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PRE-INVESTMENT STUDIES OF UNION
INDUSTRIES, PHASE II*
SI/RAF/74/889

Technical report: Feasibility of establishing a glass container factory in the Mano River Union

Prepared by the United Nations Industrial Development Organization, executing agency for the United Nations Development Programme

Based on the work of H. R. Persson, expert in glass container manufacturing

United Nations Industrial Development Organization
Vienna

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I. INTRODUCTION

The two Member States (Liberia and Sierra Leone) of the Mano River Union have found that there may be a sufficient market within the Union for a glass container factory. It has been declared by the Union that a glass container factory may be given the status of a Union Industry.

The Union will review the industrial patterns of the Member States with a view to preventing industrial imbalances.

It is stated in the Mano River Union Declaration that any person or organization shall be eligible to apply for a licence and simultaneously for investment incentives if such person or organization undertakes projects of certain characters in the Union.

The holder of a licence for a Union industry may be given a guarantee from the Commission that no other licence to manufacture for sale shall be granted.

Sponsors granted investment incentive contracts shall be entitled to various Union incentives, such as:-

1. Union tariff protection when necessary for the period of the investment incentive contract.

2. Drawback of import duties paid in respect of goods exported from the Union.

3. Exemption from income tax for a period to be determined by the Commission.

4. Approved imports of machinery and equipment to be used in establishing the approved investment project shall be exempt from import duty up to 90% of the dutiable value of such imports.

5. Approved imports of raw materials and semi-processed products used in the productive process of the approved investment project shall be exempt from import duty up to 90% of the dutiable value of such imports.

6. Any other incentive(s) negotiated with the Commission.

When carrying out this feasibility study considerations have been taken to some of the incentives mentioned above.

A Job Description for this feasibility study has been stated by UNIDO of 25 February 1977. This job description has been followed in detail.

The following table gives the actual job description and indicates in which parts of this feasibility study the various factors have been discussed and analyzed.

Job Description	Discussed in Part No.
1. Carry out demand analyses historic trends, sources of supply, patterns of demand and prices	IV.2, IV.1, IV.4.

Job Description	Discussed in Part No.
2. Identify and propose a functional integrated organisation, possible technical partners, and possible sources of financing.	VI.2, II, VII.5
3. Identify the project's total cost including the necessary costs prior to the commencement of operations, projected balance sheets as at the end of each of the first ten years of operation, projected profit and loss statements and cash flow for the same years, loan schedules showing acquisition, repayment and interest payment as well as depreciation schedule of all fixed assets	VII.1, VII.13. VII.7, VII.13, VII.6, VII.9 VII.4
4. Analyse, quantitatively and qualitatively, the socio-economic impact the project is likely to have on each Member States of the Mano River Union.	VI.4

Job Description	Discussed in Part No.
5. Assess the market for glass containers within the Union and determine the appropriate production capacity and product mix in terms of size and colour of the envisaged production plant	IV.2, Table IV.5, Table IV.3
6. Study available information on local availability of raw materials (silica sand, limestone feldspar, and soda ash) and determine to what extent local raw materials can be used in the production	V.5
7. Assist the Mano River Union Secretariat in organizing geological surveys and laboratory investigations of raw materials	V.5
8. Prepare a feasibility report for a glass container plant, including alternative locations comparative cost and benefit analyses, plant layout, equipment specifications, requirements for raw materials, manpower and energy, description of product and production technology sales forecast, investment and production costs broken down and profitability analysis including cash flow, profit and loss account, etc, for ten years.	VI.5, VI.1, V.8, V.7, V.2, V.3 Table IV.5, VII.1, VII.7, VII.12 VII.13

Job Description	Discussed in Part No.
9. Prepare investment prospectus on the project to facilitate follow-up action by the Governments concerned, potential investors and institutional lenders	VII,1, V.7,VII.5
10. Assess the need for technical assistance to bring the project successfully through the sub-sequent stages of detailed design, construction and installation, training of staff and start-up production	VI.3, V.7 III.

II. SUMMARY

The market survey carried out indicates that the glass container market 1981 in the Mano River Union will be 26 millions of bottles. There may also be a potential export market of 4 millions of bottles.

It is assumed that a glass container company will cover 65% of the domestic market in its first year of production. The share of the market will be maximum 90% after ten years of operation.

Total sales for the first year is estimated to be 21 millions of bottles. After ten years of operation it is assumed that the sales will be 57 millions of bottles. This includes an export to other West -African countries of 13.5 millions.

The study shows that the potential domestic and export markets are sufficient from economical and technical points of view for a small glass container factory in the Mano River Union.

The glass factory may be located in Freetown or in Monrovia. The largest market now and within the next ten years is in Liberia. Due to its larger population, however, future long term prospects may be brighter in Sierra Leone. Labour is considerably cheaper in Freetown. Interesting sites for a factory are available in Lakka, south west of Freetown and in the Monrovia Industrial Park. The infra structure is better developed in Monrovia Industrial Park than in Lakka. There is no space available in Wellington Estate in Freetown.

Indigenous sand is available in the two countries. It has been proved that the sand in Liberia is acceptable for glass manufacturing. The geological survey in Sierra Leone is not completely finished. Preliminary results however, show that the sand is not of the same high quality as that in the Monrovia area.

Some private companies in Monrovia have shown a definite interest in a glass container factory.

The fuel gas LPG is available in Freetown, but at present not in Monrovia. It will be available there, however, in about a year.

It is recommended that the glass factory be located in Monrovia.

The capital required is $ 7.0 millions. $ 2.5 millions should be equity capital from the potential share holders. The suppliers' credit is estimated to be $2.5 millions. The remaining $ 2.0 millions can be borrowed from banks.

One possible solution is to have private equity capital and to invite the governments to have some parts of the bank loans.

All know-how for glass manufacturing must be imported. A management con ract with a foreign well established glass company is recommended. A Polish and an American company have presented offers for the equipment and the erection of the glass factory. A management contract may be of interest, for the Polish company. It is recommended that the management fee should be related to the profitability of the company.

Some bottling companies and other companies in the two countries have expressed interest in acquiring shares of a domestic glass factory.

The company will employ 132 people at the beginning. The number of employees will gradually increase to approximately 200. Four expatriates will be required (the general manager, the production manager, the glass technologist and the machine superintendent).

The factory should start with two fully automatic lines of "Individual Sections" machines. These can successively be equipped to have a capacity of more than 60 millions of bottles.

The economic result of the glass company appears to be acceptable. The pay back period of the capital invested will be 6. 8 years. The average return on investment from the second to the tenth year of production is 11.5%.

Preliminary calculations show that the national economic profitability is twice as high as the profitability for the private share holders.

Several other industries may be started as a result of a new glass factory. Industries making corks and lids, crates and cartons, food products etc, may find interesting markets in the Union once there is a glass factory.

Implementation of the project is recommendended. With good project management production could be started in January, 1981.

III. RECOMMENDATIONS

This feasibility study shows that a glass container factory should be a viable industry if no drastic economic changes of a negative character takes place in any of the two member states of the Union.

Glass container factories will be started every year in some countries through out the world. It is therefore important not to wait too long regarding a decision about a glass factory in the Mano River Union.

It is therefore recommended that a study of a definite project be started without delay.

A qualified glass container consultant should be assigned as a project leader. (Appendix III).

First class machinery suppliers should be invited to give offers in open competition.

Potential share holders should be informed about the project and a glass company should be established.

For the success of the company it is important to get modern know-how from an international, well established glass container manufacturing company.

Key personnel will have to be employed at least six months before start of operation. Some of this personnel must be sent abroad for training.

A proposal for a project schedule is given below:

PROJECT SCHEDULE

Months	Activity
36	Feasibility study presented to Mano River Union
34	Decision by Mano River Union to go ahead with a study of a definite project
33	Project leader assigned
32	Glass machinery suppliers invited to present offers
30	Offers received from suppliers
29	Mano River Union glass company established
28	Management contract signed with a glass company
26	Contract with Building company
24	Erection of plant starts
6	Key personnel employed
6	Training programme starts
2	Furnace lit
0	Start of operation

This feasibility study will be presented to the Mano River Union Secretariat in December 1977. If this project schedule is followed operation of a glass container factory could start in January 1981.

IV. MARKET SURVEY

1 The Import of Glass Containers

Glass containers have been imported into Sierra Leone and Liberia for many years. According to the Annual Trade Statistics the import in 1968 was 7.0 millions into Liberia and in 1965 it was 1.7 millions of containers into Sierra Leone.

As the capacities of breweries and soft drink bottling plants were increased more bottles had to be imported.

The official figures from the Annual Trade Statistics for import of glass containers in the years 1971 to 1976 are shown in table IV.1

In the import statistics there are three categories of glass containers. These are (a) glass beverage containers, (b) other glass containers and (c) glass table ware. The (c) category is not included in this report. In general the manufacturing of table were required another type of glass than that used for glass bottles.

TABLE IV. 1

Import of glass containers into Liberia and Sierra Leone 1971- 1976

(in millions of units)

Liberia	1971	1972	1973	1974	1975	1976
Bottles for beer and beverages	21.31	14.10	13.23	22.97	9.48	9.00
Other bottles	-	0.37	0.27	2.42	1.54	1.60
Total	21.31	14.47	13.50	25.39	11.02	10.60
Sierra Leone						
Bottles for beer and beverages	1.55	2.13	4.35	3.85	6.23	
Other bottles	1.16	1.89	7.56	2.22	2.09	
Total	2.71	4.02	11.91	6.07	8.32	
Grand Total	24.02	18.49	25.41	31.46	19.34	

Source: Annual Trade Statistics.

It is interesting to see that the import has declined since 1974. This does not mean, however, that the use of glass containers has decreased. On the contrary there is a steady increase in the use of bottles year after year. In 1974 the bottling plants in Liberia increased the deposits on bottles. As a result of this more bottles were returned by the consumers. Today the average percentage of the return of bottles to the bottling plants is 95 -97%. This applies to Liberia as well as to Sierra Leone.

In general the return of bottles from consumers to bottling plants has increased all over the world due to increased interest for environmental factors. A return of 95% of the bottles or more is nowadays common practice in developed as well as in developing countries. Table IV.2 shows a detailed study of the import of glass containers in 1974 and 1975 for Sierra Leone and in 1975 and 1976 for Liberia. Import figures for Sierra Leone for 1976 are not yet available.

As can be seen from the table the major exporters to Sierra Leone were the United Kingdom, Belgium and Czechoslovakia. The main suppliers to Liberia were glass factories in the United Kingdom, the United States of America and Czechoslovakia. As a matter of fact United Kingdom alone supplied 56% of the bottles imported by Sierra Leone in 1974 and 1975 and 39% of the bottles imported by Liberia in 1975 and 1976.

It is interesting to note that the import value of the bottles has decreased gradually from 1974. The CIF prices actually paid by the bottling plants have not decreased, however. The market value of bottles will be discussed in part IV.4.

TABLE IV.

