw materials for the planned production programme (as per 6.5.2. above, is as follows:

Raw materials	Annual requirement (T/year)		
Basic	Total	Flint glass	Green glass
Sand	48,235.0	23,473.0	24,762.0
aluminium oxide	826.0	397.0	429.0
soda ash	13,559.0	7,493.0	6,066.0
Lime-stone	12,192.0	5,877.0	6,315.0
barite	670.0	262.0	408.0
Total - basic raw materials	77,476.0	37,437.0	40,039.0
Auxiliary			
Decolourisers			
cobalt oxide	0.3	0.3	
cerium selenine			
Dyestuff			
dichromate			
graphite	75.0		75.0
Total - auxiliary materials	75.0	0.3	75.0

It is assumed that the raw materials are of the chemical composition and grain-sizes in accordance with the Standards in force for Glass Industry, and the additional processing and conditioning is not required at site.

Quality requirements of glass raw materials:

Glass sand

Chemical composition: SiO_2 - min. 99.5 %
Al_2O_3 - max. 0.8 %
Fe_2O_3 - max. 0.03 %
TiO_2 - max. 0.08 %
CaO - max. 0.2 %
SO_3 - max. 0.02 %

Grain-size:

grains over 1 mm dia. - 0 %
1 to 0.5 mm - max 3 %
0.5 to 0.1 mm - min. 94 %
0.1 to 0.63 - max. 3 %
below 0.063 - max. 0.5 %

Mineralogy content:

quartz - min. 98 %
feldspar - max. 1.2 %
clay minerals - max. 0.5 %
heavy minerals (ilmenite, limonite, rutile, zirconium, tourmaline) - max. 0.12 %

Soda Ash

Chemical composition

Na_2CO_3	- min. 99 %
NaCl	- max. 0.7 %
Na_2SO_4	- max. 0.04 %
Fe_2O_3	- max. 0.006 %
particles non-soluble in water	- max. 0.04 %

grain-size:

basic fraction	- 1.0 - 0.5 mm
oversize particles	- max. 10 %
undersize particles	- max. 10 %

Limestone

Chemical composition

CaO	- 54.0 - 55.5 %
Fe_2O_3	- max. 0.06 %
particles non-soluble in HCl	- max. 2.0 %

grain-size:

remains on the sieve of the square side dim. eye:

0.15 mm	- max. 2.0 %
0.075 mm	- max. 28.0 %
below 0.075 mm	- min. 70 %

Barite

Chemical composition

$BaSo_4$	- min. 82 %

Fe_2O_3	- max. 0.2 %
MnCu	- max. 0.003 %

grain-size:

below 0.1 mm	- max. 40 %
0.1 to 0.3	- min. 60 %

Aluminium oxide

Chemical composition

Al_2O_3	- min. 97.8 %
SiO_2	- max. 0.25 %
Fe_2O_3	- max. 0.05 %
Na_2O	- max. 0.7 %
ignition loss	- max. 1.2 %
H_2O content	- max. 2.5 %

grain-size:

0.1 to 0.3 mm	- min. 95 %

Potassium dichromate

Chemical composition

Cl_2O_3	- min. 66.5 %
water insoluble substances	- max. 0.3 %
sulphates converted to SO_4	- max. 0.5 %
Chlorides converted to Cl	- max. 0.8 %
substances precipitated with ammonia in form of oxides	- max. 0.2 %

Calcium converted to Ca+2	- max. 0.2 %
Losses on drying in 120-130°C	- max. 1.0 %

Apart from the raw materials the Plant will be using the following materials:

- wooden pallets (1 off for 1500 bottles) - single purchase 7700 pcs + annually - 800 pcs
- foil covers (1 off for 1500 bottles) - 80000 pcs/ year
- paints (700 kg for 1 million of bottles to be painted) - 37.3 t/year
- dissolvent (7 kg for 1 million of bottles to be painted) - 380 l/year
- chamotte elements (eyes, plungers) - 3 t/year
- other auxiliary materials (greases, oils, technical gases).

6.7.3. Fuel

The following kinds of fuels will be used:

- heavy oil (melting end of tank furnaces)
- light oil (working end of tank furnaces, forehearth, annealing lehrs, sand dryer)
- fuel oil (Diesel engine for generators)
- liquid gas LPG (laboratory burners).

6.7.3.1. Heavy oil consumption

Melting end of the tank furnaces 2 x 1100 kg/hour, i.e. 2 x 24000 kg/day, i.e. 2 x 8800 t/year, 14 days stock of heavy oil in tanks is assumed.

6.7.3.2. Oil characteristic

Heavy oil, specific density 0.95 kg/dm^2, net calorific value 18500 BHT/pound, max. viscosity 125at, at 122°F, max. sulphur content - 2 %

6.7.3.3. Light oil consumption

Working end of tank furnace - 2 x 60 kg per hour, i.e. 2 x 1440 kg/daily, i.e. 2 x 520 t/year.
Feeders (6 pcs) x 120 kg/h, i.e. 2880 kg/day, i.e. 1040 t/year.
Annealing lehrs (6 pcs) - 240 kg/h, i.e. 5760 kg/day, i.e. 2080 t/year.
Sand dryer (2 pcs) - 120 kg/h, i.e. 1920 kg/day, i.e. 700 t/year.
Total - 523 kg/h, i.e. 13440 kg/day, i.e. 4850 t/year.

6.7.3.4. Fuel oil consumption

24.3 t/24 h, i.e. 8800 t/year.

6.7.3.5. Liquid gas consumption

50 kg/24 h, i.e. 18 t/year.

5.7.4. Electric energy

The Plant will be supplied by the own electric power from station equipped with electric power generators as follows:

2 operating of electric power 2.3 MW each

1 spare of electric power 2.8 MW

supplying alternative current (AC) of voltage 380/220 V and frequency 50 Hz.

Justification

The basic condition of success of Glass-Work of continuous technological process is stable feeding with the basic medium, including electric power supply.

It is to be stated, that the stability of power supply from the energy mains in both countries is unsatisfactory for this kind of production (frequent and long intervals in power supply, significant, temporary voltage drops).

Additionally in the places of possible location of the Plant, the arrangement of public power supply lines do not enable supply of the said Plant from at least two independent supply sources. Hence there was suggested to supply power for the plant as above.

The total electric power installed will reach:

6.25 MW

including lighting 350 kW

approximate annual energy consumption A = 23.2 MWh.

The power distribution to be effected through distribution station and cable network.
Electrical-shock protection by zeroing.

6.7.5. Other installation

The installation of control-measuring system and low-current installation (30 telephones, fire-fighting alarm with 20 off sensors) are also provided for.

6.7.6. Water in circulating system

The circulating water system is assumed in the project. The refilment of the water in the circulating system will be arranged from the well by means of pumps. Water will be treated by devices located in the circulating water station.
The system will be equipped with the cooler and elevated water tank.
Refilment of water in circulating system average 33 cu m/h, max. 36 cum/h.
Consumption of industrial water is: average 48 cum/h, 56 cum/h.

6.7.7. Water for drinking, social and industrial purposes

The installation of water for drinking, social and industrial purposes is provided for (water to be softened).

6.7.8. Compressed air

Compressed air of pressure 7 ata, and capacity

218 cum/min. will be produced by the compressors (operating and spare).

Compressors will be located in the power distribution building.

Compressed air installation to be equipped with the following:

- casette filters at the air intake
- dewatering vessel
- air deoiling devices
- compressed air compensating vessel

The distribution of compressed air to the supply points by means of steel piping.

6.7.9. Vacuum

There will be provided two vacuum pumps (one operating, one spare).

The vacuum installation capacity 39 cum/min.

The vacuum value 83 % (635 mm Hg)

6.7.10. Sewage

The open installation for sewage collection as well as the sewage treatment plant is provided for in the project.

Part II: Estimation of investment and civil engineering costs.

Nota: Numbers used to identify tables should not be identified with sections of the first part of this chapter.
They correspond to the numbering structure of the Manual for the Preparation of Industrial Feasibility Studies recommended by UNIDO.

NIGER

6-2/6-3 Investment cost: equipment.

(million) 10^6 CFA

Item	Quantity	Unit	Description	L	F	Cost		
						F	L	Total
1	2	3	4	5	6	7	8	9
1	1	set	Production equipment on FOB basis Europe: 31.193 million ₰		x	12,477.2		12,477.2
2	1	set	Technical documentation and know how; 10 % of FOB value of production equipment		x	1,247.7		1,247.7
3			Maritime transport CIF from Europe to Lagos ₰ 2.5 million (a)		x	1,000.-		1,000.-

Niger 6-2/6 3 cont.

1	2	3	4	5
4			Import duty - assumed to be cancelled Port clearing, handling and transport from Lagos via Kano to Maradi (from Lagos to Site)	
6			Erection of machinery and equipment: 20 % of FOB value of machinery and equipment; 25 % FC, 75 % LC.	x
7			Supervision of erection and of the start up production 300 man months at the rate of $ 5000; 60 % FC, 40 % LC	x

6	7	8	9
x		592.-	592.-
x	512.4	1,833.-	2,495.4
x	360.0	240.-	600.-

Niger 6-2/6-3 cont.

1	2	3	4	5	6	7	8	9
8			Tax statistique: 0.25 % of the FOB value of machinery and equipment		x		32.2	31.2
9			Insurance of machinery and equipment CIF; 0.6 %		x		80.8	80.8
			Subtotal (1-9)			15,697.3	2,827.-	18,524.3
10			Service equipment: office equipment	x			148.-	148.-
			Total (1-10)			15,697.3	2.975.-	18,672.3

(a) Nota: Estimation made upon the offer of Nigerian transporter from Lagos to Kano at 88 ₦/t or m^3 plus 20.4 ₦ (10600 CFA) t or m^3 according to the offer of SNTN in Niamey for the distance Kano - Maradi. The above calculation was accepted as yielding the cost of transport lower than the same cost via Cotonou- Maradi estimated by SNTN at the rate of 107600 CFA/t or m^3 equivalent of 207 ₦.

FC - foreign costs

LC - local costs


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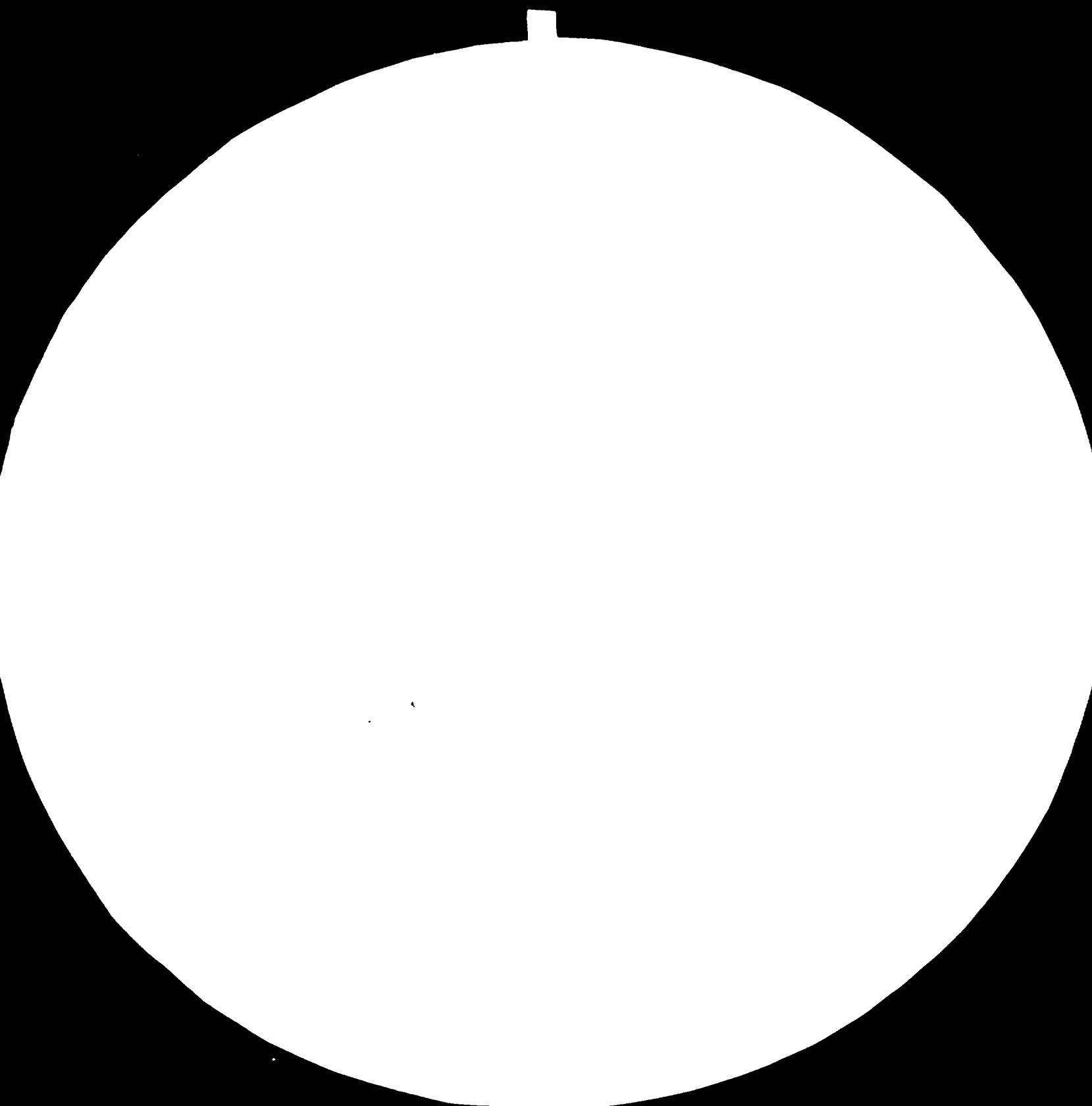

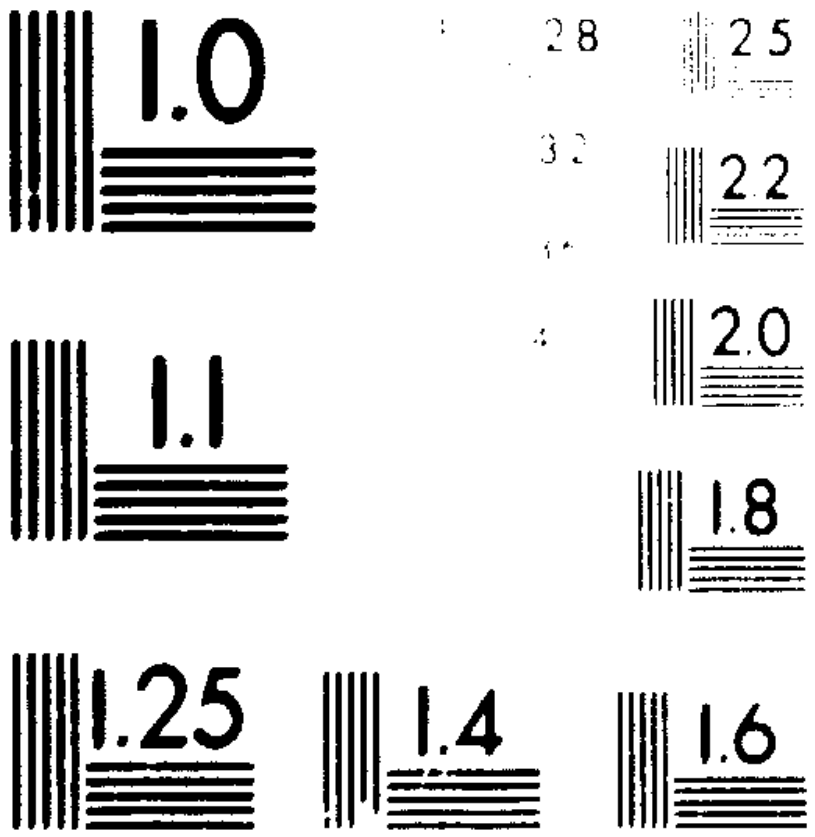

6-4/6-5 Investment cost: civil engineering works.

