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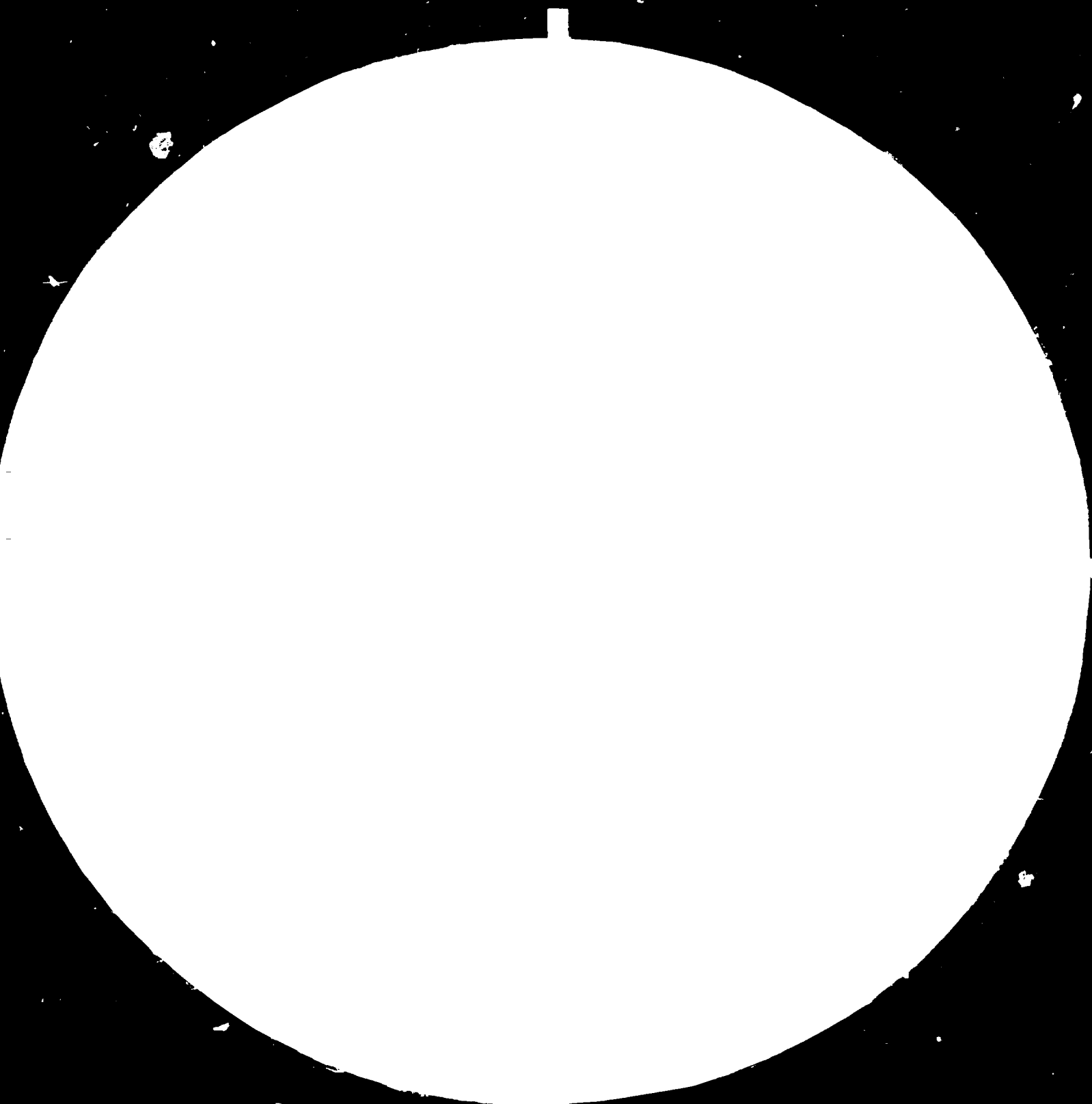
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2.5

2.2



2.0



1.8



1.6

Resolution Test Chart (NBS 1963-A)

1.0 1.1 1.25 1.4 1.6

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12324

Distr.
RESTRICTED
UNIDO/IO/R.54
7 March 1983
ENGLISH

UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

PHARMACEUTICAL GLASS CONTAINER PROJECT

AR/SYR/82/001

SYRIA

Terminal report*

Prepared for the Government of Syria
by the United Nations Industrial Development Organization

Based on the work of Pierre Mathelot,
Glass Manufacturing Expert

United Nations Industrial Development Organization
Vienna

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- INTRODUCTION -

The "Pharmaceutical Glass Container Project" for Production of Glass Containers in the Syrian Arab Republic is fully described in a very comprehensive feasibility study made by ABR Engineering.