Number and value of imported bottles and source of supply in 1974 1976

Sierra Leone	1974		1976	
Bottles for beer and other beverages	Numbers x 1000	Import Value cent/ bottle	Numbers x 1000	Import Value cent/bottle
Canada			96	12.06
Lebanon	446	11.45	144	14.75
Singapore	432	11.31	485	16.15
Belgium	422	8.08	1072	14.24
France			120	5.00
United Kingdom	1052	10.92	4310	1.75
Czechoslavakia	1499	8.18		
Total	3851	9.65	6227	7.62
Other bottles and Jars				
Guinea	5	6.64		
USA	10	4.25		
Lebanon	153	9.84		
Belgium	381	13.34	252	14.13
Denmark	51	42.04		
France	523	13.04	8	53.30
Germany, Federal Republic of	6	47.50		
Italy	1	121.90	10	21.99
United Kingdom	1008	11.30	1570	10.32
Czechoslavakia	78	11.13	24	6.50
Finland			64	2.40
Netherlands			165	1.56
Total	2216	12.77	2093	10.02
Grand Total	6067	10 79	8320	8.23

Liberia	1975		1976	
Bottles for beer and other beverages	Number x 1000	Import Value cent/bottle	Numbers x 1000	Import Value cent/bottle
Japan			6	6.95
Netherlands	373	18.50	424	8.81
Germany, Federal Republic of	4	6.50	286	7.03
France	516	6.70	965	5.52
Italy	112	9.13	1039	6.32
United Kingdom	4386	7.11	2648	10.10
Poland	625	2.89	283	7.46
Czechoslavakia	1819	12.12		
Lebanon	46	6.71	523	5.87
China	188	10.95		
USA	1923	7.60	2827	7.65
Total	9476	8.67	9001	7.91
Other glass Containers				
Poland	22	7.34		
Spain			112	6.02
Belgium,Luxemburg				
United Kingdom	366	8.95	1019	5.28
Sweden	38	6.62	72	6.50
Czechoslavakia	9	34.75	242	6.80
China	56	5.29	28	12.95
Japan			10	6.36
USA	921	5.92	107	6.00
Netherlands	125	17.10	9	4.26
Total	1537	7.75	1599	5.74
Grand Total	11013	8.56	10600	7.59

2 - Replacement of Bottles 1977 by the Bottling Plants

When carrying out the market studies all the major users of glass containers in the two capitals have been consulted. A few small plants outside the capitals have not been visited. All the companies have very willingly answered the questions and have stated their needs of bottles in 1977 and subsequent years.

The market studies indicate the replacement of bottles in 1977. Some bottling plants have a store of bottles and do not need to import all bottles that have to be replaced in 1977.

Table IV.3 gives the actual replacement figures as presented by the bottling plants.

TABLE IV. 3.

Replacement of bottles 1977 by the major bottling plants

Content	Colour	Volume ml	Weight g	Number 1000	Total weight tons
Beer	Amber	750	650	300	195
Beer	Green	750	550	120	66
Beer	Amber	330	300	1412	424
Beer	Green	330	300	1420	425
Beer	Amber	280	280	135	38
Beer	Green	280	280	100	28
Soft drink	Flint	280	375	4643	1740
Soft drink	Amber	280	325	500	162
Soft drink	Green	280	325	377	122
Wine	Flint	750	650	500	325
Spirit	Flint	750	600	30	18

Content	Colour	Volume ml	Weight g	Number 1000	Total weight tons
Spirit	Flint	375	325	65	21
Spirit	Flint	185	225	3830	863
Spirit	Green	185	225	825	186
Spirit	Flint	175	200	300	60
Medicine	Amber	500	350	32	11
Medicine	Amber	100	140	10	1
Toilet Products	Flint	100	140	2500	350
Total Flint bottles				11868	3377
Total Amber bottles				2389	831
Total Green bottles				2842	827
Grand Total				17099	5035

The average weight per bottle is 294 grams.

The actual replacement of bottles by the companies that have been visited is 17 millions. The managers of the major bottling plants in Liberia have indicated that their smaller competitors which have not been visited import over 2 millions in 1977. A similar figure indicated for Sierra Leone is one million. These bottles are used by distilleries and companies manufacturing toilet products, perfume and pharmaceuticals.

In the Manufacturing Industry of 1975 for Liberia 17 beverage industries are named. Only the five major ones were visited. Most of th others are small distilleries and wine companies, which use non-returnable beer and wine bottles. A few, however, import their own bottles.

It can therefore be stated without doubt that the total number of bottles imported by the Member States of the Mano River Union in 1977 is not less than 20 millions of bottles.

3 Projection for the use of glass containers in the Mano River Union in 1981 - 1990

According to the publication Glass and Glass Making (United Nations, New York, 1977) the average growth of glass production in 17 countries representing about 19% of the world population is 6.4%.

The growth is slightly higher in most African countries as can be seen from import statistics. It can therefore be assumed that the growth for glass containers in the Mano River Union is 7% per annum.

Table IV. 4 shows the imports by some West African countries. The figures are for 1973 and will be somewhat different by now. In some countries the import will be higher. In other countries glass works have been started and therefore these countries have decreased their import of bottles.

TABLE IV. 4

Imports of Glass Containers in 1973 of Some West African Countries

(Millions of Units)

Ghana	15.6	(Existing factory being rebuilt)
Ivory Coast	24.1	(A factory is planned)
Mali	0.8	
Niger	1.1	
Nigeria	137.8	(3 factories at present)
Senegal	7.0	
Togo	N.A	
Upper Volta	2.0	
Gambia	N.A	
Dahomey	2.2.	
Chad	1.3	
United Republic of Cameroon	9.4	(Existing factory enlarged)
Total	201.3	

Source: World Trade Statistics, United Nations

Since 1973 glass container factories have been erected in some West African countries as is shown in table IV.4. The imports by some non-glass producing West-African countries in the table was 23.8 millions of bottles in 1973. Figures for later years are not yet available. Assuming a growth of 7% for the West African countries mentioned in table IV.4 the glass producing countries will have a consumption of 300 millions of uhits and the other countries 43 millions in 1981. It should not be impossible for a glass works in Liberia or in Sierra Leone to get an export market of 1% in the glass producing countries, and of 10% in the other countries. This export market in 1982 could therefore be (3,2 + 4,6) 7.8 millions of bottles. In this study it is assumed that in the first production year only half of the expected export market is conquered

Table VI.I gives the import of bottles in 1971-1975. As an average in these years 23.7 millions of bottles were imported every year. Assuming an import in 1975 of 23.7 millions and an annual growth of 5% the expected import figures for 1976 -1990 are presented in table IV. 5.

The bottling plants have indicated an annual growth of 5% and an annual breakage of 5%. Assuming a growth of 7% the potential use of bottles will be found in table IV. 5.

Table IV.5 also gives the projected figures for the number of bottles as being used in this study. These figures have been chosen since a domestic glass company can never be a sole supplier of bottles to the market. The figures are also chosen from a technical point of view. The production capacity for the first four years of operation is limited to two "Individual Sections" machine with six single gobs.

TABLE IV. 5

Comparative figures for th consumption of bottles in the

Mano River Union 1975 - 1990

(Millions of units)

Year	Projection I	Projection II	Projection III
1975	23.7		
1976	24.9		
1977	26.2	20.0	
1978	27.5	21.4	
1979	28.9	22.9	
1980	30.3	24.5	
1981	31.8	26.2	16.9
1982	33.4	28.1	18.9
1983	35.1	30.0	21.4
1984	36.8	32.1	23.9
1985	38.7	34.4	26.6
1986	40.6	36.8	29.6
1987	42.6	39.4	32.8
1988	44.7	42.1	36.0
1989	47.0	45.1	39.6
1990	49.3	48.2	43.2

Projection I is based on import figures with a growth of 5% per annum

Projection II is based on interviews with bottling plants. Annual growth 7%

Projection III. are the figures used in this report.

.4 Prices paid for bottles in 1977

When interviewing the bottling plants questions were asked regarding prices paid for bottles. The package and shipment of bottles vary from one glass producer to another.

The prices given in Table IV. 7 are CIF prices excluding cartons In some cases bottling plants did not buy all types of bottles in 1977. The replacement of bottles could be done by taking new bottles from the storage plants. The actual prices for these bottles when being bought have been used in table IV. 7.

TABLE IV. 6

HOME MARKET, EXPECTED SHARE OF HOME MARKET, EXPORT MARKET AND TOTAL SALES PER ANNUM FOR THE GLASS CONTAINER FACTORY IN 1991 TO 1990

	1991	1992	1993	1994	1995	1996	1997	1998	1999	1990
Total home market (millions of units)	26	27.9	29.8	31.9	34.1	36.5	39.0	41.9	45.0	48.3
Share of home market, % age	65	68	72	75	78	81	84	86	88	90.0
Sales in home market (Millions of units)	16.9	18.9	21.4	23.9	26.6	29.6	32.8	36.0	39.6	43.2
Export market (millions of units)	3.7	7.8	8.3	9.0	10.2	10.3	11.0	11.8	12.6	13.5
Total sales (millions of units)	20.6	26.7	29.7	32.9	36.2	39.9	43.8	47.8	52.2	56.7

TABLE IV. 7

CIF prices paid by bottling plants in 1977 for different glass containers. Some figures refer to prices paid in 1976 or 1975. Cartons not included

Type of bottle	Number 1000	Us cents per bottle	Total price US $
Beer 75 cl	420	24	100,800
Beer 35 cl	2832	12.80	362,496
Beer 28 cl	235	8.9	20,915
Soft drink 28 cl	5520	15	828,000
Spirit 75 cl	530	20	106,000
Spirit 37.5 cl	65	16	10400
Spirit 18.5 cl	4955	13,5	668,925
Medicine jars	42	6,2	2,604
Toilet bottles	2500	6.0	150,000
Total	17,0999		2250,140

Average price per bottle = 13.16 cents
This price is offered by the glass suppliers in 1975 - 1976
It can be estimated that an offer in December 1977 is 8% higher.
The sales CIF price used for calculations in this report is fixed at 14.20 cents a bottle.

5 Rates of duty on Bottles

The import duty for bottles in Liberia and Sierra Leone are as follws;

Glass beverage containers	20%
Other glass containers	40%

These rates are given in the Duty Tariffs printed October 1977.

V. TECHNICAL SURVEY

1 Glass Manufacture

Glass is a very old material and was first made some 7000 years ago. More than 50% of the glass manufactured today is used to make glass containers.

In developed countries the annual per capital use of glass containers is over 100 containers. In many developing countries less than 10 containers per capita are used per year. A glass container factory may therefore be an interesting industry for developing countries where the home market is at least 20 millions of glass containers.

The basic raw material for the manufacturing of sand is glass. This must be a very pure silica sand. To this sand is added soda ash and limestone and some other materials. The raw materials are weighed out very exactly and mixed very thoroughly. Some glass cullet is then added and this mixture forms the batch to be fed into the melting furnace.

In order to melt the batch the temperature in the furnace must be 1500°C. The molten glass in the furnace is a liquid with a viscosity similar to that of ordinary syrup. After the glass has been well molten and homogenized it is ready to flow into the feeder and to drop into the moulds of the forming machine.

In the moulds the glass is pressed or blown to a container. Modern glass forming machines make more than 100 ordinary beer bottles a minute.

When leaving the machine the glass bottle has a temperature of about 500°C. It is quite soft and must therefore be treated very carefully. It is conveyed into the annealing lehr. In this lehr it is cooled to room temperature at a scientifically controlled rate. If a bottle is not cooled in a correct way it will contain strain and will easily crack into thousands of pieces.

At the cold end of the lehr the bottle is inspected. There is a physical inspection of every bottle regarding visual defects. In addition there is a testing of physical and chemical properties of a small sample of the bottles. This testing is carried out according to modern statistical methods.

Some bottling plants like to have a permanent label on their bottles. Such labels may be applied to the bottles by the glass container factories. The labels are made by screen printing ceramic materials on the surface of the bottle. Many different colours can be used so as to give a nice-looking label. The bottles are then heated in a decorating lehr at a temperature of about 600°C The ceramic materials melt and adhere indefinitely to the glass surface. The labels are called applied ceramic labels (ACL).

The finished and inspected bottles are then packed in cartons, in crates or in some other materials such as a shrinkable plastic film.

Appendix I shows a glass container plant.

2 Raw Materials

In order to produce 25 millions of bottles 7400 tons of glass will be needed.

The container glass will have the following approximate chemical analysis:

SiO_2	72.5%
Na_2O	14.5
CaO	10.0
Al_2O_3	2.0
Various	1.0
	100.0

For the melting of 7 400 tones of glass the following approximate quantities of raw materials are required:

Silica sand	5200 tons
Sada ash	1680 tons
Limestone	1300 tons
Feldspar	260 tons
Salt cake	5 tons
Chromium ore	8 tons
Coke	3 tons
Iron sulphare	1 ton
Cobalt oxide	100 kg
Selenium	3 kg

3 . Fuel, Power and Water

To heat the melting furnace and the lehrs fuel oil (Bunker C) LPG and electricity will be used in the following quantities per annum.