The unit costs of construction assumed for Niger are as follows:

Item	Construction type	Unit of measure	Unit cost 10^3 CFA
1	Production and auxiliary covered buildings	cum	55,000
2	Administrative buildings	cum	40,000
3	Roads, and other uncovered constructions	sqm	11,000

Annex

6-4
6-5

Civil engineering works

Item	Quantity	Unit	Description	L	F
1	2	3	4	5	6
1	5.7	ha	Site preparation and development	x	
2			Buildings and special civil works		
2.1	178596	m^3	Industrial and auxiliary covered buildings 35 % FC, 65 % LC.	x	x
2.2	8400	m^3	Administration buildings	x	

(million) 10^6 CFA

Unit cost	Cost		
	F	L	Total
7	8	9	10
30.-		171.-	171.-
0.055	3,464.4	6,356.9	9,821.3
0.040		336.-	336.-

Niger 6-4/6-5 cont.

1	2	3	4	5	6
2.3	10300	m^2	Roads and other uncovered constructions	x	
2.4	1		Stack h = 70 m	x	
2.5	3		Water source, depth = 100 m	x	
			Total		

F - foreign costs

L - local costs

(million) 10^6 CFA

7	8	9	10
0.011		113.3	113.3
		40.-	40.-
17.-		54.-	54.-
	3,464.4	6,774.7	10,239.1

(3) Investment cost equipment

10^3 M

Item	Quantity	Unit	Item description	L	F	Unit price	Cost F	Cost L	Cost total
1	2	3	4	5	6	7	8	9	10
1	1	plant	Production equipment on FOB basis		x		23,994.-		23,994.-
2	1	set	Technical documentation and know how 10% of FOB production equipment value		x		2,399.-		2,399.-
3			Maritime transport CIF		x		1,923.-		1,923.-
4			Import duty assumed to be cancelled				-		-
5			Port clearing, handling and local transport to site, insurance included 0.5 % of CAF machinery and equipment	x				1,053.-	1,053.-

Nigeria 6-2/6-3 cont.

10^3 ₦

1	2	3	4	5	6	7	8	9	10
6			Erection of machinery and equipment 20 % of FOB value of machinery and equipment 25 % FC, 75 % LC	x	x		120.-	3,598.-	4,798.-
7			Supervision of erection and of the start-up of the plant. 300 man/months at the rate ₦ 5000 60 % FC, 40 % LC	x	x		620.-	462.-	1,154.-
			Subtotal 1 -7				30,208.-	5,113.-	35,321.-
8			Service equipment. Furniture, office equipment Service cars					284.-	284.-
			Total 1 - 8				30,208.-	5,397.-	35,605.-

NIGERIA

6-4

Investment costs: civil engineering

6-5

10^3 ₦

Item	Quantity	Unit	Item description	L	F	Unit cost ₦	Cost F	Cost L	Cost Total
1	5.7	ha	Site preparation and development	x		45000		256.5	256.5
2			Buildings and special civil works and outdoor works						
	178569	m^3	Industrial and auxiliary buildings 35 % FC, 65 % LC	x	x	100	6,249.-	11,608.-	17,857.-
	8400	m^3	Administrative buildings	x		80		672.-	672.-
	10300	m^2	Roads, and other non covered constructions	x		25		276.-	276.-
	1		Stack h = 70 m	x				90.5	90.5
	3		Water source depth = 100 m	x		37.3		112.-	112.-
			Total				6,249.-	13,015.-	19,264.-

F - foreign costs

L - local costs

VII. PLANT ORGANIZATION AND OVERHEAD COSTS

With regard to technology level of automatic glass containers production and also with regard to the size of the proposed plant it seems most efficient to consider the major items of the overhead costs, namely technical (service) and administrative.
Organization structure is assumed to be the same for Niger and Nigeria

7.1. Plant management

It is assumed that the management staff will come from local human resources and will consist of 1 general manager 5 deputy directors. The following are the functions concerning deputy directors.

- technical director
- production director
- administration director
- commercial director
- economical director

7.2. The local personnel

The total personnel of the plant is assumed to be 445 persons:

direct labor workers	365	persons
technical supervision	15	"
administration	23	"
general service	42	"

7.3. Foreign assistance

The foreign assistance would consist of 3 permanent experts:

- technological specialist
- chemical engineer - specialist of the raw materials composition and batch preparation,
- mechanical engineer - specialist of IS machines.

7.4. Schedule of the management structure

The schedule presents the general organisation structure of the plant management without a detailed division of duties and responsibilities.

7.5. Overhead costs - administration and finance

Nigeria

7.5.1. Cost of local administrative and commercial personnel

The following table presents the evaluation of yearly management and administration overheads.

N

Item	Description of function	Number of persons	Annual salary	Total
1.	General director	1	21,000	21,000
2.	Deputy directors	5	14,000	70,000
3.	Technical and engineering supervision	15	4,000	60,000
4.	General administration	17	2,800	47,600
5.	Mid. office maintenance and general service	42	1,600	67,200
7.	Total general	80	x	265,800

7.5.2. Board of Directors

It is assumed that besides the plant management - the constituted, at the incorporation stage, board of directors will also function during the exploitation period.[1)]

Yearly remuneration of 5 directors + 1 secretary is assumed to be yearly 60,000 ₦

7.5.3. Foreign assistance

Estimation of annual cost 135,000 ₦

or 180,000 $

Nota: The permanent foreign assistance may be organized to suite best the needs of the plant.

7.5.4. The general administration functioning and indirect materials (telephone, furniture, travel etc...,

These costs are usually assumed to be calculated for the glass plant at the level of 3 % of total wages and salaries yearly fund of the plant. We exclude from this figure the salaries of foreign experts and of the Board of Directors. This means that only home acting personnel salaries and wages are taken as the basis for estimation.

The total salaries and wages	(table 8.2.1)	= 1,359,800 ₦
Foreign assistance	(point 7.5.3	= - 138,000 ₦
Board of Directors	(point 7.5.2)	= - 60,000 ₦
		1,141,800 ₦

3 % of 1,141,800 = 34,254 ₦

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1) It is important to distinguish between acting plant management described in 7.5.1. and Board of Directors which constitutes a promoters supervision and strategical policy making body. Board of Directors in Nigeria is rather temporary controlling and guiding organ than acting management.

7.5.5. Insurance fees and finance costs

0.5 % of the cost of the production equipment

0.5 % of 23,994,000 ₦ = 120,000 ₦

7.6. Overhead costs - service cost centers

7.6.1. Estimate of production cost: current maintenance and spare parts

Year of production	% of the equipment value	Maintenance costs ₦
1	1 %	239,900
2 and following	1.5 %	359,800

7.6.2. Major tank furnace maintenance

The cost of the tank furnaces maintenance is estimated based upon the assumption of the 50 % tank furnaces value depreciates over the period of 4 years. The estimated value of the tank furnaces consists of 12.5 % of the total value of machinery and equipment + 50 % of the cost of the equipment erection:

12.5 % of 23,994,000 plus 50 % of 4,778,000 =

= 5,398,000 ₦

$$\frac{5,398 \times 50}{100 \times 4} = 674,750 \text{ ₦}$$

The estimated foreign/local part structure is

35 % foreign currency or 236,162 ₦

65 % local currency or 438,587 ₦

7.7. Overhead cost summary

Local currency N

Item	Item description	Year of production 1	Year of production 2 and following
1	Administration and finance cost centers		
1.1	Indirect personnel	265,300	265,300
1.2	Board of directors	60,000	60,000
1.3.	Functioning costs	34,254	34,254
1.4	Insurance, fees and finance costs	120,000	120,000
1.5	Foreign assistance	130,000	130,000
	Subtotal	618,054	618,054
2	Service cost centers		
2.1	Current equipment maintenance	239,900	359,800
2.2	Major tank furnace maintenance	674,750	674,750
	Subtotal	914,650	1,034,550
	Total overheads	1,532,704	1,652,604

7.3. Overhead costs Foreign/Local currency

Foreign/Local currency(N)

Item	Item description	Year of production					
		1			2 and following		
		FC	LC	TOTAL	FC	LC	Total
1	Administration and finance cost centers	138,000	480,054	618,054	138,000	480,054	618,054
2	Service cost centers	236,162	678,488	914,650	236,162	798,388	1,034,550
	Total overheads costs	374,162	1,158,542	1,532,704	374,162	1,278,442	1,652,604

Niger

7.5 Administration and finance

7.5.1. Management and administration overheads

10^3 CFA

Item	Function description	Number of persons	Annual salary	Total
1.	General director	1	1,920.-	1,920.-
2.	Deputy directors	5	1,440.-	7,200.-
3.	Technical and engineering supervision	15	780.-	11,700.-
4.	General administration	17	480.-	8,160.-
5.	Aid, office maintenance, general services	42	240.-	10,080.-
	Total	80	x	39,060.-
6.	Social charges 15.4 %			6,015.2
	Total			45,075.2

7.5.2. It is assumed that board of directors (5 persons + 1 secretary) will function during exploitation period. Board of directors yearly cost is estimated to be 6 mln FCFA.

7.5.3. Foreign assistance

3 permanent experts at 2 million CFA/month, yearly

72 million CFA £ 180,000

7.5.4. General administration

We employ the similar methodology to derive the figure for general administration as in the case of Nigeria. The estimate for general administration is therefore equal to 3 % of the yearly salary fund excluding social charge, foreign assistance and Board of Directors.

The total salaries and wages fund (see table 8.2.2)=

= 292.600 mln CFA

Foreign assistance (point 7.5.3.) = -72.000 " "

Board of Directors (point 7.5.2.) = - 6.000 " "

214.260 mln CFA

3 % of 214.26 mln CFA = 6.3 mln CFA

7.5.5. Insurance fees and finance costs

0.3 % of the cost of machinery and equipment

0.3 % of 12,477.2 = 37.432

7.6. Service cost centers

7.6.1. Current equipment maintenance and spareparts

Year of production	% of equipment value	Costs 10^6 CFA
1	1 %	124.8
2 and following	1.5 %	187.2

7.6.2 Major tank furnace maintenance and spare parts

12.5 % of machinery and equipment	= 1,559.6
50 % of costs of erection	= 1,247.5
	2,807.1

Estimated cost of the tank furnace = 2,807.1

Amortised 50 % over the period of 4 years

$$\frac{50\ \% \times 2{,}807.1}{4 \times 100} = 351 \text{ million FCFA}$$

The estimated foreign/local proportion:

35 % FC	= 122.8 million FCFA
65 % LC	= 228.2 million FCFA

7.7. Overheads summary table

10^3 CFA

Item	Description	Year of production 1	2 and following
1.	Administration and finance		
1.1.	Indirect personnel	45,075.-	45,075.-
1.2.	Board of directors	6,000.-	6,000.-
1.3.	Functioning costs	6,300.-	6,300.-
1.4.	Insurance fees and finance costs	37,432.-	37,432.-
1.5.	Foreign assistance	72,000.-	72,000.-
	Subtotal	166,807.-	166,807.-
2.	Service cost centers		
2.1.	Current equipment maintenance	124,000.-	187,200.-
2.2.	Major tank furnace maintenance	351,000.-	351,000.-
	Subtotal	475,300.-	533,200.-
	Total 1 + 2	642,607.-	705,007.-

7.8. Foreign/Local currency overheads

10^3 CFA

Item	Description	Year of production					
		1			2		
		F	L	T	F	L	T
1	Administration and finance cost centers	72,000	94,807	166,807	72,000	94,807	166,807
2	Service cost centers	122,000	353,800	475,800	122,000	416,200	538,200
	Total	194,000	448,607	642,607	194,000	511,007	705,007

VIII. MANPOWER

8.1. Specification of labour

Post	Shift				Total
	I	II	III	IV	
Batch house plus sand store	10	7	5	3	25
Melting of glass	3	3	3	3	12
Forming of bottles	12	12	12	12	48
Annealing and sorting of bottles	14	14	14	14	56
Palletizing and internal transport	11	11	11	11	44
Screen-painting	11	11	11	11	44
Cullet processing	2	2	2	2	8
Ready made - glass store	5	5	-	-	10
Workshop and maintenance brigade	20	20	10	10	60
Laboratory	4	2	2	2	10
Auxiliary store	2	2	2	2	8
Unskilled workers	6	6	2	2	16
Supervision of electric power generators, pump, etc.	6	6	6	6	24
Total	106	101	80	78	365

8.2. Cost of manpower

Under the assumption of a continuous production process and four shifts work the total employment is assumed to be 445 persons. Functions, salaries and wages are shown in the following table.

8.2.1. Estimate of production costs:

salaries and wages

Nigeria ₦

Item	Function	Number of persons	Annual salary/ wage	FC	LC	Total
1.	Foreign permanent experts	3	46,000	138,000	-	138,000
2.	Board of directors	5	12,000	-	60,000	60,000
3.	General director	1	21,000	-	21,000	21,000
4.	Deputy directors	5	14,000	-	70,000	70,000
5.	Technical and engineering supervision	15	4,000	-	60,000	60,000
6.	Administration general	17	2,800	-	47,600	47,600
7.	Aid, office maintenance and general services	42	1,600	-	67,200	67,200
8.	Workers - direct labor	365	2,400 x)	-	876,000	876,000
	Total	445+8	x	138,000	1,201,800	1,339,800

x) At the prefeasibility stage it is assumed that yearly average wage of direct labor is 2400 ₦ without differenciating among different responsibilities levels.

8.2.2. Estimate of production costs:

salaries and wages

Niger 10^3CFA

Item	Function	Number of persons	Annual salary	FC	LC	Total
1.	Foreign permanent experts	3	24,000	72,000	-	72,000
2.	Board of directors	5	6,000		6,000	6,000
3.	General director	1	1,920		1,920	1,920
4.	Deputy directors	5	1,440		7,200	7,200
5.	Technical and engineering supervision	15	780		11,700	11,700
6.	General administration	17	480		8,160	8,160
7.	Aid, maintenance, general services	42	240		10,080	10,080
8.	Workers - direct labor	365	480		175,200	175,200
	Total	445+8		72,000	220,260	292,260
9.	Social charges 15.4 %				33,920	
	Total wages and salaries			72,000	254,180	326,180

IX. PROJECT IMPLEMENTATION

9.1. Costs of the project implementation

The project implementation phase embraces the period from the decision to invest to the start of commercial production. It includes a number of stages including negotiation and contracting, project design, construction and the test production.
The construction and equipment erection is assumed to be 30 months including the test of equipment.
The whole implementation period is assumed to be 36 months, 6 months of implementation, planning, negotiating and contracting included.

The first 3 months of the start up production is assumed to be at 50 % of the production capacity and the remaining 9 months at 90 % of the full capacity. This results in an average 76.5 % production programme for the first year of operation.
The project implementation is proposed to organized according to the following schedule.