The feasibility study contents are :

- Technical studies 1 and 2*
- Market study*
- Economic and Financial study*

The study which is now two years old is reviewed and commented on in this report.

*In other words, as it is mentioned in the terms of reference, this report is an appraisal of the **feasibility** study, with evaluation of all technical commercial and financial aspects.*

The main recommendations have been extracted from the report and are summarized in the next chapter.

- F I R S T P A R T -

AN APPRAISAL OF THE
UPDATED FEASIBILITY STUDY

1. AVAILABILITY OF RAW MATERIALS FOR PHARMACEUTICAL GLASS MANUFACTURE.

1.1 - Sand.

Syrian sand is suitable for glass manufacture. Analysis of samples are as follows (Technical Study I. Pages 17-18) :

Si O ₂	98.6 % - 98.9 %
Fe ₂ O ₃	0.05 % - 0.09 %

before treatment, and :

Si O ₂	99,5 %
Fe ₂ O ₃	0.03 %

after treatment.

which is compatible with standard specifications.

It was told by Syrian Glass manufacturers that sand deposits are used quite satisfactorily after washing and sizing.

Reserves are known for over 100 years.

Average cost to deliver it to the plant estimated : 30 syrian pounds per ton.

1.2 - Dolomite.

Syrian dolomite is available and suitable for glass manufacture after grinding and sizing only.

Analyses are as follows (Technical Study 1. Page 26)

CaO	31.74 %
MgO	20.22 %
Fe ₂ O ₃	0.12 %

1.3 - Limestone.

Syrian limestone is available and suitable for glass manufacture after grinding and sizing only.

1.4 - Other raw materials.

Other raw materials either are available; or can be imported. For example, Soda Ash is subject to an international bidding each year due to important fluctuations on the market.

In 1982, it was imported from Turkey. Average cost over the last four years to deliver this material to the plant = 150 U.S Dollars per ton.

1.5 - General conclusions concerning the availability, the homogeneity and the quality of raw-materials.

According to the feasibility study and to the opinion of local manufacturers, most of the raw materials are available; have to be beneficiated and therefore are suitable for pharmaceutical glass after proper upgrading.

Complementary studies of deposits can be achieved later on, to evaluate the appropriate treatments.

2. REQUIRED QUALITY OF THE FINISHED PRODUCTS.

"The viability of a pharmaceutical container industry will partly depend on the aggressivity of trade agents in their work of opening up markets. These markets will be developed in their sales, customer by customer, only if the production quality is compatible with the national requirements and in regard to the qualities normally supplied by the international competition".

(Technical study 1, page 34).

It is to be emphasized that the production of articles which are conform to the quality standards is a must and that pharmaceutical containers have very strict dimensional characteristics.

Therefore, it is crucial to ensure an intensive training, to secure the best possible technical support, and last but not least, to find out the right organisation giving decision priorities to the quality management over the production and sales management.

A deterioration in quality would lead to a loss of confidence and to the closing down of the company.

3. PRODUCTION SCHEDULE AND CAPACITY OF THE FURNACES.

The articles considered in the technical study are :

vials, drops, plasmas, flasks, pill bottles, powder jars for a total market from 1983 to 1988 of 18,118 tons to 22,433 tons.

Divided in a market for white glass from 1983 to 1988 of 6,212 tons to 8,632 tons and a market for amber glass from 1983 to 1988 of 11,906 tons to 13,801 tons.

(technical study 1 - pages 44,45).

Flasks only represent in 1988 : 11,257 tons of amber glass and 2,447 tons of white glass, that is to say

81.5 % of the amber glass market

28.3 % of the white glass market

and 61.1 % of the total market.

If these estimates are reliable estimates, it would be wise to select a certain number of articles and dedicate production tools to the manufacture of those articles.

Let us assume for example that **one concentrates on the manufacture of flasks.**

In that case, a complementary production could be looked for in the food processing industry, where there are important marketing potentialities to ensure a satisfactory profitability. For the time being, the capacity of the furnaces determined by ABR engineering is :

35 tons/day	for the white glass
60 tons/day	for the amber glass

According to the feasibility study, the production schedule taken into consideration uses on an average the "white furnace" at 77.2 % of its capacity and the amber furnace at 86.5 % of its maximum capacity. with gross tonnage/year of 9,057 tons and 17,381 tons respectively (technical study 1 - page 67)

These figures have to be reviewed taking into account a new selected production programme.