Fuel oil (Bunker C)	2200 tons
LPG	150000 m^3
Electricity	3 million kWh
Water	40000 m^3

A tank with a volume of 500 m^3 will be needed for the fuel oil and two tanks each with capacity of 7.5 tons for the LPG. A smaller tank will also be required for light oil.

It is of extreme importance for a glass works that electricity is always available.

The maximum load for the glass works will be 250 KVA and the daily consumption of electricity approximately 10,000 KWh.

It is recommended that the glass plant can generate its own power. Two generators each for 250 KVA should therefore be installed in the works.

Land

A glass container factory with a capacity of 50 millions of bottles requires a land area of approximately 40,000 m^2. This gives sufficient space for buildings, storage of raw materials and finished products and parking spaces.

Availability of raw materials

The two national Ministries of Lands and Mines have studied the availability of suitable raw materials in the two countries.

It has been found that no other raw material than sand is availavailable. Geological surveys and laboratory analysis of indigenous sand have been carried out.

The Liberian investigations show that the indigenous sand is fully acceptable as a raw material for container glass. (See Appendix II)

The investigations in Sierra Leone are not yet finalised. Preliminary results indicate, however, that the sand contains less silica and more iron oxide than the Liberian sand. It is not acceptable as a glass sand.

All other raw materials for glass melting have to be imported.

6 Cost of raw materials and utilities

Some suppliers in the two countries have been contacted regarding prices for raw materials and utilities.

No indigenous LPG is available in Liberia at present. It is estimated, however, that LPG will be on the market within one year.

The following average prices have been indicated by suppliers and will be used in the calculations:

Fuel oil (Bunker C)	$ 102.- / ton
LPG	$ 400.-/ ton
Gas oil	$ 144.-/ton
Electricity	$ 0.07/kWh
Water	$ 0.28/m^3
Silica sand	$ 10.- per ton
Soda ash	$ 162.- per ton
Limestone	$ 137.- per ton
Feldspar	$ 141.- per ton
Salt cake	$ 207.- per ton
Chromium ore	$ 315.- per ton
Coke	$ 205.- per ton
Iron sulphate	$ 125.- per ton
Cobalt oxide	$ 13.42 per kg
Selenium	$ 41.- per kg

These prices for glass raw materials give a total batch price of $ 72.30 per ton melted. In this report a batch price of $ 80.00.- is used. Experience shows that lower prices can be obtained after negotations. A price of $ 50-60 per ton of glass melted should be obtained after direct contact with the actual suppliers.

7 Technical considerations

The processing lines in the glass factory should be fully automatic. Bottles which should pass through high speed filling and capping machines must have exact dimensions with very small tolerances. The bottles must also have a good physical strength. It may be considered to be more difficult to obtain bottles of high quality in semi-automatic machines than in fully automatic ones.

It is important that the glass melted has a uniform chemical composition and correct physical properties.

High class raw materials must be used. The materials must be weighed very carefully and mixed thoroughly to form the batch. The weighing and mixing in the batch houses should be automatic and should be easy to control by electronic devices. Some handling of the raw materials may be carried out manually. The control and instrumentation in the batch house should be sufficient, however, to guarantee that the batch has a correct and constant composition.

It is recommended that a regenerative furnace is used. The refrectory materials used should be of a quality high enough to give a furnace life of at least four years.

The forming machines should be Emhart Individual Sections machines (I.S. machines). In an I.S. 6 single gob (I.S.6.S.G.) there are 6 forming sections. Some or all of these sections may be in operation. An I.S.6.S.G. can be converted to a double gob machine (I.S.6.D.G.). There are then 12 blow moulds in the machine.

Table IV.5 shows the number of bottles to be sold in 1981-1990. In order to produce these bottles the following quantities of glass has to be melted.

TABLE V. 1

Tons of glass melted per year in 1981-1990

Colour	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Flint	4100	5700	6390	6990	7590	8280	8900	9650	10410	11220
Amber	1020	1420	1580	1730	1880	2060	2210	2400	2590	2790
Green	1010	1410	1570	1720	1860	2040	2190	2380	2570	2770
Total	6130	8530	9540	10440	11330	12380	13300	14430	15570	16780

To produce the required number of bottles the IS machines must have 8 to 18 blow moulds as is seen from table V.2

TABLE V. 2

Estimated number of blow moulds of I.S. machines necessary to produce required number of bottles

YEAR	Bottles Produced mills	Expected package,%	Bottles sold mills	Tons of glass per day(321 days)	No. of I.S. blow moulds
1981	29.4	70	20.6	27.5	8.2
1982	37.1	72	[illegible].7	34.7	10.3
1983	40.2	74	29.7	37.8	11.2
1984	43.2	76	32.9	40.5	12.0
1985	46.4	78	36.2	43.4	12.9
1986	49.9	80	39.9	46.6	13.8
1987	53.4	82	43.8	49.9	14.8
1988	57.0	84	47.8	53.2	15.8
1989	60.8	86	52.2	55.6	16.5
1990	65.8	86	56.7	61.6	18.3

It is thus necessary to have two IS machines from the every beginning. These machines should be IS-6 single gob machines. In the first year four sections in each machine will be used. After three years all 12 sections of the machines have to be in operation.

After four years it will be necessary to shut down the furnace, rebuild it, enlarge it and introduce new refrectory materials. At the same time one of the IS-machines should be converted to a double gob machine. This machine will then have 12 blow moulds and there will therefore be 18 blow moulds in all available for production.

The melting furnace should be of a regenerative construction. Its melting area should be maximum 25m^2. The furnace should be constructed for the three feeders. According to the market review two lines only are required. The number three shop may be useful however, should the market potentialities be better than those given in table IV.5. The reserve shop should be the one in the centre of the furnace.

There should be one electric lehr to each IS-machine. Some testing equipment should be installed at the cold end of the lehrs.

After inspection most bottles can be packed for shipment. Some bottles, however, will first pass through the decorating line to get an applied ceramic label (ACL).

Some of the present bottling plants in the Union countries want their bottles packed in cartons. If cartons are absolutely required by customers this way of shipment can be accepted by the glass works. More common ways of packaging bottles nowadays is to use a plastic or wooden crate or a film of shrinkable plastics. The method of packaging should be discussed in detail with the customers. The price of bottles to be paid for by the customers depends on the packaging material used.

The bottles should be packed in such a way that a minimum of moisture will be in contact with the glass surface. In hot and moist climate the internal surfaces of bottles are easily corroded or weathered. After six months of storage under severe conditions a bottle may be so heavily corroded as to be unsuitable for its purpose. Special treatment may make the glass surface more durable.

8 Delivery of bottles

The glass containers from the factory should be delivered by road to the various customers. A contfact should be signed with two transport companies, one for each country.

In the glass producing country the delivery of bottles can be carried out by a local company. There will be no charge for return journeys of trucks. The situation is different in the non-producing country. If a contract is signed with a local company of the non-producing country this company will bring bottles on its return journeys. It will thus have an opportunity of transporting some other goods from its own country to the glass producing country.

There will thus be no payment for journeys without any goods to transport.

It would be difficult, however, for a transport company to get transport orders in a country where it is not registered.

It will be possible to load approximately 150,000 bottles on every truck. The cost for individual trips is $2.0 per mile. The distance between Freetown and Monrovia is 350 miles. The cost of transportation is thus $700 per truck, or $4.67 per 1000 bottles.

It is shown in the Market Survey that the Liberian Market is larger than the market in Sierra Leone. Thos cost of delivery will thus be higher if the glass works is located in Sierra Leone. This increased cost of delivery for a glass works located in Sierra Leone compared to one in Liberia is shown in table V. 3.

TABLE V. 3

Extra cost of delivery if the glass works is located in Sierra Leone

Year	Market in Liberia	Market in Sierra Leone	Difference L-S.L.	Extra cost of delivery US $
1981	10.1	6.8	3.3.	15411
1982	12.5	8.4	4.1	19147
1983	14.3	9.5	4.8	22416
1984	15.6	10.5	5.1	23817
1985	17.2	11.4	5.8	27006
1986	18.8	12.6	6.2	28954
1987	20.4	13.5	6.9	32233
1988	22.1	14.7	7.4	34658
1989	24.0	16.0	8.0	37360
1990	25.9	17.3	8.6	40163

It is important not to change the moulds in the machines more often than absolutely necessary. The time of delivery and storage possibilities in the customer plants must be discussed with each customer. Appendix IV gives some indication of the problem.

VI. SOCIO-ECONOMIC ASPECTS

The creation of new industries in a country usually gives many benefits of economic development. Every industry gives some employment opportunities to some different groups of the population. In addition to the economic benefit there is also an advantage for the employees being trained for jobs in the industry.

1 PERSONNEL

It is estimated that the glass container company for the first 2 - 3 years will employ 132 people as is shown in Table VI.1.

Table VI.1. The Number of staff and workers for the glass container factory.

Function	1st Shift	2nd Shift	3rd Shift	Reserve Shift	Day Shift	Total
General Manager					1	1
Production Manager					1	1
Administrative Manager					1	1
Sales Manager					1	1
Glass Technologist					1	1
Machine Superintendent					1	1
Maintenance Engineer					1	1
Cost Acct.					1	1
Personnel Manager					1	1
Purchasing Manager					1	1
Office Supervisor					1	1

Function	1st Shift	2nd Shift	3rd Shift	Reserve Shift	Day Shift	Total
Sales men					4	4
Office Staff					10	10
Foremen	2	2	2	2		8
Labourers, skilled	5	5	5	5		20
Labourers, unskilled	17	17	17	17	10	78
Total	24	24	24	24	35	132

The salaries of staff and labourers will be different in Liberia and Sierra Leone. This is shown in table VI.2. As is seen from this table the salaries are lower in Sierra Leone than in Liberia. There is a total annual difference of US $ 187,080.- In this study the figures for Liberia have been used.

TABLE VI. 2

The annual salaries in US $ for Liberia and Sierra Leone in a glass container factory

	Liberia		Sierra Leone	
Function	Individual	Total	Individual	Total
General Manager (1)	50,000	50,000	40,000	40,000
Production Manager (1)(2)	35,000	35,000	28,000	28,000
Administrative Manager	11,000	11,000	5,000	5,000
Sales Manager	10,000	10,000	5,000	5,000

	Liberia		Sierra Leone	
Function	Individual	Total	Individual	Total
Glass technologist(1,2)	25,000	25,000	20,000	20,000
Machine Superintendent(1,2)	20,000	20,000	16,000	16,000
Maintenance Engineer (2)	10,000	10,000	5,000	5,000
Cost Accountant	9,000	9,000	4,000	4,000
Personnel Manager	8,000	8,000	3,500	3,500
Purchasing Manager	8,000	8,000	3,500	3,500
Office Supervisor	7,000	7,000	3,500	3,500
Secretaries	6,000	18,000	3,000	9,000
Sales men	4,000	16,000	2,000	8,000
Office Staff	2,000	20,000	1,000	10,000
Foremen (2)	3,400	27,200	1,500	12,000
Labourers, skilled (2)	1,500	30,000	800	16,000
Labourers unskilled (2)	1,000	78,000	500	39,000
Total		382,200		227,5000
Fringe benefit 20%		76,440		44,060
Total Salary		458,640		271,560

(1) Expatriates (4 people)

(2) Employed in production departments (110 people)

2 ORGANISATION

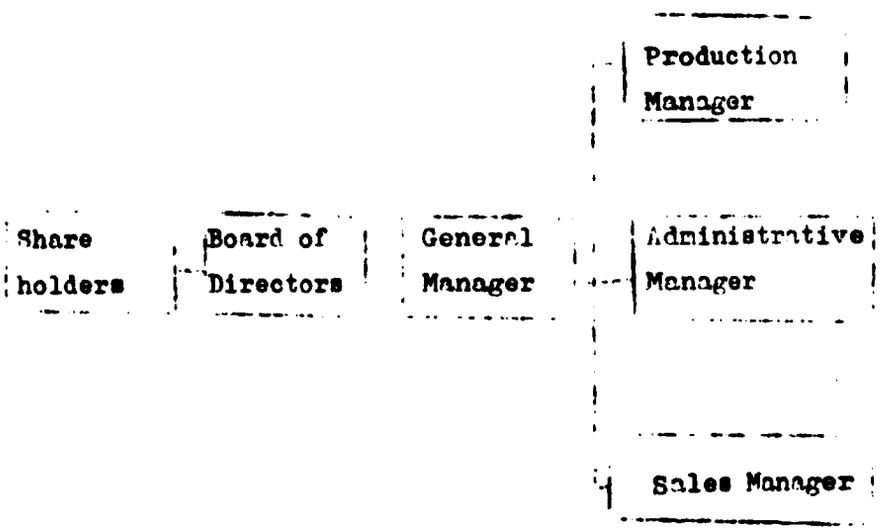
It is very important to have an efficient organisation of the personnel in the glass company. All the managers must be well qualified for their functions and must show a record of previous successful employments on similar levels and activities.