Schedule of the project implementation

(effective action)

A. Preparation of technical documentation

B. Production of machinery equipment

C. Delivery of machinery and equipment

D. Land and site development

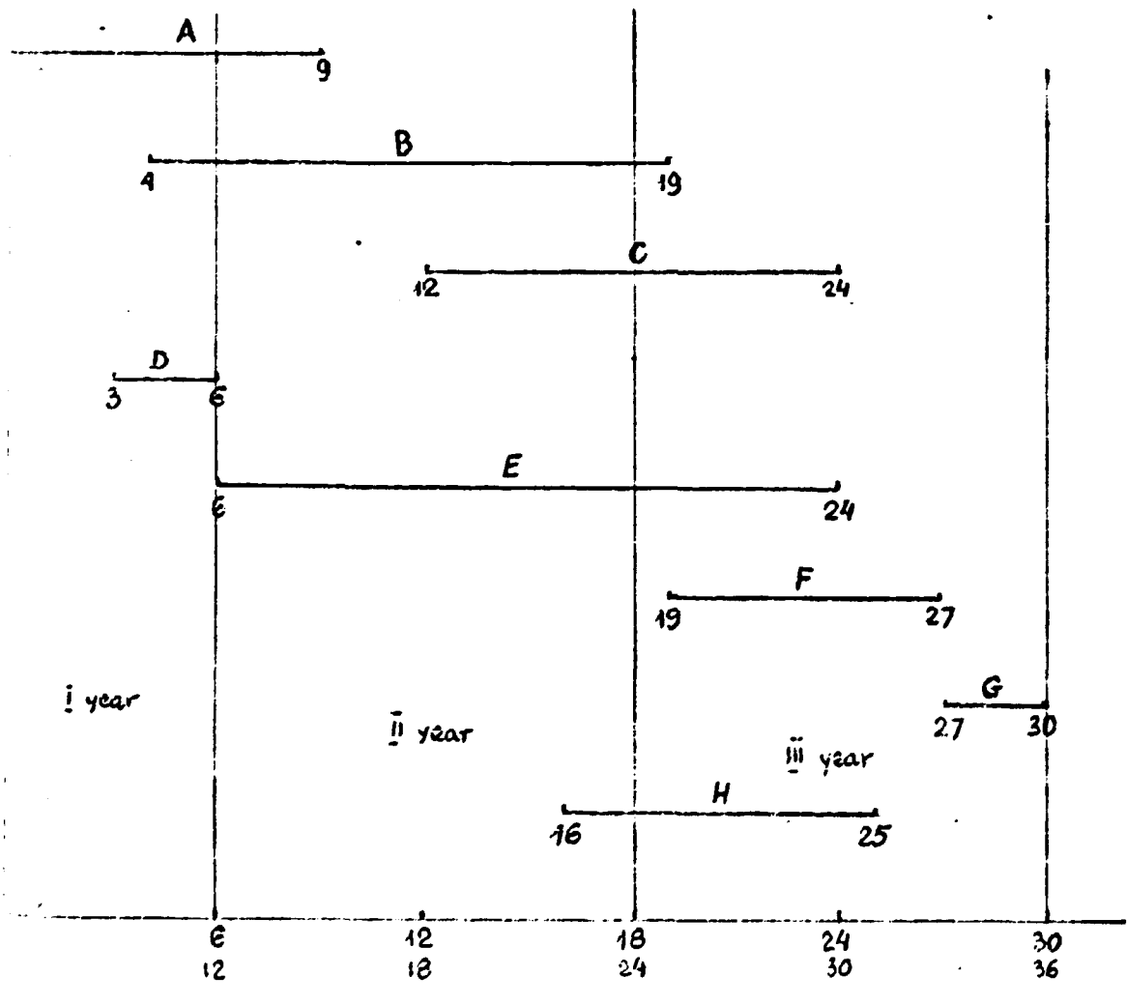
E. Civil buildings and engineering works

F. Erection of machinery and equipment

G. Start-up and commissioning of the plant

H. Training of the client's staff and laborers

I. Planning the implementation 1-6 months.



9-2 Estimate of investment costs: project implementation - Nigeria

N

No.	Quantity	Unit	Item description	L	F	Cost		
						FC	LC	Total
1	2	3	4	5	6	7	8	9
1			Management of project implementation					
1.1	2	per.	1 director + 1 secretary Salary and operating costs during 2 years of implementation	x			36,000	36,000
2.			Detail engineering, tendering					
2.1.	3	per.	3 persons, temporary salaries and operating costs during 4 months	x			18,000	18,000
			Supervision, co-ordination, test run and take over of the plant					
.1	1	per.	Construction supervision engineer	x			30,000	30,000

1	2	3	4	5
3.2	1	per.	Foreign supervision expert 2 years	
3.3			Raw materials, supplies... for test and start-up	
3.3.1			Raw materials: 1/4 of the yearly production requirement	x
3.3.2			Utilities (fuel): 1 month of the tank furnace heating up x 0.75	x
3.3.3	300	t	Supplies (cullet)	x
3.4			Interest during construction 10.5 % over the period of 1.5 year	x
4.			Build-up administration recruitment and training	

6	7	8	9
x	55,000		55,000
x			
		182,822	182,822
		9,300	9,300
		2,730,000	2,730,000

1	2	3	4	5
4.1			Board of directors: 5 persons + 1 secretary total renumeration fund for 2.5 years	x
4.2			Training of staff and labourers 84 persons and 234/man/months	
4.2.1			Cost of travel tickets to Europe: 84 x 1500 N	x
4.2.2			Hotel accomodation: 84 x 2 nights at N 50	
4.2.3			Cost of staying in the country of training 234 man months x 1000 N	
4.2.4			Cost of training - free of charge	

6	7	8	9
		150,000	150,000
		126,000	126,000
x	8,400		8,400
x	234,000		234,000
x	-		-

1	2	3	4	5	6
5			Preliminary and capital issue expenditures		
5.1			Banking fees (transfer and letters of credits) 1.25 % of the contract amount (machinery and equipment + civil engineering + office equipment = 54864500 N)	x	
5.2			Cost of the bank guarantee; 1 % of the supplier credit per annum during the period of 2 years (supplier credit amounts to 75 % of the value of machinery and equipment)		
			Implementation costs total		

7	8	9
	685,800	685,800
	270,000	270,000
297,4	4,237,992	4,535,322

9.2. Estimate of investment costs: project implementation - Niger

10^3 CFA

	Quantity	Unit	Item description	L	F	Cost		
						FC	LC	Total
	2	3	4	5	6	7	8	9
			Management of project implementation					
1	2	per.	1 director + secretary salary and operating costs during 2 years	x			4,800	4,800
			Detail engineering, tendering					
1.	3	per	Temporary personnel 3 persons during 4 months salary and operating costs				2,000	2,000
			Supervision, co-ordination, test run and take over of the plant					
1	1	per.	Construction supervision engineer	x			4,320	4,320

1	2	3	4	5
2	1	per.	Foreign supervision expert 2 years	
3			Raw materials for start-up (additional to normal production)	
3.1			Utilities 1 month of the tank furnace heating x coefficient 0.75	
3.2	300	t	Supplies - cullet	x
4			Interest during construction 13 % over the period of 1.5 year	x
5			Build-up administration, recruitment and training	
5.1			Board of directors 5 persons + 1 secretary, renumeration fund for 2.5 years	x

6	7	8	9
x	40,000		40,000
x	346,639		346,639
		48,360	48,360
		1,450,000	1,450,000
		18,000	18,000

1	2	3	4
4.2			Training of staff and laborers 84 persons and 234 man/months
4.2.1			Cost of traveltickets to Europe 84 x £ 1950
4.2.2			Hotel accomodation 84 x 2 nights at £ 65
4.2.3			Cost of staying in the country of training 234 man/months at £ 1300
4.2.4			Cost of training - free of charge
5.			Preliminary and capital expenditure
5.1.			Banking fees: transfer and letters of credit 1.25 % of the contract amount

5	6	7	8	9
x			65,520	65,520
	x	4,368		4,368
	x	121,680		121,680

2	3	4	5	6
		(machinery and equipment + civil engineering + office equipment = 28,911.4 million FCFA		x
.2		Cost of the bank guarantee 1 % of the suppliers credit per annum during the period of 2 years (supplier's credit: 75 % of the value of machinery and equipment	x	
		Total implementation costs		

7	8	9
	361,392	361,392
	187,155	187,155
512,687	2,141,547	2,654,234

X. FINANCIAL AND ECONOMIC EVALUATION - NIGER

10-1/1. Initial fixed investment costs

10^6CFA

Item	Investment category	FC	LC	Total
1	Land: plot of 5.7 ha		85.50	85.50
2.	Site preparation and development		171.0	171.0
3	Structures and civil works	3,464.4	6,774.7	10,239.1
4	Incorporated fixed assets	-	-	-
5	Plant machinery and equipment	15,697,0	2,975.0	18,672.3
	Total	19,161.4	10,006.2	29,167.6

Item	Year			
Currency	[illegible]	[illegible]	[illegible]	[illegible]
Land		[illegible]	[illegible]	
Site preparation	-	[illegible]	[illegible]	
Structures and civil works	-	-	-	[illegible]
Plant and machinery	1,000.0	-	1,000.0	7,247
Total	1,000.0	256.5	1,256.5	10.047

10^{6}CFA

			3		
[illegible]	IC	T	EX	IC	T
		-	-	-	-
-	-	-	-	-	-
[illegible]	3,300.0	6,100.0	664.4	3,474.7	4,139.1
7,247.7	391.8	7,639.5	7,449.6	2,583.2	10,032.8
10.047.7	3,691.8	13,739.5	8,114.0	6,057.9	14,171.9

10-2/1. Preproduction capital expenditure, by category

10^3CFA

Item	Category	FC	LC	Total
1	Preinvestment studies	-	-	-
2	Preparatory investigation	-	-	-
3	Management of project implementation		4,800.0	4,800.0
4	Detail planning, tendering	-	2,000.0	2,000.0
5	Supervision, coordination, test run and take over of the plant	386,639.0	1,502,680.0	1,889,319.0
6	Build-up of administration recruitment and training of staff and labourers	126,048.0	83,520.0	209,568.0
7	Preliminary capital expenditures	-	548,547.0	548,547.0
	Total	512,687.0	2,141,547.0	2,654,234.0

...tem	Period	Construction			
	Year	1			
	Currency	[illegible]	[illegible]	[illegible]	[illegible]
1	Reproduction capital expenditures		3.44	3.44	3.300

10^3 DFA

					T
[illegible]366	993.187	[illegible]	[illegible]	[illegible]	1,570.239

Total 2,654.234

10-3/1. Calculation of working capital

I. Minimum requirements of current assets and liabilities.

a) Receivables	30 days at production cost minus interest and depreciation
1. Inventory	
local raw materials	30 days
imported raw-materials	90 days
spare parts	180 days
work in progress	0 -
finished products	15 days at factory cost + administrative overheads
c) Cash in hand	5 days[x)]
d) Payables	30 days for raw materials and utilities.

Nota: Cash in hand assumed to be 5 days is rather low. This value is the intermediate result obtained in course of approximation of interest costs before working capital was known. This assumption does not affect important conclusions of the study.

II. Annual production cost estimate

10^6 CFA

Period	Construction			Start up	Ful capacity
Year	1	2	3	4	5
Production programme	0	0	0	76.5 %	100 %
Costs					
Raw materials:					
Local				320.328	418.730
Imported				827.884	1,082.201
Labour (15.4 % social charge included)				202.181	202.181
Utilities				4,991.598 (90%)	5,546.220
Repair (tank furnaces)				351.000	351.000
Maintenance				124.800	187.200
Factory costs				6,817.791	7,787.532
Administrative overheads				166.807	166.807
Sales and distribution costs 1 % of a yearly production value				101.412	132.565
Operating costs				7,086.010	8,086.904
Financial costs (interest)				2,501.760	2,287.190
Depreciation				2,386.550	2,386.550
Production cost				11,974.32	12,760.644

10-3/2. Calculation of working capital

10^6CFA

Item	X	Y	Start up 4	Full capacity 5
I. Current assets				
A. Accounts receivables	30	12	590.064	673.387
B. Inventory				
a) Raw materials local	30	12	26.694	34.894
b) Raw materials imported	90	4	206.971	270.550
c) Spare parts	180	2	62.400	93.600
d) Finished products	15	24	291.025	331.431
C. Cash in hand	12	30	46.000	49.000
D. Current assets			1,223.154	1,452.862
II. Current liabilities				
A. Accounts payable	30	12	-500.651	-587.263
III. Working capital				
A. Net working capital			722.503	865.599
B. Increase in working capital			-	143.096
IV. Total production costs			11,974	12,761
Less: Raw materials			1,148	1,501
Utility			4,992	5,546
Depreciation			2,387	2,387
	12	30	3,447	3,327
V. Required cash balance			46.000	49.000

10-6/1. Total initial investment costs

10^6 CFA

Item	Category	FC	LC	Total
1	Initial fixed investment cost	19,161.4	10,006.2	29,167.6
2.	Preproduction capital expenditures	512.7	2,141.5	2,654.2
3.	Working capital	330.0 x)	535.5	865.5
	Total initial costs	20,004.1	12,683.2	32,687.3

x) Nota: Cost of imported raw materials + 63.5 % spare parts value (in working capital).

10-7/1. Total initial assets

10^6 CFA

Item	Category	FC	LC	Total
1	Initial fixed investment costs	19,161.4	10,006.2	29,167.6
2	Preproduction capital expenditures	512.7	2,141.5	2,654.2
3	Current assets	553.9	898.9	1,452.8
	Total initial assets	20,228.0	13,046.6	33,274.6

10-8 2. Total investment costs

Period	Construction						
Year	1			2			
Currency	FC	LC	T	FC	LC	T	FC
Fixed instrument costs							
a/ Initial fixed investment costs	1,010.0	250.5	1,256.5	10047.7	369.3	13739.5	8411.0
2/ Preproduction capital expenditures		6,440.0	6,440.0	34,368	995.187	1077.555	428.31
3/ Working capital increases	-	-	-				
Total investment costs	1,010.0	262.94	1,262,940	10132.068	468.987	14817.055	8542.30

10^6 CFA

				Start-up			Full capacity		
	3			4			5		
T	FC	LC	T	FC	LC	T	FC	LC	T
739.5	8114.0	6057.9	14171.9						
77.559	428.319	1141.92	1570.239						
				275.478	447.025	722.503	54.541	88.505	143.046
817.059	8542.319	7199.8	15742.139	275.478	447.025	722.503	54.541	88.505	143.046

10-7/2. Total assets

Period	Construction									
Year	1			2			3			
Currency	FC	LC	T	FC	LC	T	FC	LC	T	FC
I. Fixed investment costs										
a/ Initial fixed investment costs	1000.0	256.5	1256.5	10047.7	3691.8	13739.5	8114.0	6057.9	14171.9	
2. Preproduction capital expenditures		6.40	6.40	84.4	993.2	1077.6	428.3	1141.9	1570.2	
3. Current assets	-	-	-	-	-	-	-	-	-	46...
Total assets	1000.0	262.9	1262.9	10132.1	4685.0	14817.1	8542.3	7199.8	15742.1	46...

10^6 CFA

	Start-up			Full capacity			Total		
	3			4			5		
	FC	LC	T	FC	LC	T	FC	LC	T	FC	LC	T
.5	8114.0	6057.9	14171.9							19161.7	10006.2	29167.9
	428.3	1141.9	1570.2							512.7	2141.5	2654.2
	-	-	-	464.4	756.8	1223.2	87.5	142.1	229.6	553.9	898.9	1452.8
7.1	8542.3	7199.3	15742.1	464.4	756.8	1223.2	87.5	142.1	229.6	20228.3	13046.6	33274.9

10-8/1. Sources of finance

10^6CFA

Item	Source of finance	LC	FC	Total
1	Promoters a) Equity (80%)	8,000	-	8,000
2	Collaborators a) Equity (20%)	2,000	-	2,000
3	Financial development institutions loans	2,148	10,374	12,522
4	Commercial loans (short term)	536	330	866
5	Supplier's credit	-	9.300	9,300
6	Current liabilities	363	224	587
	Total sources	13,047	20,228	33,275

Equity capital: approximately 30% of the total investment cost i.e. 10,000 million CFA
share promoter 80 % 8,000 million CFA
share collaborator 20 % 2,000 million CFA

Supplier's credit: approximately 75 % of value FOB of machinery and equipment: 9,300 million CFA; seven years credit, 14 half yearly installments, interest 8 % p.a. (Polimex-Cekop, Poland)

Commercial loan: for working capital, one year credit, interest 15.5 % p.a. (Banque de Developpement de la Republique du Niger)

Financial institutions: 7 years credit, 14 half yearly installments 13 % interest p.a. (source as above)

Current liabilities: distributed between FC and LC by using ratio of FC in working capital (schedule 10-8/1).

