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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

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United Nations Industrial Development Organization

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THE INDUSTRIALIZATION [illegible]

PROBLEMS [illegible]

[illegible][1]

[illegible] Pierre
TECHNIP
Rueil-Malmaison
France

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id.69-4113

D00436

United Nations Industrial Development Organization

Distribution
LIMITED

ID/WG.34/66
23 July 1969

ORIGINAL: ENGLISH

Interregional Symposium on the Development of the Petrochemical Industry in Developing Countries

Baku, USSR, 20 - 31 October 1969

ID. SYMP. 7/16

THE INDUSTRIALIZATION OF DEVELOPING COUNTRIES: PROBLEMS OF PROFESSIONAL TRAINING AND TECHNICAL ASSISTANCE WITH THEIR CONTRACTUAL ASPECTS 1/

by

J. [illegible]

Technip
Paris, France

In developing countries industrialization is felt as a vital necessity. Before launching one into the great industrial adventure, it is essential for those concerned in these countries to be fully aware of the problems they will have to solve. In this field perhaps more than any other, situations become quickly irreversible and any "Faux pas" may have unpredictable consequences for the success of a project. For some developed countries which have already an industrial past, these problems are not new. However, the quick evolution of techniques and methods do not prevent difficulties, for the problems to be solved are so delicate that the biggest industrial companies often fall into this trap.

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That is the question we propose to [illegible] [illegible] [illegible] [illegible]ation, emphasizing especially the problems raised by [illegible]er [illegible] and [illegible] and technical assistance as they cannot be dissociated from the corresponding contractual forms, that is, from the guarantees which can be connected with them and the degree of liberty which can be left to the contractors who have accepted these forms of collaboration.

Industrialization [illegible] modern world.

- First, in [illegible] industrialized countries where technical [illegible] the [illegible]
- [illegible] their [illegible] industrial products [illegible] for their consumption.

[illegible] which govern [illegible].

[illegible] lower costs [illegible] products in [illegible] to meet the requirements of [illegible] particular and who must be more [illegible].

[illegible] step towards industrialization [illegible] expansion of already existing [illegible] always [illegible] industrialization [illegible] local [illegible] national [illegible] and which [illegible] with the time.

[illegible]

[illegible] to be manufactured must [illegible] selected [illegible]:

- [illegible], the [illegible] and security of supply
- [illegible] national needs in the categories of [illegible] and determine its evolution)
- possibilities of absorption of these products on the international market

- the future possibilities of upstream or downstream integration.
  When the [illegible] manufacturers or [illegible] and producing and distribution [illegible], [illegible] increase the yield of profit [illegible] developed [illegible], [illegible] finished products from [illegible].

2 - The process of manufacture must be properly selected.
  One must be sure of the following:
  - that the process has been industrially proved and that no major difficulties are going to occur when the plant is put onstream. Is the equipment perfectly well designed and safe?
  - that the quality of the products obtained by using this process is excellent and that these products are to be sold on the international market, they will be economically acceptable;
  - that the process and the corresponding products are not going to be surpassed by a process which is likely to be quickly and widely diffused;
  - is the licensor [illegible] in improving his process and is he going to put at the licensee's disposal the improvements he is likely to develop in the future?

3 - It is essential to determine the capacity of each production unit.
  This capacity has direct bearing on:
  - the production cost of the manufactured goods (investments, yield, utilities consumptions, labour etc....)
  - it stands to reason that to start, maintain in operation, and above all to repair the complex machinery put at the user's disposal by modern industry, one needs highly qualified labour with several years of experience in this field.
    How to find it and train it?

When talking of modern complex machines, one cannot but think how difficult personnel training is, and of the results one should expect from it! Every plant, at least during the first five years of its life, is more likely to see its [illegible] approach, and if it is simple and if it's capacity does not exceed certain limits.

It is precisely the twofold aspect of cost price and determination of the plant capacity which is the hardest to approach.

- what is the use of having modern equipment if one does not know how to start it and operate it properly? It is essential that a manufacturer, when resolving the various problems of industrial equipment, should study and resolve also the problems of labour. In developing countries especially, these problems are most important and too many people concerned with industrialization have a tendency either to underestimate their importance or to expect miracles from personnel training. It is true that in this field, as in many others, experience teaches more than anything else.