This aspect will be discussed in the next chapters.

4. LOCATION OF THE FACTORY AND CIVIL CONSTRUCTIONS.

4.1 - Location of the factory.

One plot has been allocated in Syria near the village of Adra at a distance of 23 km from the center of Damascus. It is said to be cheap. (state property) with obviously good communications. Soil investigations have already been carried out.

4.2 - Civil constructions.

The detailed description of civil constructions is correct. Contents are General site works, Raw products storage and handling, moulded glass unit, Utility buildings, workshops and general warehouses and service buildings.

It is felt that most civil constructions could have smaller surface resulting in a substantial reduction of the civil works investment cost.

5. TECHNOLOGY, EQUIPMENTS AND UTILITIES.

5.1 - Technology and Equipments.

The furnaces are of the regenerative type using extra heavy fuel oil with total pull of 60 tons/day for amber glass and 35 tons/day for white glass as mentioned before.

Production lines include 8 fore-hearths, 8 feeders equipped for operation with a 6 section IS machine, single and double gob, conveyors and ware transfers with all necessary equipments. (Technical study 2. Pages 229 to 244).

The adopted technology is the correct one.

Syrian glass manufacturers confirmed that furnaces with regenerators and forming lines using IS machines are already operated in the Damas area on the basis of 50 tons/day and that a good mechanical back up is available locally.

Regarding automatic inspection (pages 249 to 253) we think, because pharmaceutical containers are sophisticated products, that more is necessary. This part of the report is extremely weak.

The pelletized batch is not recommended, which is correct. The raw materials are considered separately : big products, small products, very small products, each category is divided in local products and imported products. Cullet is a fourth category. Regarding the batch preparation, the system proposed is correct but expensive. For example, silos for big products could be made of steel instead of concrete as they are made for small products. Handling, weighing and mixing equipments are adequate and able to ensure a good preparation which is a critical point in glass manufacturing.

To summarize this part, one can say that the adopted technology is quite acceptable, with a new approach regarding automatic inspection and some economical cuts in the raw materials handling and batch preparation system.

5.2 - Utilities.

Utilities include a compressed air system, a fuel oil system, a propane circuit, a fire fighting department, a piping network, two laboratories : a quality control laboratory, a chemical laboratory, two workshops; a mould repair workshop, a general mechanics maintenance workshop, electricity supply

water supply and transport equipments.

Generally speaking, one can say that utilities as they are described are convenient for the project, and in few cases rather expensive.

Regarding electricity supply which is a critical point, it was told that an electrical network will be installed with one or two stand by generators.

It is felt that, one stand by generator of 1 000 KVA is enough. A new project to supply electricity to cover expansion in the Damascus area will be operationnal in 1985.

Cost of electricity : from 14 to 20 Syrian pounds/KW

Water is available on site.

Wells and reservoir will be constructed at a cost estimated 60.000 Syrian pounds

6. PERSONNEL.

Staffing requirements are appreciated locally and do not fit necessarily with international practice.

Recruting and Training are important, specially for the key people who are the plant manager, the furnace foreman and operators, the manufacturing superintendents, the IS machine operators and adjusters, the batch superintendent, and the quality control engineer. On going, training will be set up in the plant. This is the best choice, if and 'only if a reliable technical assistance is provided for at least five years, which corresponds to the first campaign of production.

7. START UP, PRODUCTION AND TESTING PROCEDURES.

7.1 - Start-up and Production.

Assistance in starting up and production is mentionned in the feasibility study.

Here again, one has to emphasize that it is much more difficult to manufacture pharmaceutical containers than other common containers like bottles for example.

To maintain high performances in quality, it is felt that a specific contract of technical assistance with, possibly, permanent support of a glass manufacturer is necessary.

7.2 - Testing procedures.

Testing procedures are not mentioned in the feasibility study. Without such procedures, the client has no protection against the general contractor. It is necessary to define completely the testing procedures :

8. MARKET.

8.1 - First approach.

"Production plan for the Arab Pharmaceutical Industry in selected arab countries".