10-8/2. Sources of finance

Period	Construction							
Year	1			2			3	
Currency	F	L	T	F	L	T	F	L
1. Equity		262.94	262.94		4685			5352.0
2. Loans								
Long term 13%	1000.0	-	1000.0	5832.0	-	5832.0	3542.0	2147.0
Short term 15%							339.0	536.0
3. Shippliers credit				4300.0	-	4300.0	5000.0	-
4. Current liabilities								
Total	1000.0	262.94	1262.94	10132.0	4685.0	14817.0	8872.0	7736.0

10^6 CFA

	Start-up						Full capacity					
	3			4			5			Total		
-	F	L	T	F	L	T	F	L	T	F	L	T
		5052.06	5052.6							-	10000.0	10000.0
0.0	3542.0	2147.94	5689.94							10374.0	2148.0	12522.0
	330.0	536.0	866.0							330.0	536.0	866.0
0.0	5000.0	-	5000.0							9300.0		9300.0
				191.0	310.0	501.0	33.0	53.0	86.0	224	363	587
17.0	8872.0	7736.0	16608.0	191.0	310.0	501.0	33.0	53.0	86.0	20228.0	13047.0	33275.0

The schedule of loans repayment

A. Supplier's credit: 7 years credit repaid in 14 half-yearly Installments, interest rate 8 % p.a., first principal repayment during the second year of production.

Repayment period	Balance	Principal repayment	Interest
1	9300	-	372
2	9300	-	372
3	9300	664	372
4	8636	664	345.4
5	7972	664	318.9
6	7308	664	292.3
7	6644	664	265.8
8	5980	664	239.2
9	5316	664	212.6
10	4652	664	168.1
11	3988	664	159.5
12	3324	664	133.0
13	2660	664	106.4
14	1996	664	79.8
15	1332	664	53.3
16	668	668	26.7

B. Short term credit for working capital amounts to 866×10^6 CFA and is assumed to be 15 % p.a. credit repaid during the first year of production. Interest equals 129.9×10^6 CFA.

C. Long term loan at 13 % p.a. interest is assumed to be repaid in 14 half-yearly installments. The first principal repayment happens during the second year of production.

Repayment period	Balance	Principal repayment	Interest
1	12522	-	813.9
2	12522	-	813.9
3	12522	894	813.9
4	11628	894	755.8
5	10734	894	697.7
6	9840	894	639.6
7	8946	894	581.5
8	8052	894	923.4
9	7158	894	465.3
10	6264	894	407.2
11	5370	894	349.1
12	4476	894	290.9
13	3582	894	232.8
14	2688	894	174.7
15	1794	894	116.6
16	900	894	58.5

10-3/3. Cash flow table for financial planning

Period	Construction			Start up (full capacity)					
Year	1	2	3	4	5	6	7	8	
Production program	0	0	0	70.0	100		100	100	
A. Cash inflow:	1263	14817	16608						
1. Financial receipts total	1263	14817	16608	11693	14715	14629	14629	14629	14
2. Sales revenue	-	-	-	501 11194	86 14629	- 14629	- 14629	- 14629	
B. Cash outflow :	1263	14817	15743	10823	14419	13861	13213	12856	
1. Total assets schedule	1263	14817	15743	1223	223	-	-	-	
2. Operating costs	-	-	-	7036	8087	8087	8087	8087	
3. Debt service									
a/ Interest,									
Supplier's credit	-	-	-	744	747	611	505	381	
Short term loan	-	-	-	130	-	-	-	-	
Long term loan	-	-	-	1623	1570	1337	1105	872	
b/ Repayment,									
Supplier's credit	-	-	-	-	1328	1328	1328	1328	1
Short term loan	-	-	-	866	-	-	-	-	
Long term loan	-	-	-	-	1788	1788	1788	1788	1
4. Corporate tax	-	-	-	-	-	-	-	-	1
5. Dividends	-	-	-	400	400	400	400	400	
6. Surplus/Deficit	-	-	865	-385	536	1078	1416	1773	
7. Cumulative cash balance	-	-	865	480	1076	2154	3570	5343	

Nota : Salvage value : /Land = 85.5/+/2/3 of buildings =

= 6826/+/ working capital = 865/ = 7776.5

10^6 CFA

								Salvage value	Total
7	8	9	10	11	12	13			
100	100	100	100	100	100	100			
14629	14629	14629	14629	14629	14629	14629	x	178127
–	–	–	–	–	–	–	–	33875
14629	14629	14629	14629	14629	14629	14629	–	142852
13213	12856	14146	14004	13818	10595	10595	2777	152960
–	–	–	–	–	–	–	2777	25498
8087	8087	8087	8087	8087	8087	8087	–	79869
505	381	292	239	80	–	–	–	3669
–	–	–	–	–	–	–	–	130
1105	872	640	408	175	–	–	–	7759
1328	1328	1328	1328	1332	–	–	–	9300
–	–	–	–	–	–	–	–	966
1788	1788	1788	1788	1794	–	–	–	10522
–	–	1611	1754	1950	2078	2078	–	9471
400	400	400	400	400	400	400	–	4000
1416	1773	483	625	811	4064	4064	7777	–
3570	5343	5826	6451	7262	11306	15106	23167	23167

10-9. Net income statement

Period	Construction			Start up			
Year	1	2	3	4	5	6	
Production programme				76.5%	100%	100%	
Costs /10^6 CFA/							
1. Sales	-	-	-	11190.9	14628.7	14628.7	14
2. Production costs	-	-	-	11974.3	12760.6	12422.0	12
3. Gross profit/taxable/	-	-	-	-783.4	1868.1	2206.7	
4. Tax/50%/, 5 years tax holiday a/	-	-	-	-	-	-	
5. Net profit	-	-	-	-783.4	1868.1	2206.7	
6. Dividendts/4% on equity 10000 x 10^6 CFA/	-	-	-	-400	-400	-400	
7. Undistributed profits	-	-	-	-1183.4	1468.1	1806.7	
8. Accumulated indistributed profits	-	-	-	-1183.4	284.7	2091.4	
Ratios							
Gross profit: sales/%/				-7.0%	12.8	15.1	
Net profit : /%/				-7.0%	12.8	15.1	
Net profit : /%/				-7.0%	12.8	15.1	

a/ Note : It is assumed that the minimum private sector share of "Regime d'agrément will be granted i.e., 5 years of tax holiday. It is also assumed that the turn over tax will not affect net profit or more /over 90%/ of production is going to be exported.

10^5 CFA

6	7	8	9	10	11	12	13
100%	100%	100%	100%	100%	100%	100%	100 %
14628.7	14628.7	14628.7	14628.7	14628.7	14628.7	14628.7	14628.7
12422.0	12083.3	11726.6	11405.9	11120.4	10728.6	10473.5	10473.5
2206.7	2545.4	2902.1	3222.8	3508.3	3900.1	4155.2	4155.2
-	-	-	-1611.4	-1754.1	-1950.0	-2077.6	-2077.6
2206.7	2545.4	2902.1	1611.4	1754.1	1950.0	2077.6	2077.6
-400	-400	-400	-400	-400	-400	-400	-400
1806.7	2145.4	2502.1	1211.4	1354.1	1550.0	1677.6	1677.6
2091.4	4009.8	5703.4	7950.3	9304.4	10854.4	12532	14209.6
15.1	17.4	19.8	22.0	24.0	26.7	35.2	35.2
15.1	17.4	19.8	11.0	12.2	13.4	17.6	17.6
22.4	27.4	29.1	16.0	17.6	19.9	20.8	20.8

				2336.9
				2336.9
				10473.5

10.13. Cash [illegible]

Period	[illegible]			[illegible]					
Year	1	2	3	4	5	6	7	8	9
Preliminary [illegible]	[illegible]	[illegible]	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
A. Cash inflow									
1. Sales [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
B. Cash outflow	[illegible]	41847	15743	[illegible]	6430	8567	[illegible]	[illegible]	[illegible]
1. Total [illegible] capital	[illegible]	[illegible]	15744	[illegible]	[illegible]	-	-	-	-
2. Operating [illegible]	-	-	-	[illegible]	[illegible]	8567	8567	8567	[illegible]
3. Corporate [illegible]	-	-	-	-	-	-	-	[illegible]	[illegible]
C. Net cash flow A-B	[illegible]	[illegible]	15743	[illegible]	3304	8542	8542	8542	[illegible]
D. Present [illegible] (1)	[illegible]	[illegible]	9342	[illegible]	2934	3804	1936	[illegible]	[illegible]
	[illegible]	[illegible]	11827	[illegible]	2971	3693	3357	3052	3091

IRR = [illegible] + [illegible] = 10.0 + 2.73 = 12.73 %

				100	100	100
				14629	14629	14629
				10165	10165	10165
				-	-	-
				8087	8087	8087
				1754	1950	2078
				4788	4592	4466
				841	678	554
				2887	1609	1422

10			
100			
14629	x	148852	
10165	7777	114851	
-	7777	24046	
8087	-	79863	
2078	-	9471	
4466	7777	28601	
465+813	810	-5253	
1293	2252	-2721	
2252			
3545			

Day book period calculation

Calculation of "Profit"

Item/Year	[illegible]			7	8	9
Net profit	[illegible]	[illegible]	[illegible]	[illegible]	2902	1611
Advances	2500	[illegible]	[illegible]	1610	1253	933
Depreciation	[illegible]	[illegible]	[illegible]	2307	2387	2387
"Profit"	[illegible]	[illegible]	[illegible]	3542	6542	4931

10^6 BTU

8	9	10	11	12	13
102	1611	1754	1950	2078	2078
253	933	647	255	-	-
387	2387	2387	2387	2387	2387
742	4931	4788	4592	4465	4465

Calculation of pay back period

10^6 CIM

Total instruments costs	"Profit"	Value(1) (32687)	Value(2) = Value(1) -(Land-working capital (31736)
Year:			
1	-	32687	31736
2 Construction	-	32687	31736
3	-	32687	31736
4	4106	28581	27630
5	6542	22039	21088
6	6543	15496	14545
7	5542	9954	9003
8	6542	3412	2461
9	4931	-1519	-2470
10	4788		
11	4592		
12	4465		
13	4465		

Pay back period(1) = 8.7 - 3 = 5.7 (Pay back period(2) =

= 8.5 - 3 = 5.5 years

Simple rate of return. year 5 (Full capacity)

$$R_5 = \frac{\text{Gross profit}}{\text{Tot.inv.outlay}} = \frac{1868}{32687} = 5.7\ \%;$$

$$R_5 = \frac{\text{Net profit + depreciation}}{\text{Tot.inv. outlay}} = \frac{4255}{32687} = 13.0\ \%$$

$$R_5 = \frac{\text{Net profit}}{\text{Equity}} = 18.6\ \%$$

Break even and sensitivity analysis of the project in Niger.

The glass production technology requires the plant to operate on the continuous basis. This situation makes the problem of qualification of various items in the total cost of production difficult. For the purpose of the break even analysis it is however needed to qualify different costs to two classes of fixed and varable costs. The following division of costs should be perceived as- to some extent - arbitrary although will help to give an idea about the economic safety margin for the project.

Variable operating costs at full capacity 10^6 CFA - schedule 10-3/1 -

- raw materials	
local	418.730
imported	1,082.201
- labour	202.181
- utilities	5,546.220
- sales and distribution	132.565
	7,381.897

Fixed costs:

- administrative overheads	166.807
- maintenance	187.000
- repairs of tank furnaces	351.000
- financial costs (average) for first 10 years of operation (table 10-12	1,193.480
- depreciation	2,386.550
	4,285.037

Number of bottles produced at full capacity: 10^6 pieces

	number	percentage	unit price CFA
- beer	22.856	16.70	120
- soft drink	114.278	83.30	104
total	137.134	100	x

Unit selling price of an "average bottle"

price = 0.167 x 120 + 0.833 x 104 = 106.7 CFA/bottle

The unit variable cost of production:

$$V = \frac{7,381.397}{137,134} = 53.83 \text{ CFA/bottle}$$

Production cost equation is therefore:

$$y = 53.83 + 4.285.037$$

The sales revenues equation is:

$$y = 106.7 X$$

The <u>break - even production level</u> is:

$$X = \frac{4,285.037}{106.7 - 53.83} = 81.048 \text{ million pieces}$$

or 59.10 % of the full capacity.

The break-even price at full capacity can be derived from the following equation:

137.134 x price = 53.83 x 137.134 + 4,285.037

price = 85.83 CFA/bottle

The price safety margin:

$$\frac{106.7 - 85.06}{106.7} \times 100 = 20.26\ \%$$

From the above analysis an optimistic conclusion can be drawn concerning the location of the plant in Niger. Both the capacity and price safety margin are more than reasonable.

11. NATIONAL ECONOMIC ANALYSIS - NIGER

11.1. Job creation, specific capital requirements

$$\frac{\text{Total initial investment cost}}{\text{total employment}} = \frac{32,687.3 \times 10^6 \text{ CFA}}{445 \text{ persons}} =$$

$= 73.435 \times 10^6$ CFA or 183,613 $ / job

$$\frac{\text{Foreign exchange investment costs}}{\text{total employment}} = \frac{20,004.4 \times 10^6}{445} =$$

$= 44.954 \times 10^6$ CFA or 112,384 $ / job

Foreign exchange investment costs constitutes 61 % of the total investment costs.

11.2. Foreign exchange savings

Import substitution:

3.5 % of total production is supposed to be sold in home market e.i. $137.134 \times 10^6 \times 0,035 = 4.8 \times 10^6$ bottles.

Combined price paid in 1983 for an average bottle was:

$0.167 \times 120 + 0.833 \times 104 = 106.672$ CFA/bottle

Import substitution = $4.8 \times 10^6 \times 106.672 = 512.026 \times 10^6$ CFA or 1.28×10^5 $.

Export

96.5 % of total production is supposed to be sold abroad (Nigeria) e.i. $137.134 \times 10^6 \times 0.965 =$

$= 132.334 \times 10^6$ bottles.

Combined export price = $0.167 \times 0.23 + 0.833 \times 0.20 =$

$= 0.20901$ $/bottle

Export value = 132.384 x 10^6 x 0.20501 = 27.130 x 10^6 ₹
or 35.296 x 10^6 ₰ or 14,107.6 x 10^6 CFA.

Depreciation = 1,160.552 x 10^6 CFA on the foreign exchange part of capital.

Interest (average for the first 10 years of operation) = 1,193.48 x 10^6 CFA

Current imports:

raw materials	1,082.201 x 10^6 CFA
utilities:	5,546.220 x 10^6 CFA
tank furnaces repair:	122.800 x 10^6 CFA
spare parts:	187.200 x 10^6 CFA
	6,938.421 x 10^6 CFA
overheads foreign:	194.000 x 10^6 CFA
current imports:	7,132.421 x 10^6 CFA

Foreign exchange savings summary in 10^6 CFA

Import substitution	512.026
Export	14,107.600
Depreciation	- 1,460.553
Interest	- 1,193.480
Current imports	- 7,132.421

14,619.626 - 9,786.453 = 4,833.173

or 11.600 x 10^6 £

11.5. Cost/benefit evaluation

Revenue		14,629 x 10^6CFA
Social operating costs (10^6CFA)		
80% of imported raw materials:	865.760	
60% of utilities:	3,327.732	
50% of labor:	101.091	
50% of administration	83.404	
90% od distribution costs:	119.309	
	4,497.296	- 4,497.296
		10,131.704
Depreciation:		- 2,386.555
		7,745.149

Social Rate of return

$$\frac{7,745.149}{0.61 \times 32,667} \times 100 = 38.72\ \%$$

S U M M A R Y

A. Internal rate of return (IRR) = 12.73 %
Calculated for a period of 10 years of production.

B. Pay back period 5.7 years.

C. Rentability of capital: (1/7.5) of cumulated net results of the first 5 years of exploitation divided by value of capital = 11.65 %.