4 - Once onstream, a plant must produce its maximum very quickly. This is the phase of improvements, whether they relate to the quality of products, to the yield, the duration of runs reduction of operating personnel, reduction of maintenance expenses, or to the upgrading of by-products etc....

Isn't it by experience that generally a positive result from the general economy point of view can only be contemplated after these phases of improvement?

5 - To produce is necessary, but one must also sell. It is essential to organize very early the home distribution network and to see the methods of placing the products on the international market, for the products are likely to be exported as early as the first years of production, as it is at that time that the national market is developing.

These networks are then to be developed in line with production development, whether this development is obtained by means of improvements or by expansion units.

As regards long or medium term sale contract we must also raise the problem of confidence in the likelihood of regular production on the one hand and steady consumption on the other.

As they cannot be really dissociated, we do not contemplate going into the details of each of the problems to be resolved; nevertheless, we shall raise them and we shall emphasize those relating to personnel training and Technical Assistance, showing the advantages which can be derived in the future, from the method we call "total contractor method".

The determination of the products to be manufactured requires a survey of the home market, and, often also of the international market. It is clear that those concerned with industrialization of developing countries do not and cannot have in their countries the manpower capable of estimating the marketing possibilities of such and such a product in the years to come. To do that, one must dispose not only available data on the market of these products but also be able to indicate the rhythm of its future development (which is not necessarily a simple extrapolation of the past development) and the evolution of its price. The determination of the international sale price is delicate but it is of paramount as the success of any industrial operation depends on it. Of course, if those concerned in the industrialization of developing countries contemplate selling very little or not selling on the international market, then the problem is much simplified, but in the near future, will it really be economically and politically sound to produce in a developing country at cost prices which compare unfavourably with the international prices at which these products can be delivered at their borders.

In most cases, it is of the interest of those concerned in the industrialization of developing countries to call for one or several internationally known specialized companies, provided such companies are perfectly independent from any important industrial or commercial organization carrying on its activities in fields where investigation is precisely required. In view of all the national and international parameters, these specialized companies can, as it were, define a plan of industrial development, determining:

- the qualities of the products likely to be manufactured
- the quantity which can be commercialized either at home or abroad, in view of the probable prime cost and the selling prices.

In some distinct cases of a specific product, direct sale agreements may be made between those concerned in the industrialization of developing countries and international consumers. The problem is much easier to solve, as the capacity to be set up is either automatically determined if the market is maintained, or determined as a result of market surveys of future requirements.

Let us assume then, that in all cases, the quality and quantity of the product (s) to be manufactured are determined.
What is the best way to proceed?

Whenever it is a question of either the first industrial plant or a major extension of an existing industrial plant in a developing country, we think it logical to proceed according to the method, which we shall call "method of the total contractor" and which we propose to describe later on.

Method of the total contractor

1 - Difficulties of application of the methods prevailing at the present time

At the present time, when a client wishes to build an industrial installation and this is true in any country, he can choose between several methods:

- turnkey contract
- lump sum contract
- cost + fee contract
- contract fixed on hourly rate

Of course, slightly different formulae can be used but the conclusions to which we shall come are sufficiently general not to have to examine these formulae in detail.

It goes without saying that in a developing country, the contract fixed on hourly rate and the cost + fee are not acceptable as the client cannot check the activities of the selected contractor.

For the lump sum price method, a total price of the installation for equipment and erection, and a general list of approved suppliers is decided upon. During the contract, the client chooses the suppliers on the contractor's proposal. At the completion of the contract, profit and loss are distributed between client and contractor according to a formula previously defined by common agreement.

This method can hardly be applied by a developing country as the latter is generally not equipped to make the maximum of profit out of the selection of the supplier for each piece of equipment. Moreover, the problems of responsibility and therefore, of guarantees can become subject to dispute, which is not desirable either for one or the other of the parties.

Let us see now the method of the turnkey contract, which is commonly used in developing countries. What are the various stages of this working method and the difficulties raised by its application.