"Because no information was available on the ACDIMA market, it was decided that the total requirements of the ACDIMA market for pharmaceutical glass containers would be twice the requirements of the Egyptian market. This factor was provided by the ACDIMA staff, as a reasonable method of judging the size of the ACDIMA market. However, it has been assumed that the proposed ACDIMA pharmaceutical glass plant would achieve 80 % market share.

Therefore, the forecasts of pharmaceutical glass for Egypt were multiplied by 1.6 to arrive at the forecast for the ACDIMA countries".

(UNIDO Report - August 1978)

From this forecast, one can estimate the market for the ACDIMA countries without Egypt :

approximately 9,600 tons/year	in 1980
approximately 15,500 tons/year	in 1985

This is the total market for all kinds of glass containers.

8.2 - Second approach.

The market study made by ABR engineering as a part of the feasibility study is a good one, but unfortunately very much theoretical due to the lack of relevant information.

It takes into account the socio-demographic aspects, (ACDIMA countries without Egypt : 70 millions inhabitants) the world pharmaceutical industry (sales of pharmaceutical products), the packaging industry (glass containers consumption in Egypt, Irak, Syria and Sudan).

Market needs are estimated giving the following results :

Total ACDIMA. (with Egypt)	1978	1981
white glass	8,357 tons	10,934 tons (Egypt 7,434 tons)
amber glass	14,665 tons	19,340 tons (Egypt 12,377 tons)

The market for the ACDIMA countries without Egypt is estimated at approximately 10,500 tons/year in 1981, for all kinds of glass containers.

8.3 - Third approach.

When evaluating the production programme, different figures were proposed in the last version of the ABR Engineering feasibility study as we mentioned earlier.

They are :

6,212 tons to 8,632 tons for white glass from 1983 to 1988
and 11,906 tons to 13,811 tons for amber glass from 1983 to 1988

that is to say a total market of :
approximately 18,000 tons/year in 1983
approximately 22,500 tons/year in 1988

for all kinds of glass containers.

8.4 - Comparison.

tons/year

	UNIDO report 1978	Market study ABR engineering	Feasibility study version 1980 ABR engineering	
Total Market ACDIMA countries without Egypt all kinds of glass containers	9,600 -----			1980
		10,500 -----		1981
			18,000 -----	1982
				1983
	15,500 -----			1984
				1985
				1986
			22,500 -----	1987
			1988	

From these estimates, one can say that there is a great probability that the total market will be of the order of magnitude of 20,000 tons/year in the coming years.

Considering now, complementary productions for the food processing industry or more specifically for the packaging of soft drinks, for example, one can conclude that there is room for a new plant in the area with a certain number of constraints.

One of these constraints is that, the ACDIMA factories (it was told they are seven) in different countries constitute a protected market for the new company.

9. INVESTMENT COSTS.

The total investment was estimated in 1980 at approximately 68 millions \$ of which approximately 55 millions \$ is the initial fixed investment. These figures are not in agreement with the international practice. Equipments, works and services are overestimated in most cases, underestimated in few cases.

For example, a similar plant of same capacity is described in the UNIDO report with an estimated investment of approximately 20 millions \$ (table 1) which is far less than an estimated investment of 55 millions \$ two years later.

To be able to prepare later on a financial plan, it was therefore necessary to check the most important components. The detailed costs of equipments (table 2) were reviewed by comparison with projects under development and with potential suppliers. Among the most important components furnaces are overestimated, Production equipments are more or less correctly estimated.

Automatic inspection is underestimated technically and financially. Batch plant and treatment is overestimated.

Regarding other components, it is assumed that 1980 estimated costs remain valid in 1982 which is acceptable if one considers that they were generally overestimated.

The initial fixed investment was reviewed (table 3) where civil works are considerably overestimated.

It is estimated that 10 millions \$ is a maximum and it could even be less.

It is difficult to understand why there is such a discrepancy between the ABR engineering estimate and the normal and common practice

Finally, the initial fixed investment after checking in detail the most important components is estimated at approximately 45 millions \$ which is around 10 millions \$ less than the 1980 ABR engineering estimate.

It is to be pointed out that this estimate is based upon the most recent international standards and can be considered as a reliable estimate.

Total investment is indicated in table 4.