D. Rentability of investment: (1/7.5) of cumulated net results over the first 5 years of production divided by total investment costs excluding working capital: 3.66 %.

E. Simple rate of return: net profit/sales; average of the first 5 years of production: 11.62 %.

Calculation of A-E does not take into consideration inflation. Inclusion of inflation will result in higher values of parameter due to a significant portion of external financing within the project.

X. FINANCIAL AND ECONOMIC EVALUATION - NIGERIA

10.1.1. Initial fixed investment costs

₦

Item	Investment category	FC	LC	Total
1.	Land: plot of 5.7 ha, the rent paid during 3 years of construction		90,000	90,000
2.	Site preparation and development: surfacing, clearing, levelling and fencing at the rate of 4.5 ₦/Sq.m. x 5.7 ha		256,500	256,500
3.	Structures and civil works	6,249,000	12,758,500	19,007,500
4.	Incorporated fixed assets			
5.	Plant machinery and equipment	30,208,000	5,397,000	35,605,000
	Total:	36,457,000	18,502,000	54,959,000

Annex 2

Item	Year			
Currency				FC
Land				
Site prep... and develop...				
Structures ... civil works				[illegible]
Incorporeal ... assets				
Plant and ...	[illegible]		[illegible]	[illegible]
Total	[illegible]	[illegible]	[illegible]	[illegible]

Note: (1) Supplementary ... not foreseen. The Bank finances ... excluded ... overhead costs or pacification.

	50[illegible]	[illegible]000	9500	[illegible]	8758.5	9507.5
[illegible]	[illegible]046	553	[illegible]	45[illegible]	[illegible]	29206
	[illegible]954[illegible]	453[illegible]	[illegible]09[illegible]	[illegible]	[illegible]	29743.5

10.2.1. Preproduction capital expenditures, by category

10^3 M

Item	Category	FC	LC	Total
1.	Preinvestment studies	-	-	-
2.	Preparatory investigation	-	-	-
3.	Management of project implementation		36.0	36.0
4.	Detail planning, tendering		18.0	18.0
5.	Supervision, co-ordination, test run and take over of civil works, equipment	55.0	2,952.122	3,007.122
6.	Build-up of administration recruitment and training of staff and labourers	242.40	276.0	518.40
7.	Preliminary and capital issue expenditures	-	955.80	955.80
	Total:	297.40	4,237.922	4,535.322

	FG	ID
	350	550

	25.0	799.6	824.6		2687.722	3155.122

10.3.1. Calculation of working capital

I. Minimum requirements of current assets and liabilities

a) Accounts receivables 30 days at production costs minus depreciation and interests

b) Inventory

Local raw materials (sand and limestone)	30 days
Imported raw materials (remaining)	90 days
Spare parts	180 days
Work in progress	0 days
Finished products	15 days at factory costs plus administrative overheads

c) Cash in hand 12 days

d) Accounts payable 30 days, for raw materials and utilities.

II. Annual production-cost estimate

₦

Period	Construction			Start-up	Full capacity
Year	1	2	3	4	5 and following
Production programme				76.5 %[x]	100 %
Costs:					
Raw materials					
Local				1,722,614	1,914,015
Imported				3,479,229	3,865,810
Labour				876,000	876,000
Utilities				2,632,635	2,925,150
Repair (tank furnaces)				674,750	674,750
Maintenance Spare parts				239,900	359,800
Factory costs				9,625,128	10,615,525
Administrative overhead costs				618,054	618,054
Sales and distribution costs: 0.5 % of a yearly revenues (₦ 28,144,200)				107,625	140,721
Operating costs				10,350,834	11,374,300
Financial costs (interest)				4,194,583	3,767,54
Depreciation				4,545,250	4,545,250
Production costs				19,090,667	19,687,090

x) Note: The first 3 months production operates at 50 % of the full capacity and the remaining 9 months at 90 % of the full capacity. Raw materials and utilities requirements are assumed to be at the same time 90 % of the yearly requirements, due to an excess of cullet.

10.3.2. Calculation of working capital

X - minimum days of coverage

Y - coefficient of turnover

10^3 N

Item	X	Y	Start-up year	Full capacity
			4	5
I. Current Assets				
A. Accounts receivables	30	12	862.368	947.595
B. Inventory				
a) Raw materials local	30	12	143.551	159.501
b) Raw materials imported	90	4	369.807	986.452
c) Spare parts	180	2	119.950	179.900
d) Finished products	15	24	426.799	463.066
C. Cash in hand (from V below)	12	30	190.000	215.000
D. Current assets			2,612.475	2,936.514
II. Current liabilities				
A. Accounts payable	30	12	- 652.873	- 725.415
III. Working capital				
A. Net working capital			1,959.602	2,211.099
B. Increase in working capital				251.497
IV. Total production cost			12,088.250	12,683.931
less: Raw materials			5, 201.843	5,779.825
Utility			2,632.635	2,925.150
Depreciation			4,545.250	4,545.250
	12	30	6,708.522	6,433.706
V. Required cash balance			190.000	215.000

10.6.1. Total initial investment cost

10^3 ₦

Item	Investment category	FC	LC	Total
1.	Initial fixed investment cost	36,457.0	18,502.0	54,959.0
2.	Preproduction capital expenditures	297.40	4,237.922	4,535.322
3.	Working capital	1,066.452[x]	1,144.647	2,211.099
		37,820.852	23,884.569	61,705.421

x) Note: Cost of imported raw materials + 56 % of spare parts value

10.7.1. Total initial assets

10^3 ₦

Item	Investment category	FC	LC	Total
1.	Initial fixed investment costs	36,457.0	18,502.0	54,959.0
2.	Preproduction capital expenditures	297.40	4,237.922	4,535,322
3.	Current assets	1,416.200[x]	1,520.314	2,936.514
		38,170.600	24,260.236	62,430.836

x) Note: Working capital schedule 10.6.1. + current liabilities x the proportion of FC in working capital from schedule 10.6.1.

10-6/2. Total investment costs

Period							
Year	1			2			
Currency	FC	LC	T	FC	LC	T	FC
1. Fixed investment costs							
a/ Initial fixed inv.costs	1,800.0	346.5	2,146.5	18,546.0	4,553.0	23,099.0	16,111.0
2. Preproduction capital expendit.	5.0	550.6	555.6	25.0	739.6	824.6	267.4
3. Working capital increase							
Total investment costs	1,805.0	897.1	2,702.1	18,571.0	4,292.6	23,923.6	16,378.4

10^3 #

		3/			4			5		
		FC	LC	T	FC	LC	T	FC	LC	T
3.0	23,799.0	16,111.0	13,602.5	29,713.5						
4.6	24.6	267.4	2,887.7	3,155.1						
					944.5	1,015.1	1,959.6	121.2	130.3	251.5
2.6	23,[illegible]	16,378.4	[illegible]	32,[illegible]	944.5	1,015.1	1,959.6	121.2	130.3	251.5

31,[illegible].4

10-7/2. Total assets

Period	Construction								
Year	1			2			3		
Currency	FC	LC	T	FC	LC	T	FC	LC	T
1. Fixed investment costs.									
a/ Initial fixed investments costs.	1,000.0	346.5	2,146.5	18,546.0	14,550.0	33,096.0	18,111.0	13,618.5	31,729.5
b. Preproduction capital expenditure	0.0	550.6	550.6	85.0	739.6	824.6	287.4	2,887.7	3,175
c. Current assets increase									
Total assets	1,805.0	897.1	2,702.1	18,631.0	15,289.6	33,920.6	18,398.4	16,506.2	34,904.6

10^3 ¥

	Start up						production			Total
	3			4			5			
	FC	DC	T	FC	DC	T	FC	DC	T	
[illegible]	[illegible]	43,612.5	100,712.5							54,159.0
[illegible]	[illegible]	3,087.7	3,155.1							4,535.3
				1,253.2	1,253.2	2612.5	156.2	[illegible]	33.0	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	1,253.2	1,253.2	2612.5	156.2	137.2	33.0	[illegible]

10.8.1. Sources of finance

10^3 ₹

Item	Source of finance	LC	FC	Total
1.	Promotors			
	a) Equity (80 %)	14,400.0	-	14,400.0
2.	Collaborators			
	a) Equity (20 %)	3,600.0	-	3,600.0
3.	Financial institution loans	4,739.922	18,758.9	23,498.822
4.	Commercial loans	1,144.647	1,066.452	2,211.099
5.	Supplier's credit		17,995.5	17,995.5
6.	Current liabilities	375.667	349.748	725.415
		24,260.236	38,170.60	62,430.836

Details on sources of finance

Equity capital:	18,000,000 ₩ i.e. approximately 30 % of the total investment cost.
The share in equity:	promoter 80 % = 14,400,000 collaborator 20 % = 3,600,000
Supplier's credit:	75 % of the value of machinery and equipments; 75 % of 23,954,000 = 17,995,500 seven years credit 14 half-early installments, interest 8 % p.a.
Commercial loans:	short term credit for working capital, one year credit, interest 13 % p.a.
Financial institution loan:	seven years credit, 14 half-yearly installment, interest 10 1/2 % p.a.

Note: Current liabilities distribution was made by using the ratio of FC share in working capital (schedule 10.6.1.).

1148 C. Sources of fixed investment funds

Item	Investment							
	A			B				
Currency	33	33	33	33	33	33	33	33
1/ Equity capital	-	897.1	897.1	[illegible]	[illegible]	[illegible]	-	[illegible]
2/ Loans								
Long term loan	1805.0	-	1805.0	10421.0	-	[illegible]	[illegible]	[illegible]
Short term loan	-	-	-	-	-	-	[illegible]	[illegible]
3/ Supplier's credit	-	-	-	8450	-	[illegible]	[illegible]	-
4/ Current liabilities	-	-	-	-	-	-	-	-
Total	1805.0	897.1	2702.1	[illegible]	5352.6	[illegible]	[illegible]	[illegible]

	[illegible]											
	3			4								
	10	20	T	10	20	T	10	20	T	[illegible]	[illegible]	[illegible]
[illegible]	–	11750.3	[illegible]	–	–	–	–	–	–	–	[illegible]	[illegible]
[illegible]	[illegible]	4733.9	11072.3	–	–	–	–	–	–	18759.0	[illegible]	[illegible]
[illegible]	[illegible]	1144.6	2211.1	–	–	–	–	–	–	1160.5	[illegible]	[illegible]
[illegible]	[illegible]	–	3545.5	–	–	–	–	–	–	17235.5	–	[illegible]
–	–	–	–	314.7	338.2	651.9	34.3	37.0	72.5	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	17034.6	35079.7	314.7	338.2	652.9	34.3	37.0	72.5	38,170.5	[illegible]	[illegible]

Depreciation (10^3 ₹)

Buildings	19,354.0	2.5 % 40 years	483.85
Machinery/equipment	35,321.0	10 % 10 years	3,532.10
Office equipment	284.0	20 % 5 years	56.80
Other fixed assets	6746.421 61705.421	7 %	472.25 4545.25

The schedule of loans repayment

A. Supplier's credit:

Interest 8 % p.a. 14 half-yearly installments, the first one paid during the second year of production.

Interest of 8 % p.a. assumed by Polimex-Cekop

10^3 ₦

Repayment period	Balance	Installment	Interest
1	17995.5	-	719.8
2	17995.5	-	719.8
3	17995.5	1285	719.8
4	16710.5	1285	668.4
5	15425.5	1285	617.0
6	14140.5	1285	565.6
7	12855.5	1285	514.2
8	11570.5	1285	462.3
9	10285.5	1285	411.4
10	9000.5	1285	360.0
11	7715.5	1285	308.6
12	6430.5	1285	257.2
13	5145.5	1285	205.8
14	3860.5	1285	154.4
15	2575.5	1285	103.0
16	1290.5	1290.5	51.6

B. Short term loan for working capital is assumed to be a yearly loan at 13 % p.a. interest rate. Repayment of both the principal and interest during the first year of production: (source for interest rate: International Merchand Bank (Nigeria) Limited)

Principal 2211.099 x 10^3 ₦

Interest 13 % 287.443 x 10^3 ₦

C. Long term loan of 23,498.822 x 10^3 N is assumed to be repayed during 7years with 14 half-yearly installments.
Interest rate 10.5 % p.a.
(source for interest rate as in B)

10^3 N

Repayment period	Balance	Installments	Interest
1	23500	-	1233.75
2	23500	-	1233.75
3	23500	1680	1233.75
4	21820	1680	1145.55
5	20140	1680	1057.35
6	18460	1680	969.15
7	16780	1680	880.95
8	15100	1680	792.75
9	13420	1680	704.55
10	11740	1680	616.35
11	10060	1680	528.15
12	8380	1680	439.95
13	6700	1680	351.75
14	5020	1680	263.55
15	3340	1680	175.35
16	1660	1680	87.15

...3/3. Cash flow for financial planning

Period	Construction			Start up	
Year	1	2	3	4	5
Production programme					
Costs /10^3 , /					
1. Cash inflow	6702.1	23923.6	35079.7	32183.2	33815.7
1. Financial,harvestees total	6702.1	23923.6	35079.7	650.9	70.5
2. Sales revenues	-	-	-	31530.3	33744.2
3. Cash outflow	6702.1	23923.6	32368.6	21126.3	23811.7
4. Total variable schedule	6702.1	23923.6	32368.6	9612.5	9[illegible]
5. Operating costs	-	-	-	10350.3	11274.2
6. Debt service					
a/ Interest during credit		-	-	1439.6	1[illegible]
short term loan	-	-	-	287.5	
long term loan	-	-	-	2467.5	2[illegible]
b/ Repayment					
[illegible]	-	-	-	-	2[illegible]
[illegible]	-	-	-	2211.1	-
[illegible]	-	-	-	-	-
7. Corporate tax	-	-	-	1027.1	3[illegible]
8. [illegible]				720	7[illegible]
9. [illegible]		-	2711.1	[illegible]	[illegible]
10. [illegible]	-		2711.1	2867.5	[illegible]

[illegible]

	Full capacity						
	7	8	9	10	11	12	13
	28210.7	28144.2	28144.2	28144.2	28144.2	28144.2	28144.2
	28144.2	28144.2	28144.2	28144.2	28144.2	28144.2	28144.2
	25821.5	25821.5	25821.5	25821.5	25821.5	25821.5	25821.5
	11374.2	11374.2	11374.2	11374.2	11374.2	11374.2	11374.2
	1033.2	1033.2	1033.2	1033.2	1033.2	1033.2	1033.2
	337.3	337.3	337.3	337.3	337.3	337.3	337.3
	2575.5	2575.5	2575.5	2575.5	2575.5	2575.5	2575.5
	3240	3240	3240	3240	3240	3240	3240
	3331.4	3331.4	3331.4	3331.4	3331.4	3331.4	3331.4
	720	720	720	720	720	720	720
	4403.2	4403.2	4403.2	4403.2	4403.2	4403.2	4403.2
	27216.9	27216.9	27216.9	27216.9	27216.9	27216.9	27216.9