First of all, the turnkey contract requires a perfectly thorough and accurate call for bids so that no misunderstanding of its terms can be possible and in order to avoid any ambiguity during the comparison of the offers or even later on, during the execution of the contract. But the establishment of such a document is not an easy matter and the specialists of those in charge of industrialization are not always able to perform this task.

This document is, in effect, of paramount importance for the technical, commercial and juridical conditions upon which the client wishes to discuss before placing a contract. It is difficult to gather in this call for bids all the details necessary for the perfect definition of the equipment as regards its specifications. Nevertheless, this method can be used, but it requires the previous determination of the processes to be used and therefore involves particularly long studies to define the main equipment and to fix the norms or standards of construction for the various units constituting the installation.

Even then, and above all if thorough and detailed specifications cannot be imposed, it is clear that the contractor can trifle with the quality of the material he has to supply. On that account, if the price he had

to accept to get the contract seems insufficient to him, he may be tempted to equip the future plant with material which will normally meet the requirements but may cause difficulties in the start up and in reaching full capacity. The client will be essentially the one to bear the consequences.

Other methods are also likely to be applied by the contractor to reduce the cost of design and construction. For instance, the installation can be simplified to the extreme by reducing the number of instruments, the surface area of each unit can be reduced so as to decrease the lengths of pipes, electric cables etc...

In this case, start up and operating difficulties will be increased. When a plant is intended for a developing country which cannot check these basic construction parameters, everything is possible to an unscrupulous contractor.

On the other hand, the client may think he is perfectly safe thanks to the guarantees he had so much difficulty in obtaining from the contractor and which are comparable in every point to the traditional guarantees that such and such a high standing company has already [illegible] obtained.

One knows what is to be thought of these traditional guarantees, when plants are more and more complex and use more and more advanced technology where extrapolation is often carried to the extreme limits of daring.

Of course the contractor accepts an important liability but the amount risked by the client, if the plant does not work properly, is far more important than the contractor's liability. It can hardly be otherwise, as the annual turnover reached by a plant in normal operation is not far from the total investment required for the construction of the plant.

A year's delay in the start up represents therefore, for the client, a loss more or less equivalent to the total amount of the contract signed with the contractor. When one knows the ridiculously low profit a contractor can count upon in view of the international competition, one cannot see how the client's loss might not reach 10 to 20 times the maximum sums he has just cause for expecting from an honest contractor in case of any disagreement.

What about the reception of plants built on a "turnkey basis"? In some cases this takes place [illegible] the end of the construction period, the plant is [illegible] delivered to the client for the production [illegible] preliminary run [illegible] runs [illegible] to prove [illegible] guarantees, [illegible] when contractor [illegible] responsibility [illegible] client's personnel. In some cases, [illegible] contract has been signed between the two parties for the training of personnel. Fairly often, the client hires the contractor's [illegible]. Of course, this is [illegible], but it does not resolve all the problems. For instance, if the client wants to have the mechanical guarantees maintained, the contractor must check the work performed in the maintenance shop; for all that the shop should be organized and equipped [illegible] spare parts must be available.

In any case, and whatever the good will of the parties may be, the efficiency of the plant is often poor and [illegible] is always delayed to a considerable extent, unless the [illegible] of the client is really traditional.

What are the delicate problems arising in personnel training and how are they solved? An [illegible] concerned in the industrialization of a developing country wishes above all to have [illegible] local personnel. Furthermore, industrialization [illegible] means of fighting against unemployment and this argument is often [illegible] to start or accelerate [illegible] decision on industrialization. Unfortunately, even the biggest industrial installations [illegible] little personnel [illegible] minimum of perfectly experienced and trained men is sufficient to operate [illegible] - for it is essentially team work - and it is illusive [illegible] they will be operated better and quicker if the operating personnel is [illegible] or if they are [illegible] out [illegible] manually, that is without automation. Generally it is quite the contrary.

This does not mean that it is impossible to have modern plants operated by local, especially trained personnel. It only means that this training is absolutely necessary and that it always takes a long time, and that, in most cases, it is better to start with skilled men and to replace them little by little, by locally recruited personnel, who have been previously trained and are slowly but surely learning their difficult craft.