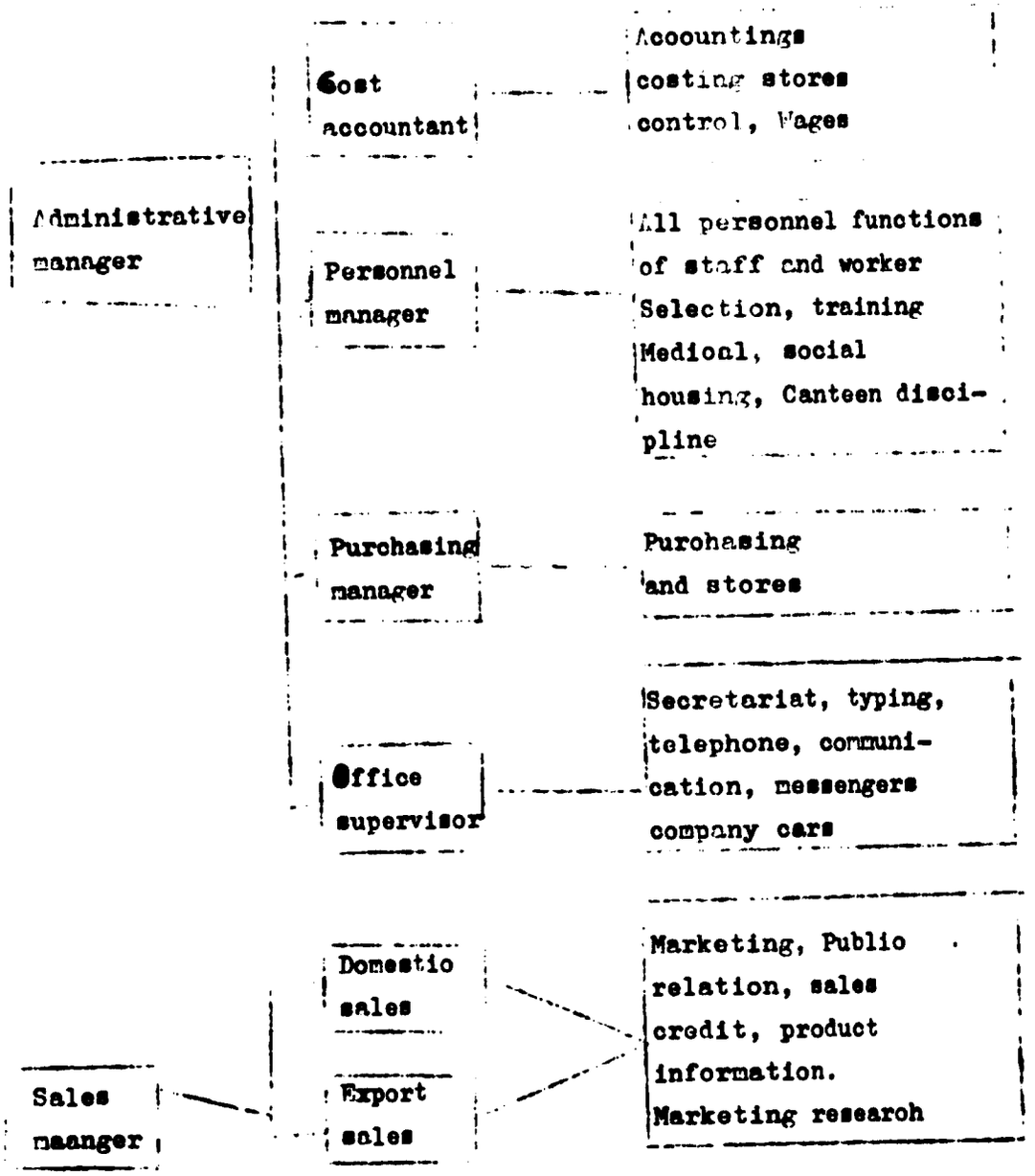
The general manager, the production. manager, the machine

superintendent and the glass technologist must have previous experience from a glass container factory. The maintenance engineer should have good experience of maintenance supervision from at least one well recognized foreign company.

The following organisation is proposed for the glass company.

Organisation Chart




Administrative manager
Cost accountant
Accountings costing stores control, Wages
Personnel manager
All personnel functions of staff and worker Selection, training Medical, social housing, Canteen discipline
Purchasing manager
Purchasing and stores
Office supervisor
Secretariat, typing, telephone, communication, messengers company cars
Sales manager
Domestic sales
Export sales
Marketing, Public relation, sales credit, product information. Marketing research

3 TRAINING OF PERSONNEL

Glass is at present not manufactured in the Mano River Union and there is therefore no knowledge of this industry in either of the two countries. All know-how of glass manufacturing must be acquired from foreign glass companies or glass technologists.

All the personnel have to be trained for their new functions. The key personnel should be employed 6-12 months before start of production. By working during the installation period valuable experience will be obtained by the personnel.

Most of the foremen must be trained in a foreign glass container factory. Such a training should last for 3-6 months.

For the installation of equipment and start up of production expatriates must be employed.

4 SOCIO-ECONOMIC BENEFITS FROM A GLASS CONTAINER COMPANY

A glass container company will stimulate other new industries and activities in the two member states of the Mano River Union.

Indigenous sand will be used as one of the main raw materials for glass melting. The sand has to be mined, screened and washed. This processing of sand will be a small profitable industry by itself. There is a shortage of good quality glass making sand in this part of the world. It will therefore be possible for a sand processing industry in Liberia or Sierra Leone to export some sand to other glass producing countries.

Other raw materials for the glass manufacturing have to be imported. This will increase the activity of the local harbour and local international trade. Transport companies will also benefit from all raw materials being imported.

Most of the maintenance of the glass factory will be carried out by its own maintenance department. Some smaller very specialized jobs may be given to companies with local expertise.

Before delivery from the glass factory the bottles should be packaged in one way or another. One packaging material is cartons. The breweries prefer to use cartons. Cartons are now imported together with the bottles. A carton manufacturing company could perhaps be established in one of the two Union countries. It is not necessary to have this industry in the same country as that of the glass container company.

Another way of packaging glass containers is to use wooden or plastic crates. This is preferred by the soft drink bottling plants. A crate plant may be started in one of the countries.

A shrinkable plastic film is often used as packaging material. This could be a starting point for another local industry.

In addition to glass bottles the glass company can manufacture some table ware. The I.S. machines that are recommended for the factory are capable of manufacturing tumblers and jugs. No market study has been carried out for these products but there should be no doubt that articles of this type would have a very beneficial effect on the profitability of the glass company.

Tumblers, jugs and similar table ware may be nicely decorated. They can thus be very attractive for house hold use and for cafeterias and restaurants.

Many small bottling companies in the two Union countries use second hand bottles for their products. They may use one way beer bottles and this is not to be recommended.

When glass containers are easily obtainable in the two countries packaging companies will start to use glass more frequently.

The countries will also be more attractive for glass container using industries. Such industries are for instance food and fruit industries making fruit juices, baby food, marmalade and jam, tomato ketchup, soups, vegetables, and many other food products. Companies making toilet products may also find an interest to locate in a country where glass containers are produced.

It is recommended that further studies be carried out regarding these types of industries. The country in which the glass company is located will have most of the benefits from it. Other industries dependent on the glass company could, however be started in the other country. Industries making foods, toilet products and packaging material may be attractive for the non-glass manufacturing country.

The glass containers have to be sealed. Closures like crown cork, lug caps, pilfer proof screw caps and plastic screw caps will be needed by the different bottling plants. Such industries may well be located in either of the two countries.

It is important that the price of the bottles is the same whether they are sold to customers in the glass manufacturing country or in the other country. The cost of transport has therefore to be added to the production cost of the containers.

5 WHERE SHOULD THE COMPANY BE LOCATED?

There is no obvious location for the glass plant. The environmental and industrial conditions are acceptable in both countries.

It can be stated quite firmly that the glass works should be located very closely to one of the two capitals, Freetown or Monrovia. Most of the glass using industries are situated in these two cities. In addition both of them have good ports.

In Monrovia the company can be erected in the Monrovia Industrial Park, MIP. This park presents itself in the following way:

1. Location

Monrovia Industrial Park is located on 1,000 acres of land only seven miles from the heart of the Capital city. A paved road, which is being enlarged to a six lane highway, leads to the Park.

2. Features

The road to thePark also extends to the deep water port, only five miles distant. The paved highway also leads to Roberts International Airport some 35 miles from the Park.

3. Housing

Adjacent to thePark is a 112 acre housing development that contains 412 housing units for middle income workers; with a further 700 more homes under construction nearby.

4. Utilities

Government-owned utilities assure services for normal demand.

Telephone, power, water and sewer lines will be installed underground for protection and appearance, By the end of 1976 about 5,000 feet of water main will be complete.

5. Labour market

Monrovia has a population of 180,000 within a 15 mile radius. Semi-skilled and unskilled labour is available. A trade school is planned for the Park for training workers as the need arises.

6. Special services

The Liberian Development Corporation can offer engineering and architectural services, or provide feasibility studies in connection with projects for the park when required.

In Freetown there is the Wellington Estate. This has a similar location to the capital and a similar infrastructure as the MIP. Unfortunately, however, there is not enough space. It will not be possible to get 10 acres of land in the Estate. 3-4 are obtainable only. According to the director of Lands and Survey there are plans to acquire moreland for the Wellington Estate. This land is at present owned by private people and it is difficult to say when it can be acquired.

Another very interesting place for a glass factory is Lakka. This is situated along the beach west of Freetown and approximately 15 miles from the centre of the city.

A location at Lakka may be very suitable. Water an electricity are available. The road has to be improved. Labour should be available in the near village. The land has to be acquired by the city authorities. Unfortunately it has not been proved that acceptable sand is available in the Freetown area.

Before a firm decision is taken regarding where to build the plant the different sites have to be controlled and properly investigated.

Some advantages for locating the plant in Monrovia and Freetown respectively may be given.

MONROVIA

1. It has been proved that indigenous sand is acceptable for glass manufacturing.

2. Land is readily available in the Monrovia Industrial Park.

3. The glass container market is larger in Liberia than in Sierra Leone.

4. There is a valuable experience in the country of foreign industries.

FREETOWN

1. Skilled labour is available since some industries have closed down.

2. Salaries for personnel are lower in Freetown than in Monrovia.

3. Future potential market may be larger in Sierra Leone since more people live there.

6 PROPOSAL

It is proposed that the glass factory be located in Monrovia. Land is available in the Monrovia Industrial Park. Most of this land, however, is not acceptable for a glass factry since the ground is too wet.

An acceptable site is in the north western part of MIP, next to the Liberian Refinery Co. The topographic map prepared in 1972 shows that this area is within contour line 40-45-50. This area is thus elevated from the swampy land. It is proposed for heavy industries.

This part has not yet been served with infra structure facilities. The management of MIP has promised to look into this immediately and prepare the site for industrialisation or give acceptable alternatives.