10^3 $

	11	12	13	Selvage value	Total
	28144.2	28144.2	28144.2	–	337258.9
	–	–	–	–	62430.8
	28144.2	28144.2	28144.2	–	274828.1
	23740.3	17595.7	17595.7	-15113.7	273801.3
	–	–	–	+15113.7	– 47317.1
	11374.3	11374.3	11374.3	–	-112719.5
	134.3	–	–	–	-6839.4
	–	–	–	–	-287.5
	282.5	–	–	–	-11713.6
	2575.5	–	–	–	-17955.5
	–	–	–	–	-2211,1
	3340	–	–	–	-23500.0
	5513.4	5501.4	5501.1	–	-44017.6
	720	720	720	–	-7200.0
	4403.9	10548.5	10548.8	15113.7	–
	27846.5	37705.1	48343.7	63457.6	63457.6

10-3. Net Income Statement (first two years)

10^3 ฿

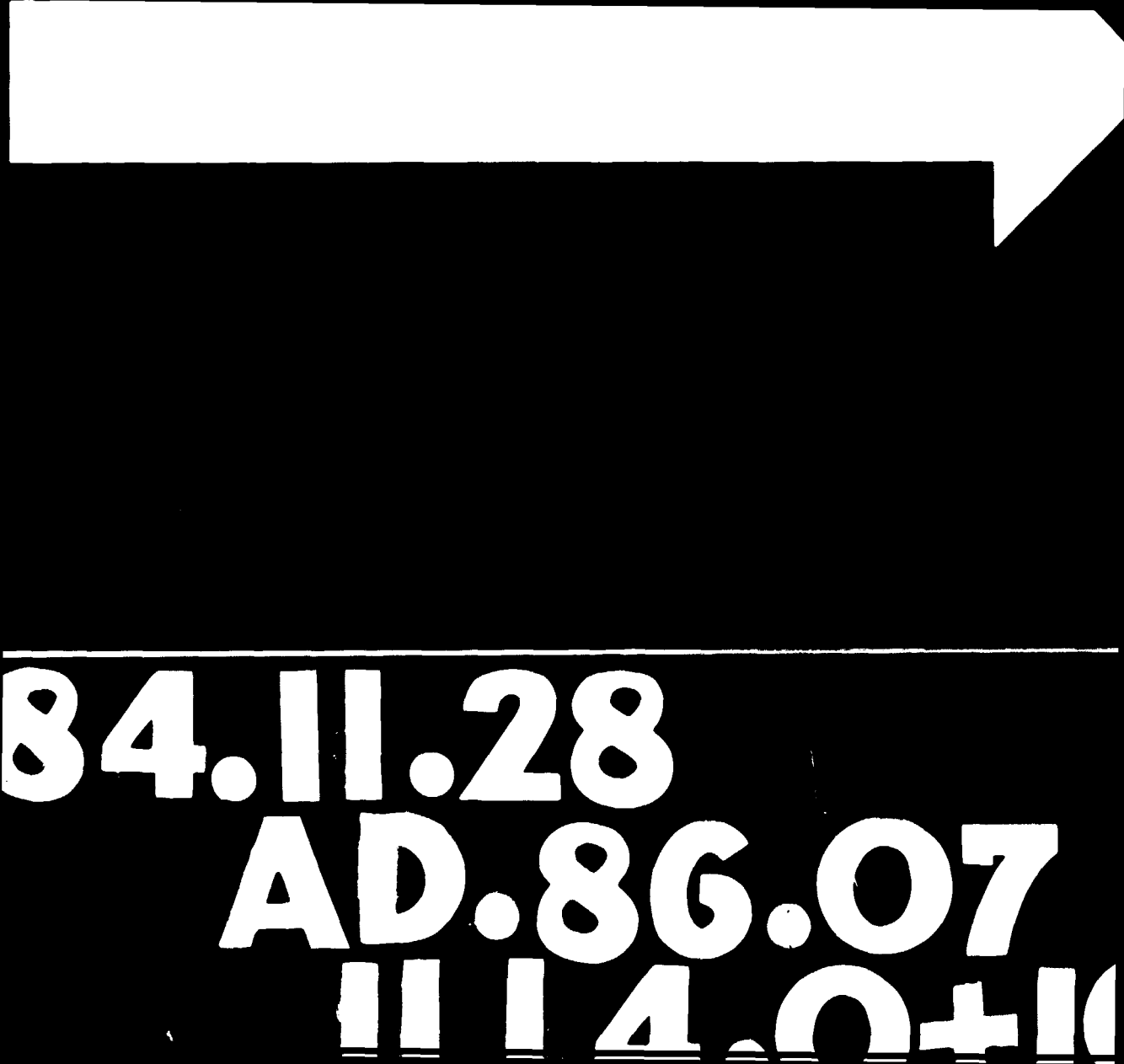
Period	Start-up	Full capacity
Year	4	5
Production programme	76.5 %	100 %
Costs(10^3 ฿)		
1. Sales	21,530.300	28,144.200
2. Production costs	19,090.667	19,687.090
3. Gross (taxable) profit.	2,439.633	8,457.110
4. Tax (45%) of taxable profit	1,097.835	3,805.700
5. Net profit	1,341.798	4,651.410
6. Dividends 4 % on equity	720.000	720.000
7. Undistributed profits	621.798	3,931.410
8. Accumulated undistributed profits	621.798	4,553.208
Ratios:		
1. Gross profit: sales (%)	11.33	30.05
2. Net profit: sales (%)	6.23	16.53
3. Net profit: equity (%)	7.45	25.84

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Cost of [illegible]	190087	19937.1	19.25	[illegible]	1801
Other	21330.5	[illegible]	[illegible]	[illegible]	281
Profit	2430.0	6437.1	5015.2	5079.0	1011
Tax 45 %	[illegible]	3265.7	[illegible]	1310.3	45
Net profit	[illegible]	4571.4	4551.4	5265.6	55

	8	9	10		12	13
	11374.3	11374.3	11374.3	[illegible]	11374.3	11374.3
	2092.3	1533.9	975.5	417.1	-	-
	4545.3	4545.3	4545.3	4545.3	-545.3	4545.3
	18011.9	17453.5	16895.1	16336.7	15919.6	15919.6
	28144.2	28144.2	28144.2	28144.2	28144.2	28144.2
	10132.3	10690.7	11249.1	11807.5	12224.6	12224.6
	4560.0	4810.8	5062.1	5313.4	5501.1	5501.1
	5572.3	5879.9	6187.6	6494.1	6723.5	6723.5

10-13. Cash flow table and calculation of present value for a project without outside financing

Period	Construction			Production				
Year				4	5	6	7	8
Production programme	1	2	3	76.5%	100%	100%	100%	100%
Values /Mk$\times 10^3$/								
A. Cash inflow								
1. [illegible]	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	-	-	-	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]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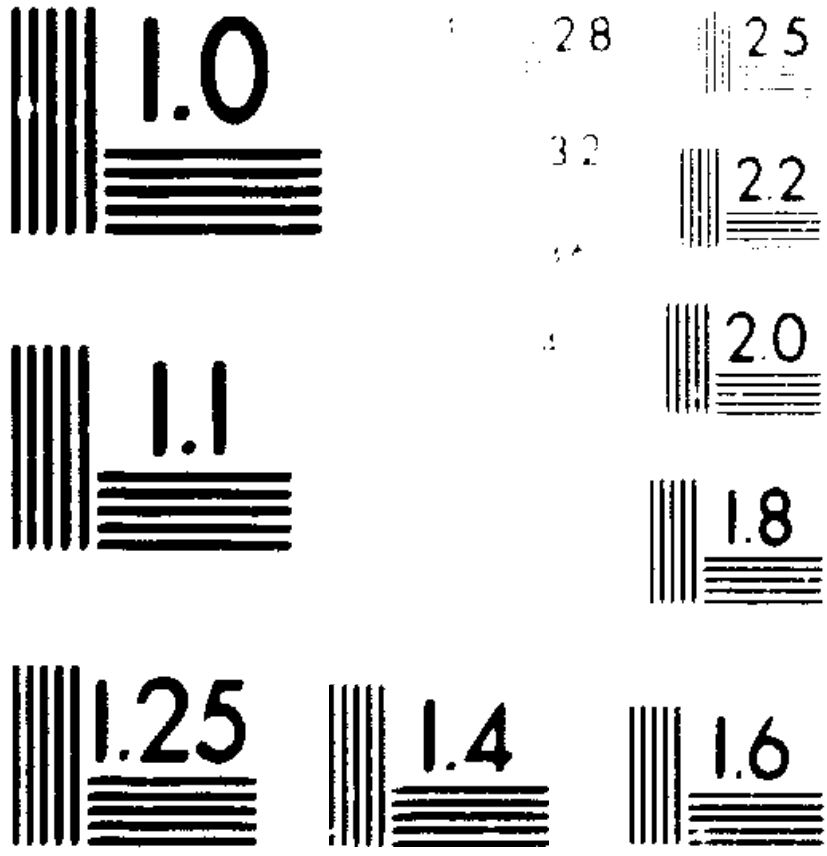

Section								
7	8	9	10	11	12	13	Salvage value	
100%	100%	100%	100%	100%	100%	100%		
28144.2	28144.2	28144.2	28144.2	28144.2	28144.2	28144.2		675465.1
15930.0	15934.3	16135.1	16436.1	16337.7	16379	16379	+15113.7	393353.-
-	-	-	-	-	-	-	+15113.-	-362711.-
11374.3	11374.3	11374.3	11374.3	11374.3	11374	11374	-	-272985.-
4556.2	4560.0	4810.3	5062.1	4963.4	5004	5004	-	120056.-
12304.6	12209.9	11953.1	11707.8	11 [illegible]	11 [illegible]	11 [illegible]	+15 [illegible]	[illegible]
[illegible]	3036	3033	3035	3041	3071	+50		
[illegible]	3031	[illegible]	3034	4031	4031	2		
[illegible]	42 [illegible]	21 [illegible]	2033	33 [illegible]	6 [illegible]	31 [illegible]		

SECTION 2

Pay back period calculation

Calculation of ("Profit")

10^3 ₦

Description/Year	4	5	6	7	8	9	10	11	12
Net profit	1341.8	4651.4	4958.5	5265.6	5572.3	7529.9	6187.0	6 [illegible] 4.1	6723.5
Interests	4194.6	3767.5	3209.1	2650.7	2093.3	1535.9	975.5	417.1	-
Depreciation	4545.3	4545.3	4545.3	4545.3	4545.3	4545.3	4545.3	4545.3	4545.3
("Profit")	10081.7	12964.2	12712.9	12641.6	12210.9	13609.1	11707.8	11456.5	11268.8

A. Calculation of pay-back period		Balance at the end of year	
Year	Amount paid back ("Profit")	Value[1] 61705.4	59496.3[3] = Value[1] - Land and working capital
1	-		
2 Construction	-		
3	-		
4	10081.7	51623.7	41412.6
5	12964.2	38659.5	28448.4
6	12712.9	25946.6	15735.5
7	12641.6	13305.0	3093.9
8	12210.9	1094.1	- 9117.0
9	13609.1	-12515.0	
10	11707.8		
11	11456.5		
12	11268.8		
13	11268.8		

Pay-back period[1] = 8.08 years - 3 years of construction =

= 5.08 years

Pay-back period[2] = 7.25 years - 3 years of construction =

= 4.25 years

I $R_{(5)} = \frac{\text{Gross profit}}{\text{Total inv.outlay}} = \frac{8457.1}{61705.4} = 13.7\ \%$

$R_5 = \frac{\text{Net profit + depreciation}}{\text{Tot. inv. outlay}} = \frac{4651.4+4545.3}{61705.4} =$

$= \frac{9196.7}{61705.4} = 14.9\ \%$

II $R_{e5} = \frac{\text{Net profit}}{\text{Equity}} = \frac{4651.4}{18008.3} = 25.8\ \%$

Break even and sensitivity analysis of the project in Nigeria

The methodology and assumptions needed here are the same as adopted for Niger (see page 139 ,.

Qualification of costs of production based upon the schedule 10.3.1.

Variable operating costs:	10^3 ₦
- raw materials	
local	1,914.015
imported	3,865.810
- labor	876.000
- utilities	2,925.150
- sales and distribution	140.721
	9,721.696
Fixed costs:	
- administrative overheads	618.054
- maintenance	359.800
- repairs of tank furnaces	674.750
- financial costs average for the first 10 years of operation	1,884.070
- depreciation	4,545.250
	8,081.924
Total	17,803.620

The unit selling price of "average bottle"

	number	percentage	unit price ₦
- beer	20.[illegible]	16.70	0.23
- soft drink	114.[illegible]	83.30	0.20

number in 10^6 pieces

Unit selling price of an average bottle equals to 0.20501 ₦.

The unit variable cost of production:

$$V = \frac{9,721.696 \times 10^3 \text{ ₦}}{137.134 \times 10^6 \text{ pieces}} = 0.07891 \text{ ₦/bottle}$$

The production cost and sales revenues equations:

$$y = 0.07891 \times X + 8,081.924$$

$$y = 0.20501 \times X$$

The break even production level is:

$$X = \frac{8,081.924 \times 10^3 \text{₦}}{(0.20501 - 0.07891) \text{ ₦/pc}} = 64.091 \times 10^6 \text{ pcs}$$

or 46.73 % at the full capacity

The break even price at full capacity:

$$137.134 \times 10^6 \times \text{price} = 0.07891 \times 137.134 \times 10^6 + 8,081.924 \times 10^3$$

$$\text{price} = \frac{17,803.620 \times 10^3}{137.134 \times 10^6} = 0.1298 \text{ ₦/bottle}$$

The price safety margin:

$$\frac{0.20501 - 0.1298}{0.20501} \times 100 = 36.69 \%$$

Both the capacity and price safety margins represent favourable situation of the project located in Nigeria.

S U M M A R Y

A. Internal Rate of Return (IRR) = 14.146 %

B. Pay-back period: 5.0 years

C. Rentability of capital: 1/7.5 of cumulated net results over the first 5 years of production divided by equity value: 16.14 %

D. Rentability of investment: 1/7.5 of cumulated net results over the period of first 5 years of production divided by total investment costs excluding working capital: 4.88 %

E. Simple rate of return: the first 5 years of net profit divided by first five years sales: 16.24 %
Calculations of A through E does not take into consideration inflation. Inclusion on inflation will, however, result in higher values of the above mentioned parameters due to important portion of external financing within the project.

11. NATIONAL ECONOMIC BENEFITS - NIGERIA

11.1. Job creation, specific capital requirements

$$\frac{\text{Total initial investment}}{\text{employment}} = \frac{61{,}705.421 \times 10^3 ₦}{445 \text{ persons}} =$$

= 138.664 ₦/job or 130.263 $ / job

$$\frac{\text{Foreign exchange investment}}{\text{employment}} = \frac{37{,}820.852 \times 10^3 ₦}{445 \text{ persons}} =$$

= 84,990 ₦/job or 110,483 $ / job

The share of foreign exchange part constitutes 61,3 %
of total initial investment.

11.2. Foreign exchange savings

Import substitution:

96.5 % of total production is assumed to be sold in the home market e.i. 132.334×10^6 bottles at a combined (weighted by structure of beer and soft drinks bottles) price of:

0.167 x 0.23 + 0.833 x 0.20 = 0.20501 ₦ / bottle

Import substitution value = 132.334×10^6 x 0.20501 ₦/bottle = 27.130×10^6 ₦ or 35.269×10^6 $

Export:

3.5 % of total production is supposed to be delivered to Niger, e.i. $137.134 \times 10^6 \times 0.035 = 4.8 \times 10^6$ bottles at a combined price:

0.167 x 120 + 0.833 x 104 = 106.672 CFA/bottle or 0.20501 ₦/bottle.