TABLE 1 - INVESTMENT COSTS (Amounts in thousand \$)

(Plant : one furnace : 100 tons/day)

UNIDO Report 1978

Site preparation	320
buildings	3,947
utilities	460
services	1,880
batch system	1,070
furnace	1,365
forming machines	1,810
lehrs	870
spare parts	300
carton forming)	
hand packing)	90
miscellaneous equipment	955
transportation	2,000
engineering	2,000
engineering contingency	900
Training and start up	1,200
T O T A L	19,167

TABLE 2 - DETAILED COSTS OF EQUIPMENT FOR

(Amounts in thousand \$.)

Machinery and Equipment	Feasibility study 1980	Expert estimates 1982	checked ←
Furnaces	5,101	4,000	←
Production lines	7,254	7,254	←
Production treatment	1,193	1,600	←
Automatic inspection	1,351	2,400	←
Packing	870	500	←
Batch plant and treatment	4,400	1,500	←
Compressed air	681	500	←
Fuel oil	54	54	
Propane circuits	809	809	←
Water circuits	127	127	
Fire fighting	164	164	
Piping	869	650	←
Quality control laboratory	114	114	
Chemical laboratory	143	143	
Mould repair workshop	618	400	←
General mechanics maintenance workshop	183	183	
Garage	42	42	
Refractory material shop	106	106	
Joiner's Workshop	16	16	
Cold end maintenance	8	8	
Forge and welding shop	178	178	
Electrical and electronic maintenance	26	26	
IS machines maintenance	62	62	
Electricity	2,576	1,300	←
Transport	448	448	
TOTAL	27,393	22,584	

TABLE 3 - INITIAL FIXED INVESTMENT (amounts in thousand \$.)

	Feasibility study 1980	Expert estimates 1982	Checked
Land	58	58	
Civil works	15,219	10,000	←
Know how	491	1,500	←
Machinery and equipment FOB	27,393	22,584	←
Transport	1,335	1,335	←
Erection (technical assistance included)	4,878	5,000	←
Technical assistance in commissioning	856	1,000	←
Offices and canteen	343	343	
Means of transport	580	580	
Engineering	3,886	3,500	←
Total initial fixed investment	55,039	45,900	

TABLE 4 - TOTAL INVESTMENT (amounts in thousand \$)

	Feasibility study 1980	Expert estimates 1982	checked
Initial fixed investment	55,039	45,900	←
Reproduction costs	2,583	2,583	
Financial charges before starting up	2,776	2,776	
Working capital (1st year)	7,557	7,557	
TOTAL INVESTMENT	67,955	58,816	

10. ECONOMIC AND FINANCIAL STUDY.

It is felt that it is not necessary to review the financial and economic evaluation of the project.

First of all, if the project is feasible with a total investment cost of 68 millions \$, it will obviously be feasible for a reduced amount.

Secondly, results are depending too much on the ability of the key people to manufacture products of good quality in demanded quantities, which means that computations are more or less illusory.

Thirdly, marketing prospects look satisfactory, but at the moment it is difficult to know wheather all ACDIMA factories will be 100% clients of the new company or not.

- SECOND PART -

SUPPLEMENTARY NOTES

RELATED TO THE STUDY

1 - PRODUCT TYPES TO BE MANUFACTURED, OPTIMUM CAPACITY, AND PRODUCT MIX.

The quality of glass containers is poor, when compared to international standards.

Pharmaceutical glass containers because of their relatively small size present special manufacturing problems to the normal glass plant that is geared mainly for the larger sized bottles.

It is felt that it would be safer to concentrate efforts on manufacturing a limited number of products representing around 80% of the demand, rather than trying to supply a great variety of products. These glass containers (white glass and amber glass) could be produced in either one or two furnaces, and supply the pharmaceutical industry and the soft drink producers as well.

It is considered that a total of 20,000 tons of glass/year is acceptable and is a minimum to build a new industry on safe commercial and financial grounds.

With the following furnace capacities and products :
either only one furnace (around 90 tons/day)

or

two (white glass furnace (around 45 tons/day instead of 35 tons/day)
furnaces} (amber glass furnace (around 45 tons/day instead of 60 tons/day)

Assuming 70% of the maximum capacity as an average production which is conservative and reasonable, these figures lead to approximately :

11 500 tons/Year for each furnace (45 T/day)
and 23 000 tons/year for two furnaces (45 T/day)
 or one furnace (90 T/day)

A selected product mix could be, for example :

white glass containers	pharmaceutical	50%
	soft drink	50%
amber glass containers	pharmaceutical	100%
	exclusively	

In other words, these new figures are able to ensure better commercial and financial results, keeping in mind that the new production will be partly in competition with local glass manufacturers.

