OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

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

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

07469

Distr.
LIMITED

ID/WG.250/3
2 May 1977

ENGLISH

United Nations Industrial Development Organization

Workshop on Case Studies of Aluminium Smelter Construction in Developing Countries

Vienna, Austria, 27 - 29 June 1977

PLANNING OF ALUMINIUM SMELTER 1/

by

Y. Ismail*

---

* Chairman of the Aluminium Company of Egypt

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. This document has been reproduced without formal editing.

id.77-3263

While realising that industrialization can furnish the widest chances for the overall development of the developing countries, yet we appreciate that some minimum basic requirements should be made available to ensure proper development through industrialisation:

electric power, raw materials, capital, infra-structure, manpower and markets.

The main factor of those elements may change for each type of industry and for this reason intensive analyses of all the prevailing conditions and the overall status of the country should be considered before the list of priorities of the proposed industries can be made. The availability of all the above-mentioned basic requirements in a developing country can furnish a strong base for successful establishment of aluminium industries, but still the absence of one or more of those elements can be tolerated as long as the proper substitute could be found.

On the other hand, establishment of aluminium industries in some of the developing countries may be decided for other economical, technical and social reasons of which we may mention the following:

1) Making use of some of the potential national natural resources.
2) Diversifying the national income resources.

3) Employing some of the national wealth in hard currencies.
4) Establishing new social and economical development centres
5) Satisfying some of the local demands in aluminium metal.

I. Selection of Aluminium Smelter Capacity

Once the decision is taken positively, the capacity of the aluminium smelter will be the next point to consider, guided by the following factors.

1) The optimum economical size of the aluminium smelter;
2) The volume of the financial funds which can be made available for this industry;
3) The volume of the electric power and other resources which can be devoted for this industry.

Under the present conditions of today:

- A 60,000 - 75,000 mt aluminium smelter can be considered as the smallest economical size.
- A 120,000 - 150,000 mt aluminium smelter can be considered as the optimum economical smelter size.
- A 300,000 - 400,000 mt aluminium smelter can be considered as the maximum economical smelter size.

It is quite obvious that the first and second categories of aluminium smelters are those to be considered in the case of developing countries while the third category of aluminium smelters is by all means out of question.

II. Site Selection for Aluminium Smelters:

This should be decided on the basis of techno-economic studies and investigations, while not neglecting some other specific factors such as strategical and social factors.

In Egypt the selection of the site for its aluminium smelter was one of the most difficult points to decide upon and for that purpose at least seven different locations were investigated and evaluated in the period between 1954 and 1970.

- Alexandria could be the best from the point of view of import and export possibilities, but is the most expensive and unreliable with regard to electric supply from the Aswan high dam.

- Aswan could be the best from the point of view of electric supply, but is the most expensive and unaccessible as regards import and export.

- Cairo could be the best from the point of view of infra-structure, skilled manpower and local marketing, but it is not the same as regards cheap electric energy and pollution problems.

- Suez could be accepted from the point of view of import and export but not with regard to electric power and for some strategical reasons.

- Quseir and Safaga on the Red Sea coast could be encouraged for development purposes but are not acceptable from the point of view of infra-structure and manpower.

Finally, came Nag-Hammadi to offer the best possible site for the establishment of the Egyptian Aluminium Smelter, being the nearest to the source of electric power of the Aswan high dam and also being accessible to the Red Sea at Safaga and to the Mediterranean at Alexandria and to all local consumers, by roads, railways and by the Nile and the other navigation canals.

In the meantime Nag-Hammadi could also realize the strategical and social requirements set forth for such an industry in the modern Egypt.

Accordingly, it was decided to establish the Egyptian Aluminium Smelter in the desert area at Nag-Hammadi and all efforts had been directed to make out of it a new master developing centre for the whole of Northern Egypt.

III. The Selection of the Product-Mix

The selection of the product mix for a new aluminium smelter in a developing country depends on the following factors:

(a) The possibility of getting the know-how from a world reputed aluminium producer;

(b) The level of skill of the available manpower and to which extent they can master the production technology of the advanced aluminium alloys and shapes;

(c) The expected marketing status of the new enterprise and the expected channels where it can get its products distributed.

We may endeavour to choose from the very beginning a highly sophisticated product mix which is legable to give back the maximum revenue. But such a decision can be very dangerous unless we are assured that we will find the proper market for all our products taking into consideration that most of the potential consumers of the alloys and shapes are captive for their own affiliated smelters.

In general it is always easier to produce and to sell aluminium ingots and T sections 99.5% and 99.7% for remelting rather than to produce and to sell alloys and shapes.

A natural development in this field is also recommended after mastering the major technological problems usually connected with the simple production of the aluminium metal itself.

IV. FORWARD AND BACKWARD INTEGRATION

In the field of aluminium production, three different stages have to be distinguished and each of them should be dealt with quite separately.

1) Bauxite treatment for the production of alumina;

2) Production of the aluminium metal by electrolysis;

3) Fabrication of the aluminium metal for the production of semi-finished and finished products.

Each of those industries is of quite a different nature and needs very specific and different types of skill in the fields of production, handling and sales.

Consequently, forward and/or backward integration in the field of aluminium industries in developing countries is not recommended to be included in the same industrialization programme.

However, if for certain special reasons it is decided to cover two or more of those stages in the same industrialization programme, each of them should be dealt with as a separate project.

V. Planning and Construction Management

Amongst the metallurgical industries, aluminium smelters are characterized by the following nature:

1) The wide spreading of the construction areas.
2) The big number of industrial and services buildings.
3) The big dimensions and the heavy structures of the production premises.