Import value = $4.8 \times 10^6 \times 0.20501 = 0.984 \times 10^6$ ₦

Depreciation on the foreign exchange part of investment 0.613 x 4,545.250 x 10^3 ₦ = 2,786.238 x 10^3 ₦

Interest (average for the first 10 years of operation) equal to 1,884.070 x 10^3 ₦

Current imports:

raw materials	3,865.810 x 10^3 ₦
utilities	-
tank furnaces repair	236.162 x 10^3 ₦
spare parts	359.800 x 10^3 ₦
	4,461.772 x 10^3 ₦
overheads foreign	374.162 x 10^3 ₦
current imports	4,835.934 x 10^3 ₦

Foreign exchange savings summary (in 10^6 ₦)

Import substitution	27.130		
Export	0.985		
Depreciation		- 2.786	
Interest		- 1.884	
Current imports		- 4.836	
	28.115	- 9.506	= 18.609

Foreign exchange savings equals to 18.609 x 10^6 ₦ or 24.192 x 10^6 £

11.3. Cost/benefit evaluation (10^3 ₹)

Revenue		28,144.2
Social operating costs:		
80 % of imported raw materials	3,092.7	
50 % of utilities	2,419.6	
50 % of administration	309.0	
50 % of labor	438.0	
50 % of distribution costs	70.4	
	6,329.4	- 6,329.4
		21.814.8
Depreciation		- 4,545.3
		17,269.5

Social rate of return:

$$\frac{17,269.5}{0.613 \times 61,705.4} \times 100 = 45.66\ \%$$

Analysis of limestone samples

Samples of limestone depicted as Keitha I and Tahoua have been handed to mission from archival collection in Ministry of Geology, Niamey, Niger, with information that they had been collected in Keitha region and Tahoua region.

They can not be taken seriously as representatives of limestone deposits for production purposes, but can be considered as indicative information that there is a possibility to find limestone deposits in the a/m regions.

1. Macroscopic estimation of samples.

Sample Keitha I

Sample in form of snail shell with distinct rusty-brown inclusion in central part. Smooth surface (non porous, firm) bright-white with dark coatings in places.

Sample Tahoua

Sample in form of irregular block with shell shaped fossil distinctly visible on surface of variable intensity of yellow-brown tincture with black coatings in places.

2. Macroscopic estimation of crushed samples.

Sample Keitha I

Sample after comminution and blending shows slightly pink tincture.

Sample Tahoua

Sample after comminution and blending shows white-cream coloured tincture.

3. Chemical composition of samples

	Sample Keitha I	Sample Tahoua
CaO	53.41	53.53
MgO	1.10	0.68
SiO_2	1.42	1.36
Al_2O_3	0.33	0.63
Fe_2O_3	1.15	0.393
TiO_2	0.017	0.027
Na_2O	0.16	0.18
K_2O	traces	traces
ignition loss	42.18	42.38
particles non-soluble in HCl	2.35	2.46
humidity	0.51	0.64

Determination of respective oxides have been done using the following methods:

CaO, MgO - determined by complex titration analysis

SiO_2, TiO_2

Al_2O_3, Fe_2O_3 - determined by calorimetric analysis

Na_2O, K_2O - determined by flame type photometric analysis

Analysis done by Chemical Laboratory of Glass-works Krosno at Krosno, Poland.

Sources of Information

I. Institutions visited

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2. U.N.D.P.
3. Ministère des Mines et de l'Industrie
   - Direction de l'Industrie et de l'Artisanat
   - Direction des Recherches Géologiques et Minieres
   - Direction d'Energie
4. Ministère de Finance
   - Direction du Personel
   - Direction de Contrôle de Prix
   - Direction de Contribution Divers
5. Ministère du Plan
   - Direction de Programmes et du Plan
   - Direction de la Statistique et de Comtes Nationaux
6. Banque de Développement de la République du Niger
7. Banque Mondiale
8. L'OPEN, Office de Promotion de l'Entreprise Nigerienne
9. Ministre des Travaux Publics, des Transports et de l'Urbanisme
   - Direction de la Construction
   - Direction de Travaux Publics
10. Ministre de Commerce
11. LEYMA, Société Nigerienne d'Assurance et de Reassurance
12. Braniger de Niamey
13. Braniger de Maradi

14. CONCONIGER a Maradi
15. SPGN - Industrie des Cosmétiques
16. SATOM - Société Anonyme Travaux Outre-Mer
17. Maurice Delens, Société Anonyme Entreprise de Bâti-ments
18. WAZIR Travaux Publics Bâtiments Terrassement-Routes
19. SNG Société Nigerienne de Ciment
20. SNTN Société Nationale de Transport Nigerien

NIGERIA

1. U.N.D.P.
2. Federal Ministry of Industry
   - Investment Information and Promotion Centre
3. Federal Office of Statistics
4. National Population Commission
5. National Planning Commission
6. Federal Ministry of Finance
   - Home Finance Department
   - Import Licence Department
   - External Trade Department
   - Banking Division
7. Federal Ministry of Mines and Power
8. Federal Ministry of Commerce
9. Nigerian Export Promotion Council
10. Nigerian Bank for Commerce and Industry
11. Nigerian Industrial Development Bank
12. International Merchant Bank
13. Banque National de Paris
14. Manufacturers Association of Nigeria

15. Federal Ministry of Mines and Power
    - Geological Survey Department - Daduna
16. Liaison Office of Kaduna State
17. Liaison Office of Kano State
18. Liaison Office of Imo State
19. Liaison Office of Rivers State
20. Ministry of Trade and Industry Kaduna State
21. Ministry of Trade and Industry Kano State
22. Ahmadu Bello University, Deprtment of Industrial Design, Zaria
23. Metal Box Toyo Glass, Agbara
24. Ballapur Nigeria Ltd., Kaduna
25. Nigerian Soft Drink Co. Ltd.
26. Guinness (Nigeria) Ltd.
27. Union Beverages Ltd.
28. West African Breweries Ltd.
29. Nigerian Bottling Co. Ltd.
30. Seven-up Bottling Co. Ltd.
31. Floride Food (Nig) Ltd.
32. Mandara Holding Ltd.
33. Adiatu Laduni Brothers Ltd.
34. Drinco Industries Ltd.
35. International Breweries and Beverages Industry
36. Arewa Bottlers Ltd.
37. North Breweries Ltd.
38. Habot International Agency Ltd.
39. Dufaco (Nig) Service (Custom Licensed Agents)
40. Daltrade (Nig) Ltd.
41. Taylor Woodrow of Nigeria

II. Selected documents

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4. Catalogue des tables de codification de gestion des agents de la fonction publique, Bureau de la Solde Ministère des Finances, Niamey, tirage 27-12-82
5. Code des Investissements en Faveur de l'Entreprise Nigerienne et Texte d'Application, Assamblée Nationale du 11 Mars 1974 et Décret du 17 Juillet 1975 Déterminant les modalités d'application de la Loi No 74-19 du 11 Mars 1974
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3. Investin au Niger, Jeune Economists, April 1983
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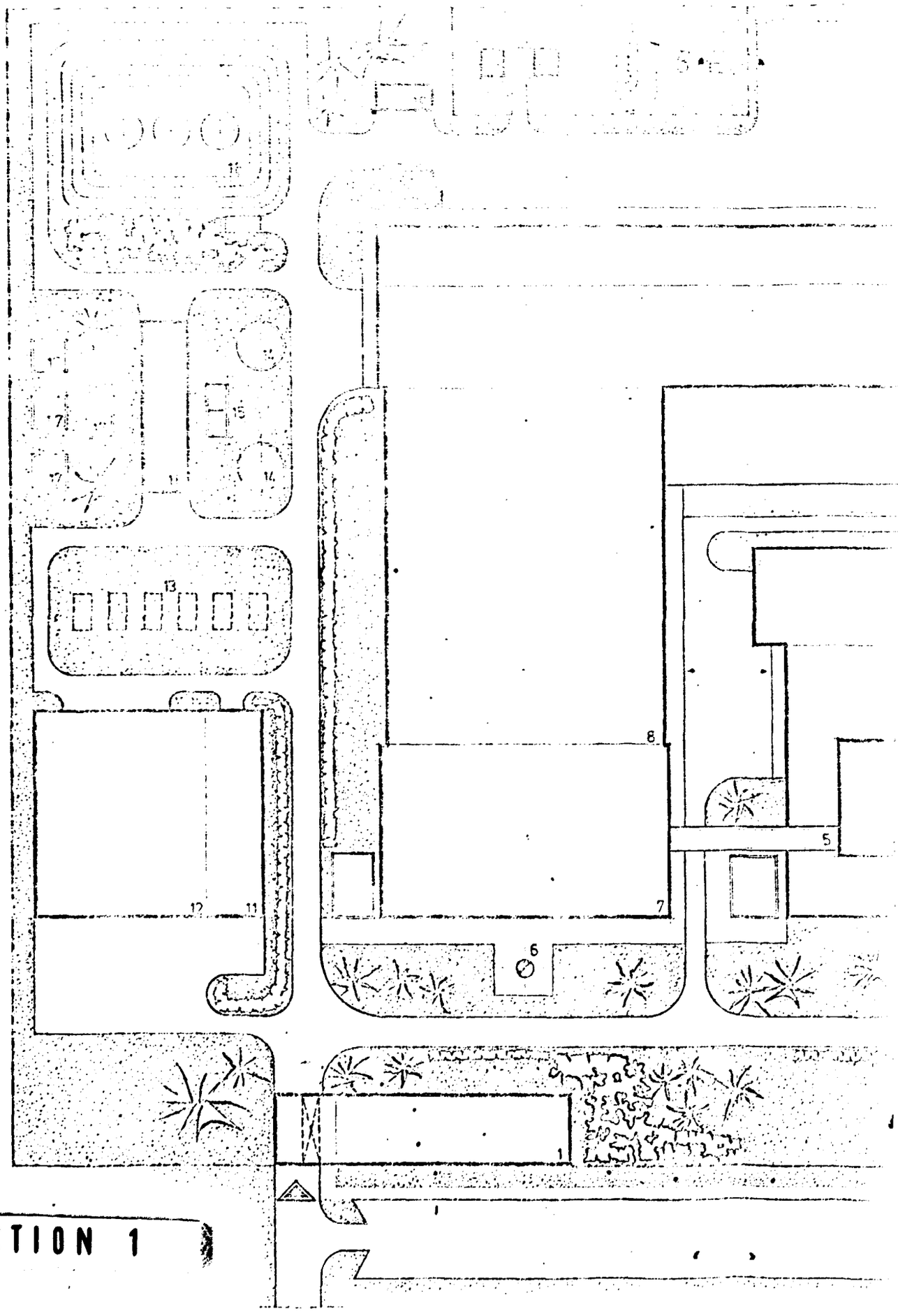
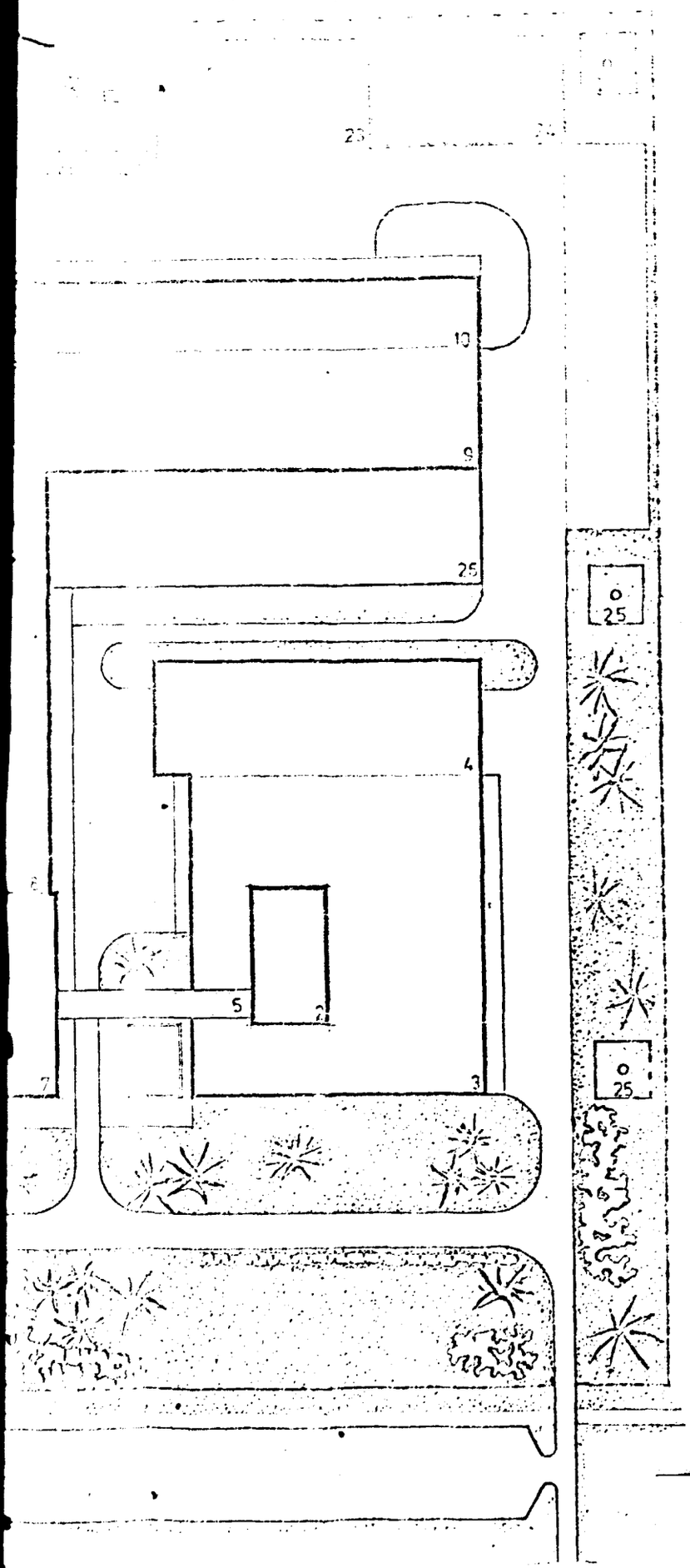