2. PLASTIC VS. GLASS.

Some of the pharmaceutical manufacturers mentioned that their plans to install faster and more automated filling lines cannot be implemented because of the problems encountered with glass containers.

The glass containers they receive are usually off specifications as to shape and dimension and therefore create problems in the high speed filling machines.

They are attempting to switch from glass to plastic wherever possible because of these problems plus the inherent advantages of plastic bottles such as lightweight, non-breakability, etc....

However, this is not possible for all products, because of non-compatibility of plastics with the product packaged.

UNIDO Report, 1978

It is felt that plastic and glass are not really in competition for the manufacture of pharmaceutical containers. Very little information is available on the glass container market vs the plastic container market and it is not possible to determine a world trend.

Both containers have advantages and are dedicated to specific pharmaceutical products.

3. MARKETING IN ACDIMA COUNTRIES.

Very little published information is available on the packaging industry in ACDIMA countries.

Information on the total consumption of glass in these countries is not known. The major end use market for glass containers is the soft drink industry. Very little information is available on Glass Container manufacturers in ACDIMA countries.

UNIDO Report, 1978

The anticipated market for pharmaceutical containers look favourable, but it would be wise to check what is really the "protected" market in ACDIMA countries and to confirm, up to what extent, ACDIMA factories are potential customers.

It is suggested to send to ACDIMA factories a very simple questionnaire, such

as this one :

- QUESTIONNAIRE -

Country :

ACDIMA factory :

Address

Product	item 1	item 2	----	item i
Consumption of glass containers in tons/year	_____	_____		_____
specify white or amber glass	_____	_____		_____
Specify origin	_____	_____		_____

Information valid for the last three years.

Assuming that a new ACDIMA factory, installed in SYRIA will manufacture pharmaceutical glass containers, would you buy products manufactured in this new factory and at what conditions ?

In your opinion, what is the size of the market for glass containers in your own country ? Specify product and colour (white or amber).

4. PROBLEMS OF TECHNICAL ASSISTANCE.

On the long term, technical assistance on site is necessary. It is a critical point.

It has to be backed up by a glass manufacturer wether on a partnership basis or according to a specific contract.

Training and start up are part of such a contract. It is not recommended to train abroad, with the exception of few key people who could develop their knowledge and experience in other factories in addition to on-site training.

5. FORMULA FOR THE SELECTION OF SUPPLIERS AND CONTRACTORS.

The selection process necessitate several rounds of discussion with short listed companies including :

- a technical check up which is a complete technical description of : buildings, machinery and equipments, erection, start up, training, technical assistance.

- a financial check up :
detailed price list, pricing policy, penalties

- references and guarantees

- general conditions and rules of contract.

and finally, a thorough comparison of offers preparing the final decision.

- THIRD PART -

CONCLUSIONS

AND

RECOMMENDATIONS

1. The updated feasibility study is technically acceptable within certain limits.
The most important points are :
 - 1-1. Raw materials are available in Syria and are already used by Syrian glass manufacturers.
 - 1-2. The type of technology selected is the correct one.
 - 1-3. Capacity of the plant
It is recommended either : one furnace 90 tons/day
or : two furnaces 45 tons/day
one for white glass, one for amber glass.
 - 1-4. Automatic control has to be reviewed according to the possibilities offered by the most modern electronic equipments to provide a satisfactory end-product to the client.
2. The updated feasibility study is acceptable regarding the evaluation of the market. But it has to be completed. Market depends very much on the ability of the new manufacturers to manufacture good products.
Potentialities exist to develop such a new production which should be strictly limited to a certain number of products. (see details in the report).
3. The updated feasibility study is not financially acceptable because the fixed investment costs are overestimated. **This part was reviewed in detail and the estimate of 45 millions \$ is valid which is in 1982 10 millions \$ less than the 1980 ABR engineering estimate.**
This discrepancy is obviously in favour of the feasibility of the plant.
4. Technical assistance and Back up by a glass manufacturer is necessary at least during the first campaign (five years).
5. UNIDO could help all parties involved in the project:
 - in preparing the final selection of suppliers and contractors
 - in assisting to control the implementation of the project.
 - in supervising the testing procedures before the final acceptance of the plant.

To summarize, the pharmaceutical glass container project is feasible.

Precautions are necessary :

- to negotiate prices and contracts
- to delimitate capacities and markets
- to define assistance and back up.

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