7. ENVIRONMENTAL PROBLEMS

A glass works does not give any major ecological disturbances. The combustion gases from the furnace contains sulphur dioxide. This can be controlled by using a fuel oil having a low sulphur content. In addition the combustion gas can be purified before leaving the chimney.

When loading soda ash into the silos care should be taken not to let the soda ash being caught by winds and thereby be spread around. Wet soda ash is alkaline and very corrosive.

.8 NATIONAL COST BENEFIT

A steel works will give some commercial profitability to its owners, as is shown in the Financial survey. There will also be a national cost benefit from a steel company. Table VI. 3 shows a national cost benefit analysis for one production year.

Table VI.3. National Cost Benefit Analysis
(for 1987) $1,000

Factor %-age		Commerical Profitabil.	National Economic Profitability
+ 40	Operating Revenue	6,220	8,708
	Operating Costs		
+ 40	Raw Materials	1,270	1,778
+ 40	Fuel	300	420
+ 40	Power	250	350
	Water	15	15
+ 30	Auxiliaries	150	195
+ 20	International Staff	156	187
- 30	Local Staff	58	41
- 60	Labour	130	52
	Depreciation	597	597
	Taxes	830	-
		3.756	3.635
	Net Profit	2.464	5.073

The national economic profitability is thus twice as high as the profitability for the private share holders.

The value added to bottles being produced in the Mano River Union from imported raw materials is shown in table VI. 4.

Table VI. 4 Value Added

Value in $ 1000

Year	Sales Revenue	Depreciation' Raw Materials Fuel	Value Added
1981	2,897	1,612	1.285
1982	3,791	1.877	1.914
1983	4.217	1.982	2.235
1984	4.672	2.087	2.585
1985	5.140	2.202	2.938
1986	5.666	2.327	3.339
1987	6,220	2.441	3.773
1988	6.788	2.572	4.216
1989	7.412	2.697	4.715
1990	8.051	2.872	5.149

As is seen the value added is approximately 45% for the first production year and increases to 65% after ten years. The value added is a contribution to the national income.

Another very rough way of estimating the national economic profitability would be to consider the value added due to local production compared with the import duty on bottles.

The value added for 1987 is $3.773.000.-. The total import duty in 1987 for 32.8 millions of bottles would be $935.000.

The national economic profitability is thus 3.773.000 -935.000 = $2.838.000. - It can thus be estimated very roughly that the national economic profitability due to local production in 1987 is $2,8-5.0 millions. This should be compared with the commercial profitability for 1987 which is $1.6 million (profit after tax and dividend)

No studies have been carried out regarding the industries mentioned in part VI.4. It may be assumed, however, that all together these industries will have a similar working force and similar profitability to that of the glass factory.

If this very rough estimation is true and if these industries are located in the country, where there is no glass works, this country could then have a similar national cost benefit to that of the glass producing country.

Table III. 10 shows the income tax to be paid. More favourable conditions may be obtained for the glass company as a Union Industry after application to the Commission of the Mano River Union.

Table VII. 11 shows that the total capital of $ 7.0 millions will be paid back in the 7th year of production. As is seen from the cash flow the first input of capital ($ 0.5 millions) is in 1978. Most of the capital is acquired in 1980 and the pay back period is therefore calculated from that year.

There are deficits in the cash flow in 1980 and in 1985. 1980 is the year before production starts and in 1985 there is a new investment of $ 870.000 for rebuilding the furnace and for some new equipment to convert one of the I.S. machines from single gob to double gob operation.

The company plans to pay dividends (10%) in its 4th year of production. After 7 years the dividends paid are 30% of the share capital.

Return on equity and return on investment have been calculated. When comparing these figures it is important to notice how they are defined and how they have been calculated.

VII. FINANCIAL SURVEY

The financial survey is carried out on the assumption that the glass plant will be located on Monrovia.

As is shown in table VI.2 the total salaries for the basic glass factory (25 millions of bottles) is $ 187.080.- less in Sierra Leone than in Liberia. On the other hand distribution would be approximately $ 19.000 - more expansion.

The investment figures have been obtained by budget offers from suppliers (see Appendix V).

The cost of production is calculated on figures received from suppliers of raw materials and glass equipment (see Appendix V). It is extremely difficult to distinguish between variable cost of production and fixed cost. In the calculations all the manufacturing cost has been regarded as variable cost. This is not in full agreement with reality. The total production cost in this study will thus be higher than the production cost obtained in real practice.

In the Financing Plan (VII.6) only one bank has been mentioned, the Liberian Bank for Development and Investment. This bank has declared preliminary that it is ready to supply the capital required. In the calculations the total bank loan ($ 2.0 millions) has been split into two loans. This is just a way of showing that a loan from a second bank is possible should this be prefered.
In addition the two governments concerned may be interested in contributing some of the money.

1 INVESTMENTS (in US $)

Buildings		
Furnace shop	200,000	
Lehr	100,000	
Warehouse	100,000	
Auxiliaries	75,000	
Offices	50,000	525,000
Batch plant		400,000
Plant equipment		
Carton maker	50,000	
Power station	400,000	
Cold end manuel	84,000	
Maintenance shop	150,000	
Warehouse equipment	50,000	
Convevor	20,000	
Storage shelves	10,000	
Gas and fuel station	120,000	884,000
Regenerative furnace for 2 shops		850,000
Decorative machine and lehr		400,000
Locker room and sanitary installations		50,000
2 Embart IS 6 SG including all auxillaries		1,740,000
Initial mould investment		150,000
Total		4.999,000
Miscellaneous (office equipment etc)		201.000
Design, engineering		300.000
Installation		200,000
Investment for two lines		5.700.000
Pre-investment cost		
Project management and engineering	250.000	
Site preparation	100,000	350.000
Total investment		6.050.000

2 PRODUCTION (25 millions of bottles)

1. Manufacturing cost

Batch material to make	
7400 tons of glass @ $80	592,000
Fuel oil	
2200 tons @ $102	224,400
LPG gas	
75 tons @ $400	30.000
Lubricants and supplies	30,000
Distribution of bottles	100,000
Power	
3 Millions kwh @ $ 0.07	210,000
Water	
40,000 m^3 @ $0.35	14.000
Auxiliaries	87.250
Moulds, replacements	175,000
cleaning, repair	
Furnace, repairs	50,000
Machine, general repairs	100,000
Labour	162,240
Manufacturing cost	1,774.890

2. Non-manufacturing cost

Personnel cost	296,400
Cost of land, renting	1,700
Insurance, 1.5% on investment	78,000
Non-manufacturing cost	376,100
Manufacturing cost	1,774,890
Total production cost	2,150,990

3. Manufacturing cost rejected bottles

Manufacturing cost	1,774,890
Less batch material	592.000
Less distribution	100.000
Manufacturing cost for rejected bottles.	1.082.890

3 WORKING CAPITAL

Raw materials (3 months)	148,000
Fuel oil and LPG (3 months)	60.000
Direct labour (2 months)	27,000
Indirect labour (3 months)	50,000
Auxiliary equipment (2 months)	20,000
Sundry debtors (1 month)	227,000
Unforeseen	300,000
Total Working Capital	832.000

4 CAPITAL REQUIREMENT

Total investment	6,050.000
Working capital	832.00
Capital required	6,882.000

The financing plan should be based on $7,000,ooo as capital required.

5 DEPRECIATION

Buildings, 25 years	37,000
Furnace 4 years	212,500
Machinery 10 years	342,500
Annual depreciation, 1st-4th year	592.000
5th-10th year (new furnace, new machine equipment)	597.000

6 FINANCING PLAN

1. Equity capital	2.500.000
2. Suppliers' credit, 6 years, 8%(first year no amortization)	2.500.000
3. Liberian Bank for Development and Investment 13 years, 3 years free from amortization, 10%	1.00.000
4, Same as 3.	1100,000
Total capital	7,000.000

7 PRODUCTION COST

Year	Variable cost for bottles			Fixed cost	Total Production cost
	Sold	Rejected	Total		
1981	1.462.509	381.177	1.843.686	376.100	1.219.786
1982	1.895.583	450.482	2.346.065	376.100	2.722.865
1983	2.108.569	454.814	2.563.383	376.100	2.939.483
1984	2.335.755	446.151	2.781.906	376.100	3.158.006
1985	2.570.041	441.819	3.011.860	376.100	3.387.960
1986	2.832.724	394.172	3.226.896	376.100	3.602.996
1987	3.10?.807	415.830	3.525.637	376.100	3.901.737
1988	3.393.590	398.504	3.792.094	376.100	4.168.194
1989	3.705.970	372.514	4.078.484	376.100	4.454.584
1990	4.025.451	394.172	4.419.623	376.100	4.795.723

8

REIMBURSEMENTS OF LOANS

A= Amortization

I= Interest

Figures in $1000

Loan	2		3		4		Total	
Year	A	I	A	I	A	I	A	I
1980				50		50		100
1981		200		75		75		350
1982	500	200		100		100	500	400
1983	500	160		100		100	500	360
1984	500	120	50	100	50	100	600	320
1985	500	80	75	95	75	95	650	270
1986	500	40	100	87.5	100	87.5	700	215
1987			100	77.5	100	77.5	200	155
1988			100	67.5	100	67.5	200	135
1989			100	57.5	100	57.5	200	115
1990			100	47.5	100	47.5	200	95

9. PROFITABILITY ANALYSIS

Year	Millions of bottles sold	Sales revenue	Production Cost	Depreciation	Interest on loans	Profit (Loss) before Tax
1980	--				100,000	(100.000)
1981	20.6	2,925,200	2,219.786	592.000	350.000	(236.586)
1982	26.7	3,791,400	2,722.065	592,000	400.000	77.335
1983	29.7	4,217.400	2,939.483	592.000	360.000	325.917
1984	32.9	4,671.800	3.158.006	592.000	320.000	601.794
1985	36.2	5,140.400	3.387.960	597.000	270.000	885.440
1986	39.9	5,665.800	3,602.996	597.000	215.000	1,250.804
1987	43.8	6.219.600	3.901.737	597.000	155.000	1.565.865
1988	47.8	6.787.600	4.168.194	597.000	135.000	1.887.406
1989	52.2	7.412.400	4.454.584	597.000	115.000	2,245.816
1990	56.7	8.051.400	4.795.723	597.000	95.000	2,563.677

.10 TAX SCHEDULE

Year	Net Profit before tax	Investment allowances	Taxable profit	Tax at 45%
1980	(100000)			
1981	(236586)			
1982	77335	2.126.250	(2.048.915)	
1983	325.917		(1.722.998)	
1984	601.794		(1.121.204)	
1985	885.440		(235.764)	
1986	1,250.804		1.015.040	456.768
1987	1.565.863		1.565.863	704.638
1988	1.887.406		1,887.406	849.333
1989	2.245.816		2.245.816	1.010.617
1990	2.563.677		2.563.677	1.153.655

Calculation basis for investment allowances:

Buildings	925000 x 45%	= 416.250
Machinery	4275000 x 40%	= 1.710.000
Total allowance		2,126.250

11. PAYBACK PERIOD

Year	Net Profit after tax	Depreciation	Total yearly	Cumulative total
1980	(100.000)		(100.000)	(100.000)
1981	(236.586)	592000	355.414	255.414
1982	77,335	592000	669.335	924.749
1983	325.917	592000	917.917	1.842.666
1984	601.794	592000	1,193.794	3.036.460
1985	885.440	597000	1,482.440	4,518.900
1986	794.036	597000	1,391.036	5.909.936
1987	861.225	597000	1,458.225	7,368.161
1988	1.038.073	597000	1,635.073	
1989	1.235.199	597000	1,832.199	
1990	1,410.022	597000	2.007.022	

Total investment including working capital is $ 7.000.000.-

The payback period is thus 6.8 years after the input of most of the capital ($ 6.500.000) in 1980.