4) The great amounts of electric and mechanical equipment and machines, electric connections and instrumentation systems.
5) The evolution of great amounts of harmful gases which can detriment plantations and affect the environment if not treated adequately.

Accordingly, the construction area for aluminium smelters should correspond to the following requirements:

1) Nearest to electric power resources and other production requirements;
2) Nearest to the local aluminium consumers and the exporting ports;
3) Availability of big areas of ground with possible expansion in the future. Most favourable are desert areas located under the prevailing wind with respect to plantations and other human activities.
4) Inert soil containing minimum sulphates and alkalines, of maximum electric resistancy and maximum bearing strength.

The general layout of the aluminium smelters should assume a logical situation of the different production, stores and services buildings relative to each other to ensure the shortest transportation routes of the raw materials and products and also to minimize its crossing. Administrative and services buildings should be located above the wind while the gases and heat generating premises and inflammable materials stores should be located below the wind.

Possibilities for extension in two of the smelters sides at least should be considered always.

VI. Construction Management

The realization of an aluminium smelter in the time limits adopted in the feasibility and techno-economic studies necessitates careful and elaborate planning programming and follow-up and it goes without saying that an elongated execution period results always in an increase in the investment and consequently changing the whole economical structure of the project.

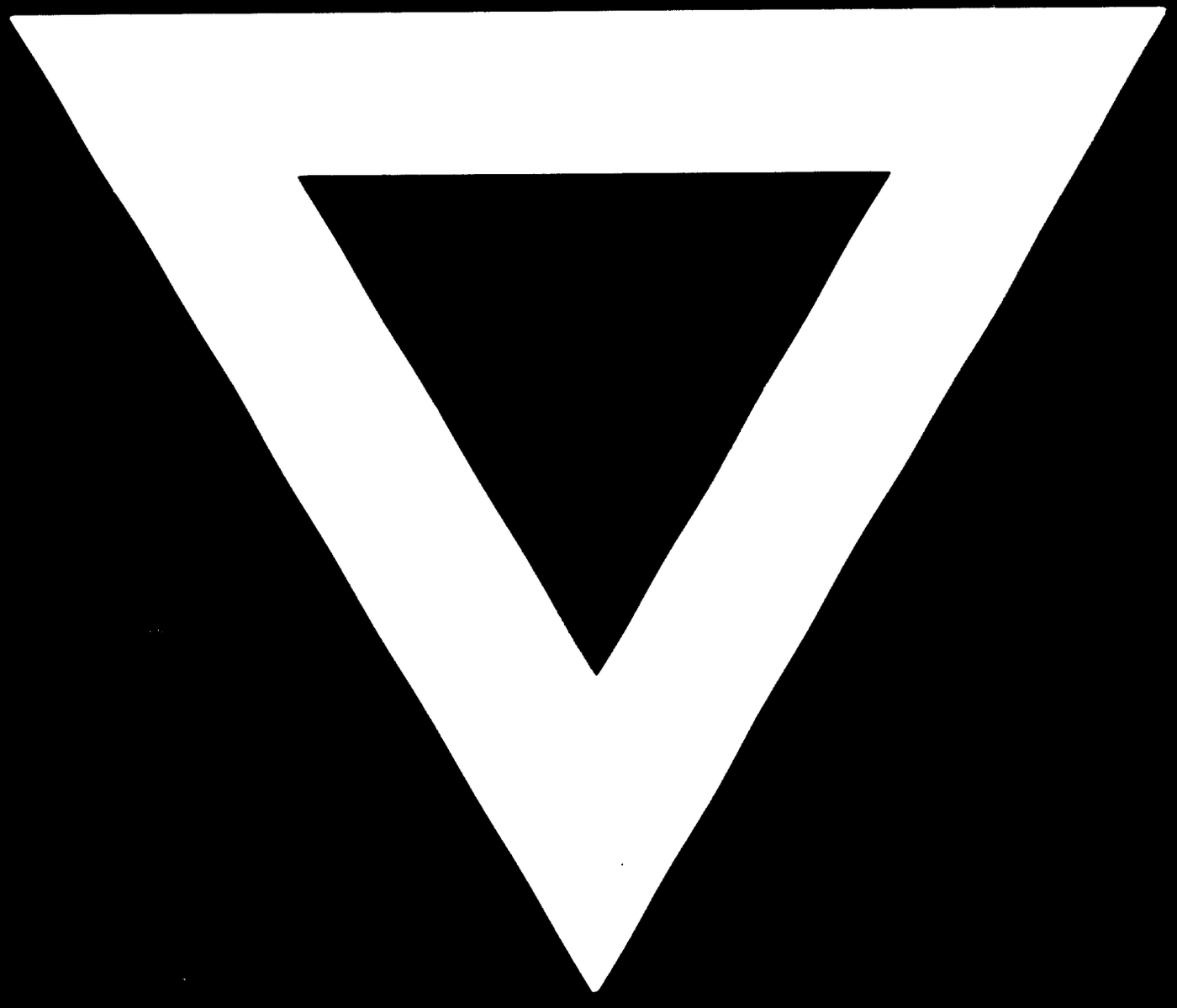
Programming of the construction and erection activities should be worked out in virtue of a detailed critical path design whereby construction and erection activities have to be specified in full detail and the corresponding volume of work in each case has to be specified.

Based on those studies, construction and erection material and equipment have to be secured timely and the construction and erection groups have to be mobilized.

Co-ordination and follow-up should be the every-day task of the powerful executive directors who have to be selected and devoted in the construction site for this job.

Parallel to the engineering and technical activities running on the construction site there should be an equivalent continuous financial support to ensure an uninterrupted flow of all construction and erection requirements.

G-319



77.09.13