SECTION 1



3 RAW MATERIALS STORE

5 RAILWAY SIDING AND TRESTLE BRIDGE

6 STACK

7 TANK BUILDING

8 ANNEALING BUILDING

9 FINISHED PRODUCT STORE

10 WOODWORKING SHOPS TECHNICAL STORE

11 COMPRESSOR STATION

12 CURRENT GENERATING SETS

13 FUEL UNDERGROUND TANK

14 WATER ELEVATED TANK

15 SUCTION TANK

16 PUMPING STATION WITH WATER TREATMENT PLANT

17 FAN COOLER AND SUCTION TANK

18 FUEL TANK WITH PUMPING STATION

19 OILS AND LUBRICANT STORE

20 SLUDGE BEDS

21 IMHOFF SETTLING TANK

22 GRATE CHAMBER WITH WASTES

23 TIMBER STORE

24 FIRE-FIGHTING TANK

25 WELL

26 FINISHED PRODUCT STORAGE YARD

LEGEND

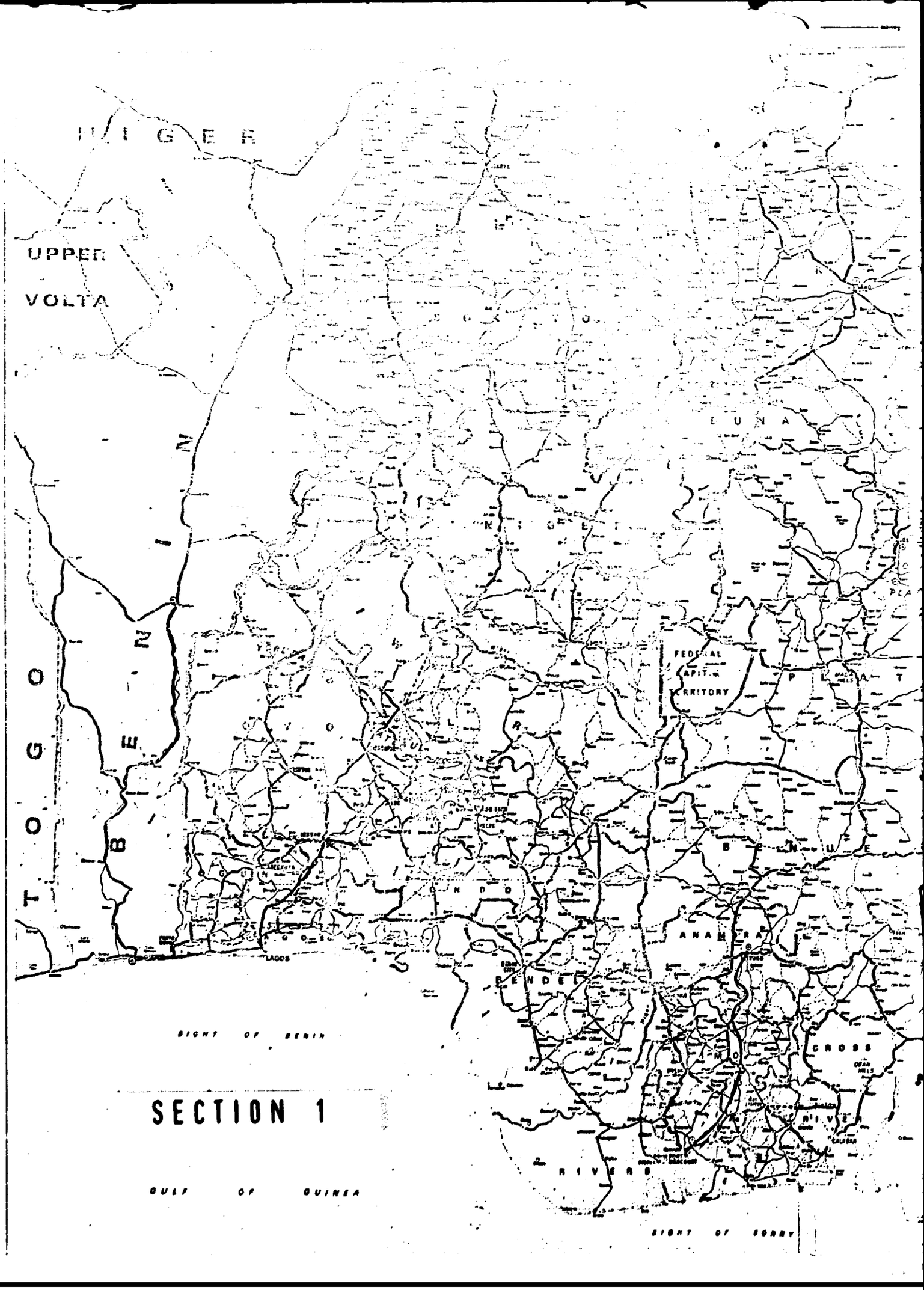
PLANNED OBJECTS

FENCING

ROADS, PLACES

GREENS

SECTION 2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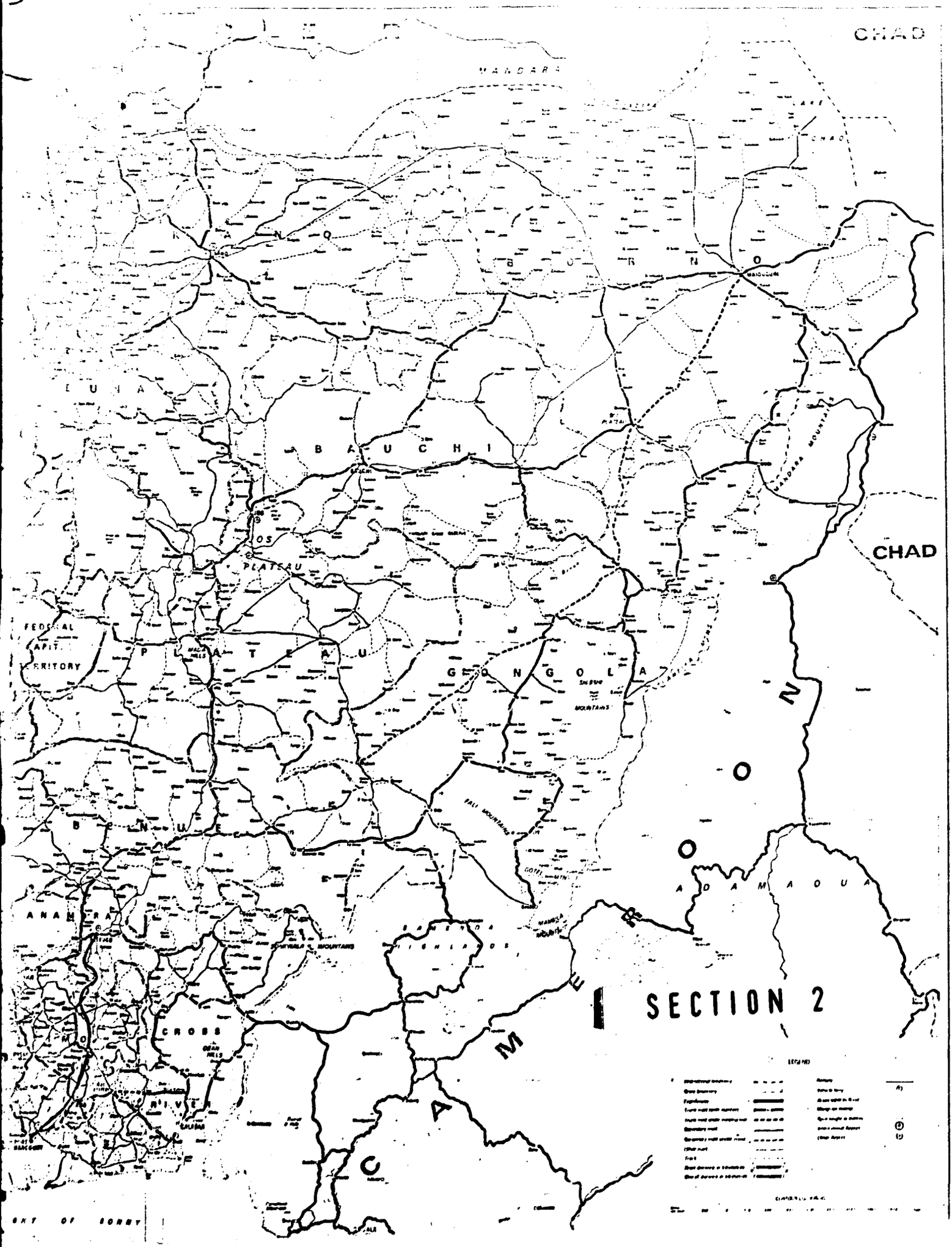
UPPER VOLTA
TOGO
BENIN
FEDERAL CAPITAL TERRITORY
PLATEAU
BENUE
ANAMBRA
CROSS RIVER
RIVERS
LAGOS
BIGHT OF BENIN
BIGHT OF BONNY
GULF OF GUINEA

SECTION 1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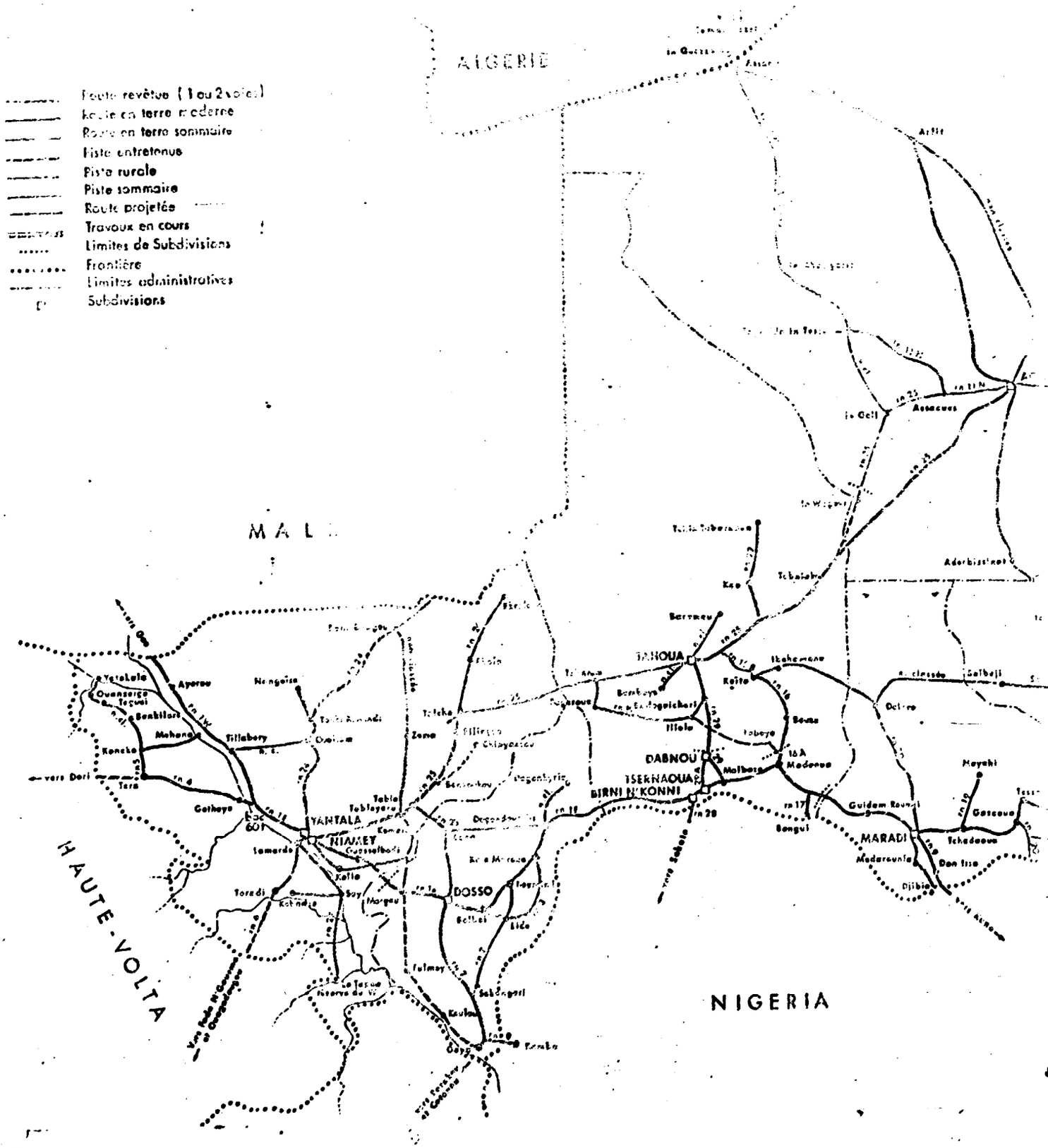
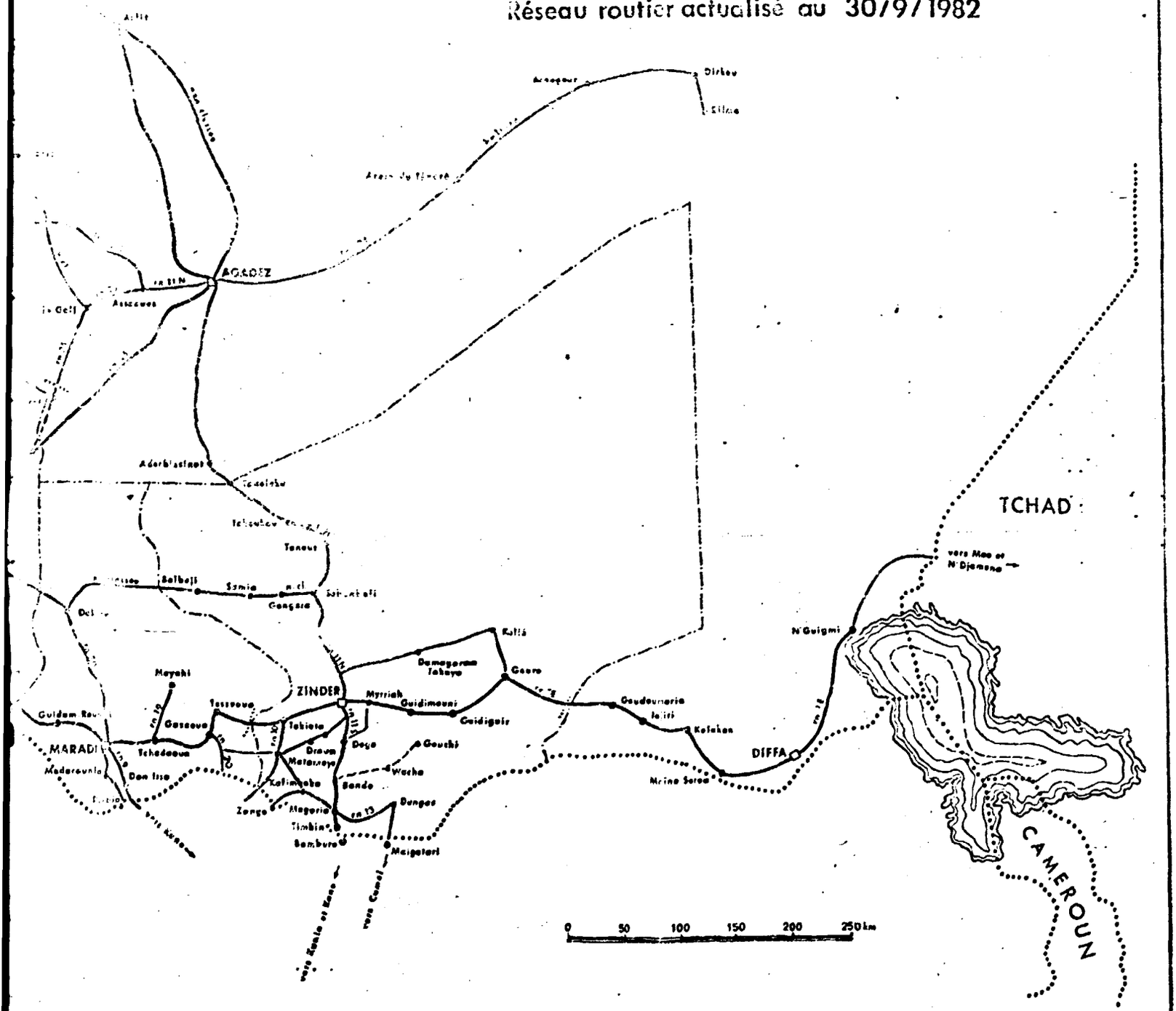
GONGOLA
BENUE
ADAMAWA
CROSS RIVER
SECTION 2


Route revêtue (1 ou 2 voies)
Route en terre moderne
Route en terre sommaire
Piste entretenue
Piste rurale
Piste sommaire
Route projetée
Travaux en cours
Limites de Subdivisions
Frontière
Limites administratives
Subdivisions
ALGERIE
MALI
HAUTE-VOLTA
NIGERIA
DOSSO
DOGONDOUTCHI
TAHOUA
DABNOU
TSERNAOUA
BIRNI N'KONNI
YANTALA
NIAMEY
MARADI
Arlit
Assamou
Tchintabaraden
Keita
Illela
Bouza
Madaoua
Guidam Roumji
Tessaoua
Tchadoua
Gothaye
Tillabery
Ayorou
Ouallam
Filingue
Tera
Say
Torodi
Kollo
Tamaro
Konni
Falmey
Birnin Kebbi
Sokoto
Gaya
Kamba
Bengui
Djibia
Moyahi

SECTION 1

REPUBLIQUE DU NIGER

Réseau routier actualisé au 30/9/1982



SECTION 2