12 DIVIDEND AND RESERVE SCHEDULE

Year	Profit before tax	Tax	Dividend	Accumulated reserve
1980	(100.00)			(100.000)
1981	(236.586)			(336.586)
1982	77.335			(259,251)
1983	325.917			66.666
1984	601.794		250.000	418.460
1985	885.440		250.000	1,053.900
1986	1.250.804	456.768	500.000	1,34[illegible].936
1987	1,565,863	704.638	750.000	1,459.161
1988	1,887,406	849.333	750.000	1,747.234
1989	2,245.816	1,010.617	750.000	2,232.433
1990	2,563,677	1,153.655	750.000	2,892.755

The rate of dividend is:

1984 - 1985	10%
1986	20%
1987 -1990	30%

13

PROJECTED C SH FLOW STATEMENT

	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
Profit before tax			(100000)	(236586)	77335	325917	601794	885440	1250804	156586	1987400	2245816
Depreciation				592000	592000	592000	592000	592000	587000	587000	587000	587000
Operating cash flow			(100000)	355414	669335	917917	1193794	1477440	1837804	2143586	2574400	2832816
INFLOW												
Equity capital	500000	500000	1500000									
Machinery credits			2500000									
Other loans		1000000	500000	500000								
Cash available	500000	1500000	4400120	855414	669335	917917	1193794	1477440	1837804	2143586	2574400	2832816
OUT FLOW												
Buildings		225000	700000									700000
Machinery		750000	3525000	500000				870000				
Current assets			500000	332000								
Pre-operational	50000	300000	153120									
REPAYMENTS												
Machinery credits					500000	500000	500000	500000	500000			
Other Loans							100000	150000	200000	200000	200000	200000
Tax payments									436768	704638	949333	1010617
Dividends							250000	50000	500000	750000	750000	750000
Total outflow	50000	1275000	4878120	832000	500000	500000	850000	1770000	1636768	1654638	1899333	2660617
SURPLUS	450000	225000	(478120)	23414	169335	417917	343794	(287560)	191036	508285	685033	12199
Cumulative	450000	675000	196880	220294	389629	807546	1151340	863780	1054816	1563041	2248114	2260313

14 CASH FLOW SUMMARIZED

Year	Total inflow	Total Outflow	Cash surplus	Cash at and of period
1978	500.000	50.000	450.000	450.000
1979	1500.000	1,275.000	225.000	675.000
1980	4400.000	4,878.120	(478.120)	196.880
1981	855.414	832.000	23.414	220.294
1982	669.335	500.000	169.335	389.629
1983	917.917	500.00	417.917	807.546
1984	1.193.794	850.000	343.794	1.151340
1985	1.482.440	1.770.000	(287.560)	863.780
1986	1.847.804	1.656.768	191.036	1,054.816
1987	2.162.863	1.654.638	508.225	1,563.041
1988	2,484.406	1,799.333	685.073	2.248.114
1989	2,842.816	2,830.617	12.199	2,260.313
1990	3,160.677	2,103.655	1.057.022	3.317.335

PROJECTED BALANCE SHEET

	1978-1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
FIXED ASSETS											
Land & Buildings	925000	925000	925000	925000	925000	925000	925000	925000	925000	925000	925000
Machinery and Installations	4275000	4775000	4775000	4775000	4775000	5645000	5645000	5645000	5645000	6515000	6515000
Total Fixed Assets	5200000	5700000	5700000	5700000	5700000	6570000	6570000	6570000	6570000	7440000	7440000
Less:Accumulated Depreciation		592000	1184000	1776000	2368000	2965000	3562000	4159000	4756000	5353000	5950000
NET VALUE	5400000	5108000	4516000	3924000	3332000	3605000	3008000	2411000	1814000	2087000	1490000
Current Assets											
Stock		620000	905000	891000	948000	1092000	1200000	1319000	1440000	1575000	1701000
Sundry debtors		227000	227000	227000	270000	227000	227000	227000	227000	227000	227000
Cash in bank	1000000	709414	692749	1024666	1771460	1623900	3576472	5718295	8086706	9464806	10962711
TOTAL ASSETS	6400000	6663414	6240749	6066666	6318460	6553900	7811472	9675205	11507306	13355996	15380711
CURRENT LIABILITIES											
Income tax							456768	704638	849333	1010617	1153655
Dividends					250000	250000	500000	750000	750000	750000	750000
Bank loans	1500000	2000000	2000000	2000000	1900000	1750000	1550000	1350000	1150000	950000	750000
NET ASSETS	1500000	2000000	2000000	2000000	2150000	2000000	2506768	2804638	2749333	2710617	2653655
Share capital	2500000	2500000	2500000	2500000	2500000	2500000	2500000	2500000	2500000	2500000	2500000
Retained earnings	(100000)	(336586)	(259251)	(66666)	668460	1553900	2804704	4370567	6257973	8145379	10032786
	3900000	4163414	4240749	4566666	5318460	6053900	7811472	9675205	11507306	13355996	15186441
Machinery Credits	2500000	2500000	2000000	1500000	1000000	500000					
TOTAL LIABILITIES	6400000	6663414	6240749	6066666	6318460	6553900	7811472	9675205	11507306	13355996	15186441

16 RETURN ON EQUITY

Return on equity (shareholders return) (ROE) is calculated in the following way

$$ROE = \frac{\text{Profit after tax}}{\text{Net value share capital and earnings}}$$

1982 $ROE = \frac{77.4}{2240.7} = 3.45\%$

1983 $ROE = \frac{325.9}{2566.7} = 12.70\%$

1984 $ROE = \frac{601.8}{3168.5} = 18.99\%$

1985 $ROE = \frac{885.4}{4053.9} = 21.84\%$

1986 $ROE = \frac{794.0}{5304.7} = 14.97\%$

1987 $ROE = \frac{861.2}{6870.6} = 12.53\%$

1988 $ROE = \frac{1038.1}{8757.9} = 11.85\%$

1989 $ROE = \frac{1235.2}{10645.4} = 11.60\%$

1990 $ROE = \frac{1410.0}{13209.0} = 10.67\%$

17. RETURN ON INVESTMENT

The return on investment (ROI) is calculated in the following way:

$$\text{ROI} = \frac{\text{Profit after tax + interest}}{\text{Total capital employed}}$$

1982	ROI =	$\frac{77.4 + 400}{6240.7}$ =	7.65%
1983	ROI =	$\frac{325.9 + 360}{6066.7}$ =	11.31%
1984	ROI =	$\frac{601.8 + 320}{6318.5}$ =	14.59%
1985	ROI =	$\frac{885.4 + 270}{6553.9}$ =	17.63%
1986	ROI =	$\frac{794 + 215}{7811.5}$ =	12.92%
1987	ROI =	$\frac{861.2 + 155.0}{9675.2}$	10.50%
1988	ROI =	$\frac{1038.0 + 135}{11507.3}$ =	10.19%
1989	ROI =	$\frac{1235.2 + 115}{13356.1}$	10.11%
1990	ROI =	$\frac{1410.0 + 95}{15862.7}$	9.49%

18 BREAK DOWN OF COST OF INVESTMENT AND COST OF PRODUCTION INTO FOREIGN CURRENCY AND LOCAL CURRENCY

Investment cost

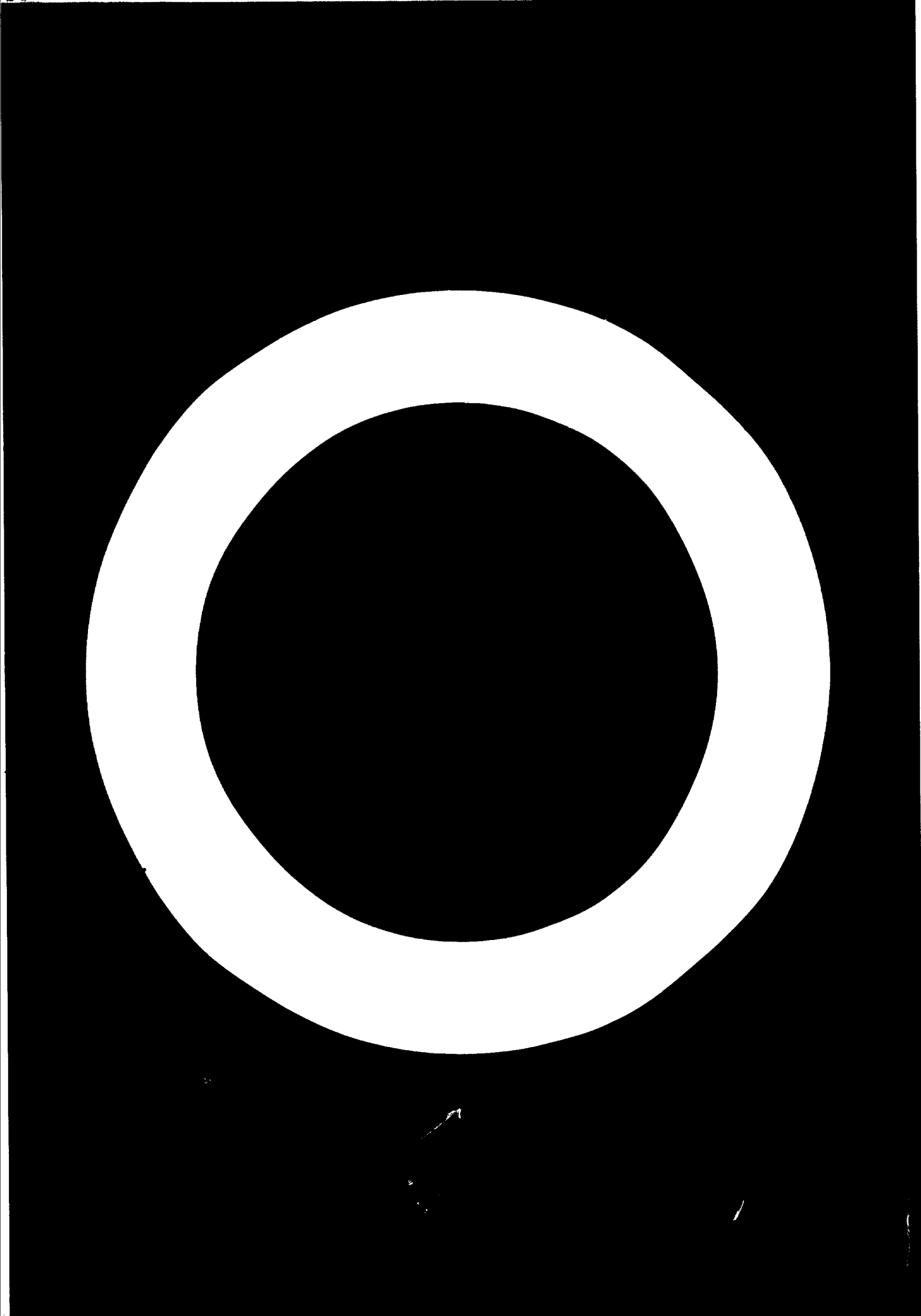
a) Local currency

Buildings	$ 350.000
Storage nel ca	10.000
Gas and fuel ation	20.000
Locker room and sanitary installations	35.000
Miscellaneous (office equipment)	20.000
Design, engineering	30.000
Installation	50.000
Site preparation	100.000
	615.000
b) Foreign currency	5435.000
Total investment	6050.000

Production cost

a) Local currency

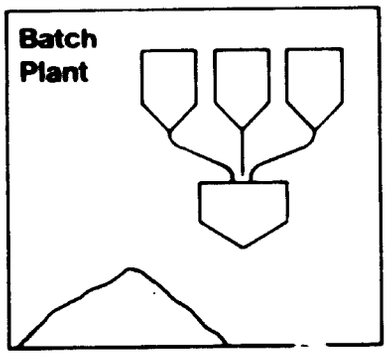
Silica sand	52.000
Distribution of bottles	100.000
Power	210.000
Water	14.000
Machine, general repairs	20.000
Labour	162.240
Personnel cost	140.400
Cost of land (renting)	1.700
Insurance	78.000
	778.340
b) Foreigns currency	1372.650
Total production cost	2150.990

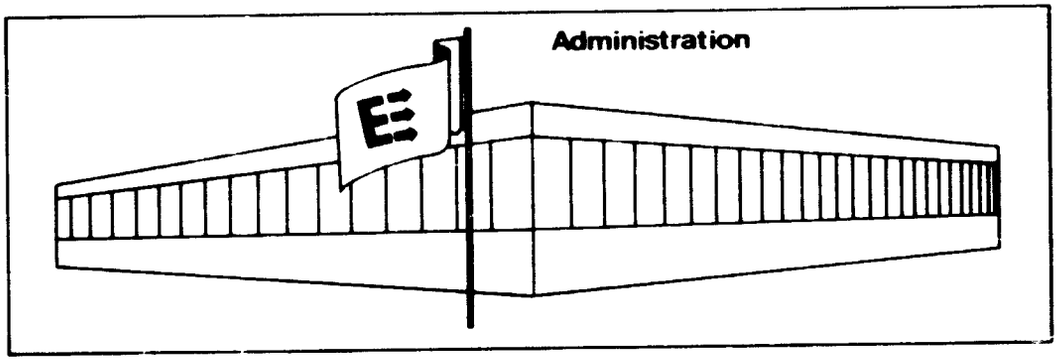


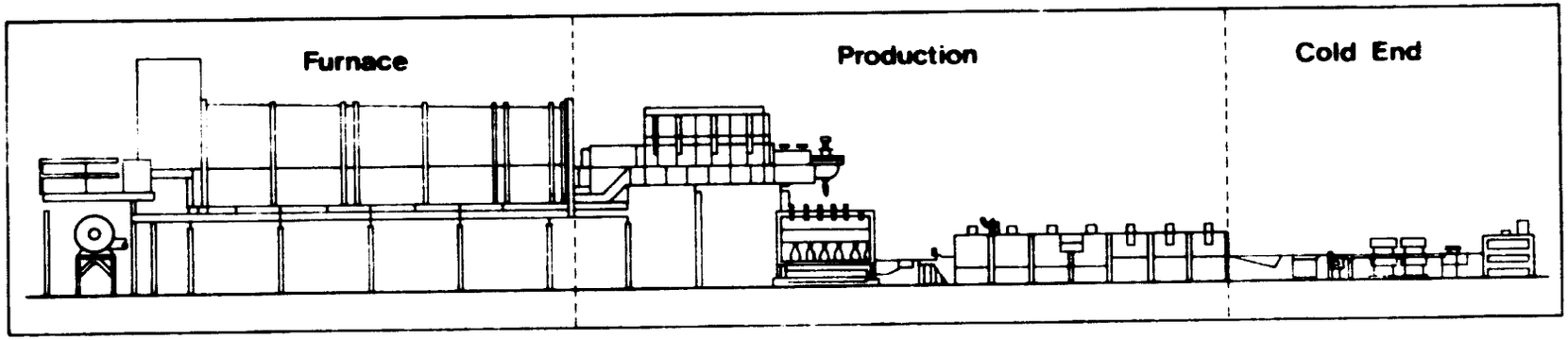
Appendix I

Glass Container Plant

Model for cost analysis

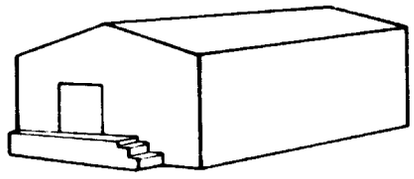






Transport

Warehouse



Appendix II

SILICA SAND DEPOSITS IN LIBERIA

The Liberian Geological Survey has published two reports regarding deposits of sand in the Monrovia area. These reports are:

1. Silica Sand Deposits in the Monrovia Area, Liberia; Sam Rosenblum, US Geological Survey and S.P. Srivastava, Liberian Geological Survey. Memorandum Report No. 47 (USGS IR -LI -41) - Liberian Geological Survey, Bureau of Natural Resources and Surveys.

2. Further Investigation of the Silica Sand Deposits on the Monrovia Area, Liberia; Sam S. Sangmor, Liberian Geological Survey.

Both these reports show that sand of acceptable quality for the manufacturing of glass containers is available in the Monrovia are. The abstracts and conclusions of the reports are the following.

Report 1.

Abstract. ABSTRACT

Thin surficial deposits of white silica sand occupy much of the flat coastal area of Liberia from Monrovia to Buchanan 100 km southeast: most of the sand is of good quality for glass manufacture. A lagoonal mode of origin is suggested for these essentially monomineralic deposits. Based on the average thickness of one meter and a conservative bulk density of 1.6, the easily accessible deposits along the Freeway, the Kakata highway, and the Schieffelin road cover about 68 square kilometers and contain at least 109 million metric tons of silica sand.

CONCLUSION

The results of this study show that sufficient reserves of high-quality silica sand exist in the Monrovia area to supply a glass manufacturing industry with all foreseeable needs, even for the development of a large-scale export trade. The possibility of using the silica sand for other valuable silica products such as abrasives, refactory materials, and optical products should not be overlooked.

REPORT 2

ABSTRACT

Further field and laboratory investigations of the surficial deposits of unconsolidated white silica sand, occupying parts of the flat coastal area of Liberia between Monrovia and Marshall 45 kms (28 miles) and extending about 20 kms (12.5 miles) inland have confirmed the previous results that the sand is of good quality for glass manufacture. Though part of the previously proven reserves amounting to 19 million metric tons are no longer available due to cultural development, more deposits have been discovered bringing the presently available deposits to about 136 million metric tons. Further exploration may increase the reserves.

CONCLUSION

Estimated reserves of 136 million metric tons of high grade, easily accessible and mineable silica sand justify plans for the manufacturing of glass in Liberia. However, it should be noted that silica (SiO_2) constitute only about 70 per cent of the required ingredients for glass manufacture. Other important constituents for glass manufacturing are lime, magnesia and alkalies. The availability of these commadities in Liberia is limited. Energy requirements should also be considered.

Should it be decided not to locate the glass factory at the Industrial Park, an alternative area might be considered between E.L.W.A. and Schiefflin which is centrally located with respect to most of the easily accessible deposits. It would require about 380 years to exhaust the present silica sand reserves at the proposed mining rate of 350,000 metric tons per annum.

Appendix III

JOB DESCRIPTION

General Field	Industrial Development
Title of Post	Business Adviser Glass Technology
Duration	1 - year with possibility of extension
Location	Free town and Monrovia
Starting Date	1st March 1978 or earlier

Background

The Mano River Union is an association between Sierra Leone and Liberia to expand trade by the elimination of all barriers to mutual trade; by cooperation in the expansion of internal trade; by the creation of conditions favourable to the expansion of mutual productive capacity including the progressive development of a common protective policy and cooperation in the creation of new productive capacity, and to secure a fair distribution of the benefits from economic capacity.

This post is concerned with the creation of new productive capacity in the form of a glass container factory.

Description ofDuties

General

Initially, the Adviser will be responsible to the Mano River Union to give the bridging technical assistance neccessary to develop the project from the existing feasibility study, to establish a company and to advise on all the stages of project development and implementation.

When the company is established he would be required to continue to advise the owners until the factory is commissioned, or until the arrival of a permanent glass technologist who would be employed by the Company.

Duties Specific

1. Check the feasibility study and up-date information as required.

2. Activate the geological survey regarding the availability of suitable sand in Sierra Leone (Data for Liberia already exists)

3. Assist the Mano River Union to locate suitable investors and in the discussion with banks regarding the necessary loans. Advise investors and banks on all technical and financial matters relating to the establishment of a factory

4. Advise and assist on the location of a suitable site in Monrovia for the factory. Prepare a check-list of all requirements. gas, fuel, water, electricity, sewage and effluent; storage and handling; office and administration; labour requirements. building dimensions, road/rail access,etc.

5 Communicate with suppliers of glass machinery and equipment, check prices and delivery availability. Assist in the preparation of requests for tenders which must include the suppliers' responsibility for training national staff in operation, and the maintenance of machinery including full specifications for preventive maintenances.

6. Advise and assist in the enquiries for, and placing of a management contract.

7. Report and inform the Mano River Union on all aspects of the development of the project.

Qualifications

1. A university or similar degree in glass technology, chemical or mechanical engineering.

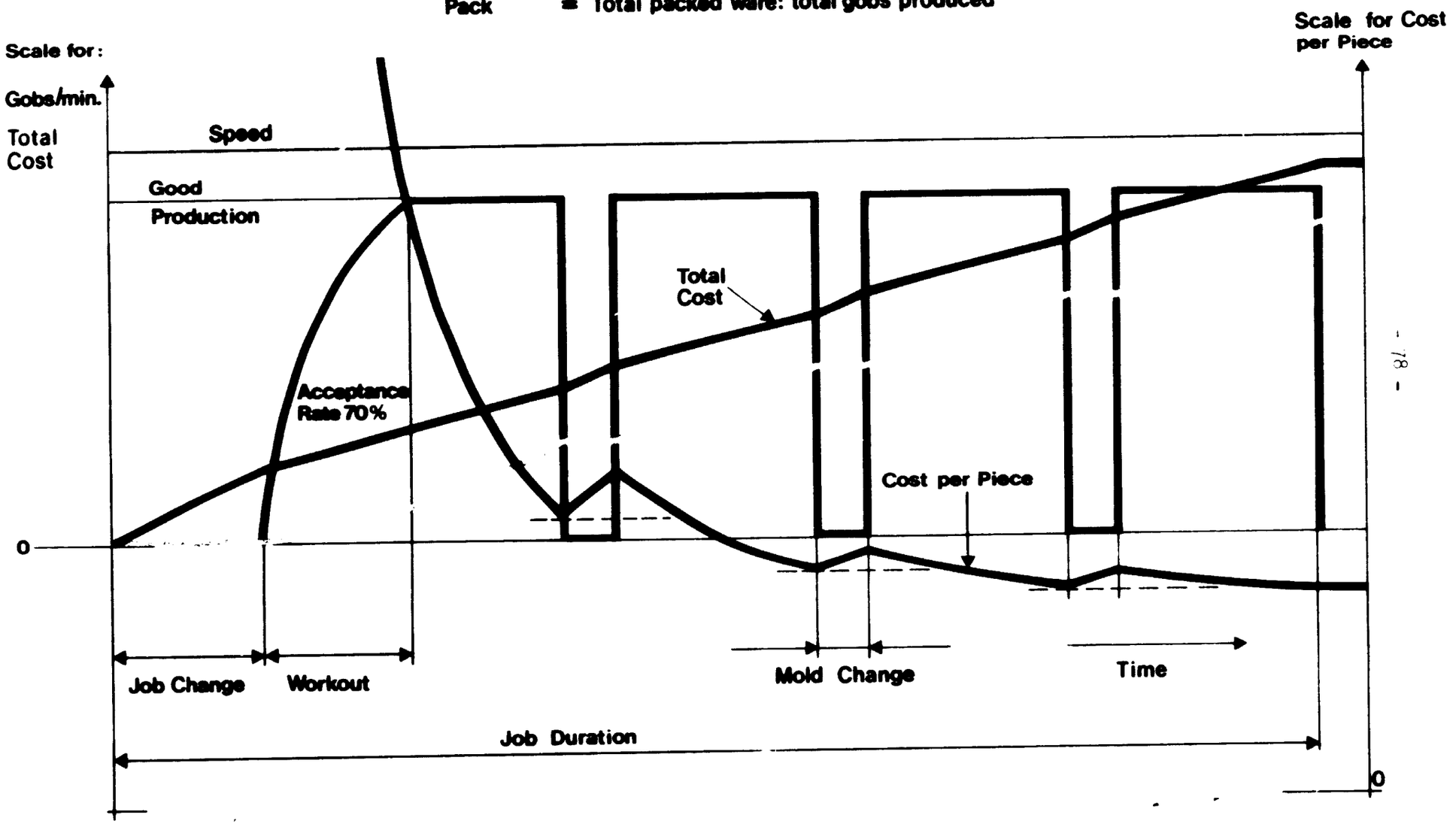
2. An all-round experience in the glass container industry which includes production management, design of production and financial systems of monitoring and control, methods of purchasing and some knowledge of glass container marketing and distribution.

3. Fluency in speaking and writing English.

Appendix IV

Mode of Operation for Glass Container Forming Machine

Definition: Efficiency = Good Production: Speed
Pack = Total packed ware: total gobs produced



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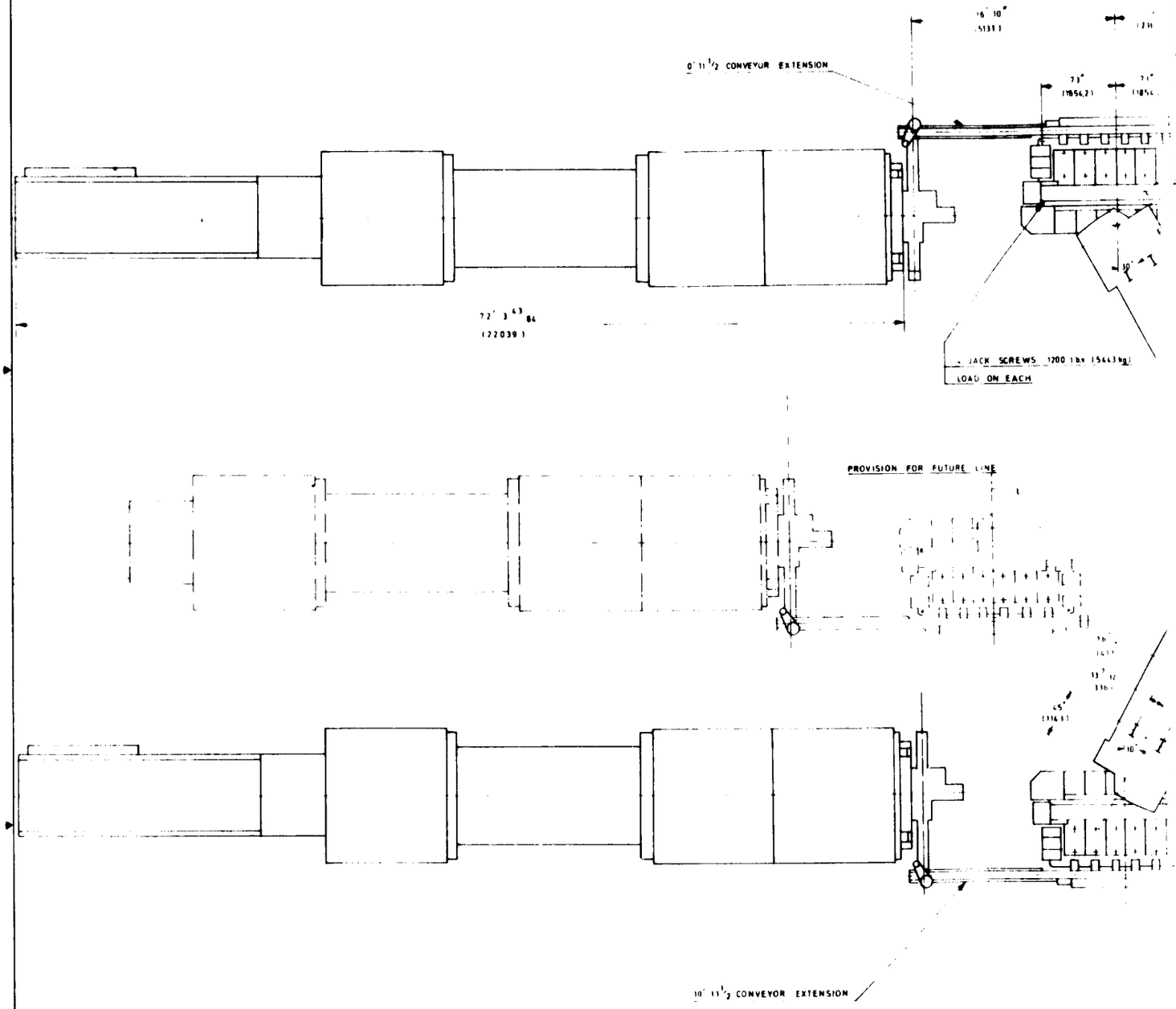
AMERICAN PROJECTION



Append

EQUIPMENT PROPOSAL FI

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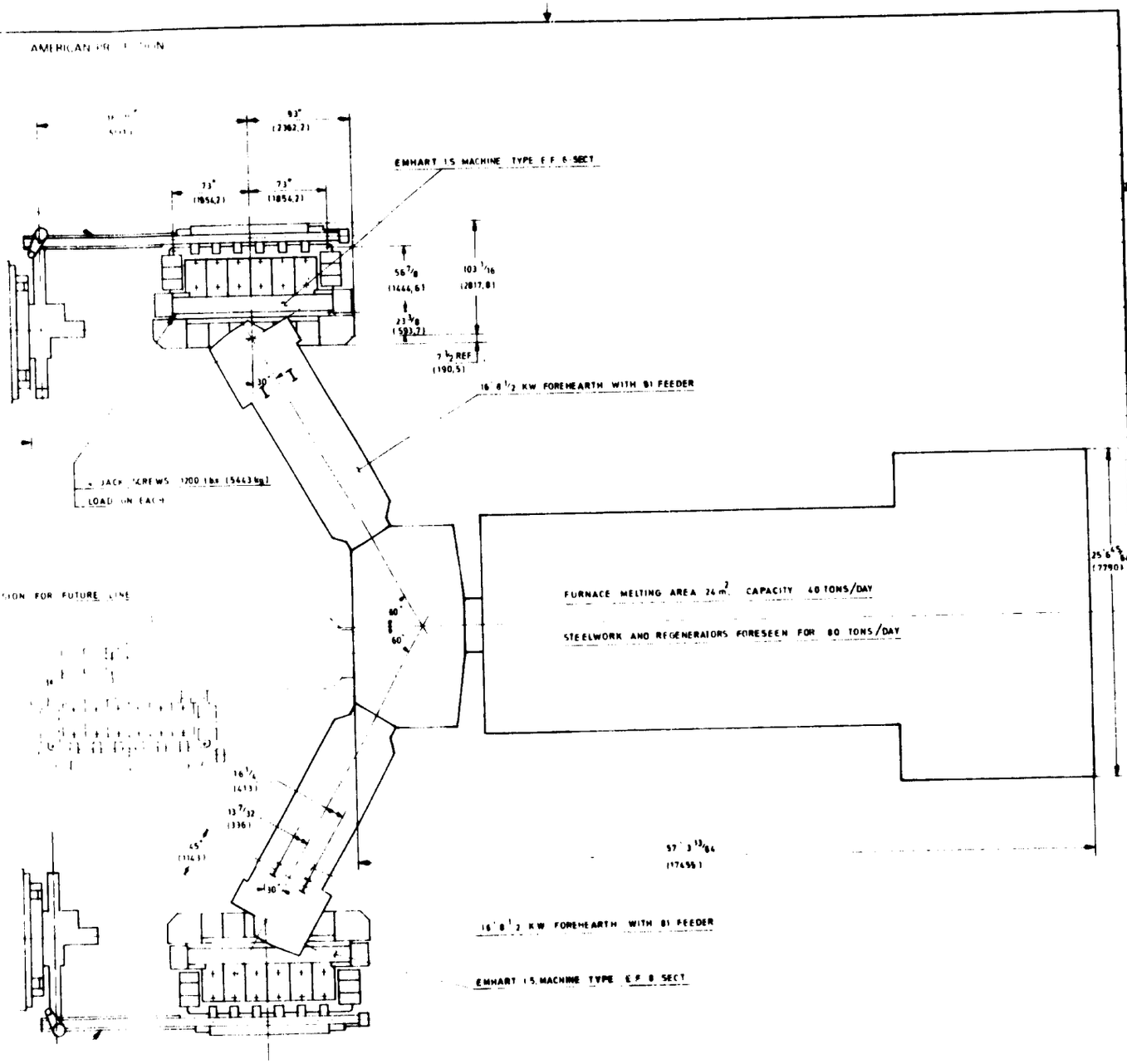

Appendix V

EQUIPMENT PROPOSAL FROM EMHART SWEDEN AB

EMHART ZURICH S.A.

LAYOUT FOR MANO RIVER UNION

SVP-6169

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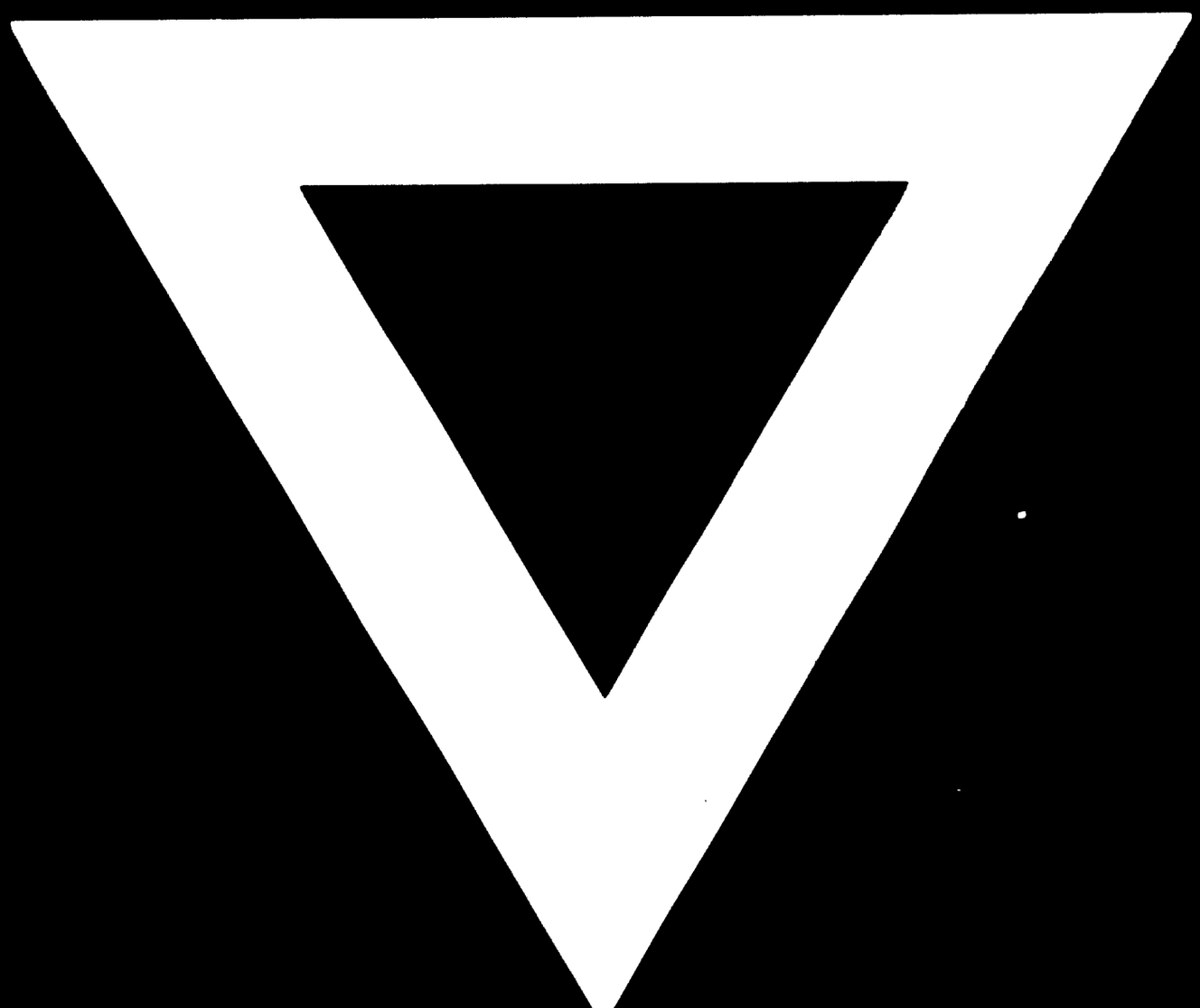

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