Problems raised by maintenance are more delicate when one thinks, for instance, of the automation systems which are installed in modern units with huge complex machines, turbines or compressors, which must be adjusted and inspected. It is far more difficult to train a mechanic than an operator. At least five or six years are necessary to succeed in this profession, all the same it would be risky to entrust young people with only 5 or 6 years of experience, with the maintenance of such machines.

Personnel training must not be limited to operating and maintenance personnel in developing countries with no experience in industrialization; all categories of personnel must be trained and adapted to their new functions, because it is impossible to start a plant and maintain it in normal operation without disposing of an already organized and, if possible, run in general industrial infrastructure. What can be done if the warehouse is not organized nor provided with all kinds of spare parts? If it is not regularly supplied? What can be done if there are no raw or consumable materials, if there is no equipment in the maintenance shop, if finished products are not sold or sent, if the local personnel is not properly controlled or managed, if the technical assistance personnel or the suppliers representatives have neither accommodation nor transport?

In fact, the whole problem must be solved; there are not actual problems of plant construction, of personnel training, of start-up assistance etc... there is one general problem which, at this level, must be perfectly directed and coordinated. If a link of the chain is missing, very important sums will be lost by one or the other of the parties and mainly by the client.

At present, the experience of developing countries in industrialization, the rapidity of the industrial progress on a world basis, as regards processes as well as technology, the difficulties met as to the quick adapting of the personnel of underdeveloped countries to the needs of operation and maintenance of modern plants, all this leads us to think that the usual methods of turnkey contract are really almost [illegible] in the case of underdeveloped countries [illegible] further, and propose to those concerned in industrialization [illegible] the so-called "method of the total contractor" which we propose to describe now.

2 - Method called "method of the total contractor" and its advantages

Its principle is that the contractor should be more alive to the solution of the overall problem.

That is mainly:

- to build at lower cost, a plant of a determined capacity,
- to train the personnel who shall be [illegible] in charge of operating this plant and of constituting the teams which will start it up within a reasonable time
- to organize and to set up all the services which will directly or indirectly contribute to the future start-up and operation
- to improve the quality of the products obtained, the recorded yields, the durations of continuous operation etc. - to make a long story short, to increase production over and above the guarantees while reducing as much as possible cost prices
- to go on training the local personnel during the operation, so that they can replace within the shortest time, the contractor's personnel.

The total contractor undertakes the first series of responsibilities; that is:

- construction of the plant according to the turnkey traditional methods, with technical guarantees
- professional training of part of the local personnel who will be able quite quickly to assume, under the general responsibility of the contractor, functions involving their

direct responsibility inside the plant. Therefore, personnel shall be entrusted to the contractor.

- organization of client's [illegible] services [illegible] contractor, and corresponding training of them.
- preparation for start-up and actual start-up including test runs.

To carry out the start-up, the contractor constitutes, under his direct responsibility, a team consisting of the contractor's representatives and of a part of the previously trained personnel of the client. There will be such teams in each activity: operation, safety, maintenance, warehouse, purchase, etc....

The client's personnel who are not immediately put in charge of a certain function are limited and trained on the site by representatives of the contractor. As needed, or in order to replace contractor's personnel, additional personnel is recruited when necessary by the client according to a rhythm defined in agreement with the contractor.

The main difficulties come from the presence on the site of too many teams whom it is impossible to entrust with definite responsibilities and who, by constituting themselves in parallel hierarchies lead to many a difficulty for the operation itself as well as from the psychological point of view. It is therefore essential to study thoroughly the personnel requirements.

The basic teams and the personnel supplied by contractor to client are included in the lump-sum price and will be present on the site from the mechanical acceptance which confirms the completion of construction, to the end of the test runs.

All supplies of material, instrumentation, consumable material catalysts, spare parts consumption etc.... necessary for the plant operation during this period are also included in the lump-sum price.

Therefore, the client will only bear the supply of raw materials and if any, of some utilities, the client's personnel trained on the site as well as the personnel in charge of their training being supplied by the contractor. Up to the end of the test runs, the facilities remain the contractor's property.

In order to give the contractor a financial interest in the results, an estimate of the production of finished products according to contractual specifications is established when the lump-sum contract is being negotiated; the contractor is then interested in the profits derived by the client from the excess of production. Of course, the contractor's interest has previously been [illegible].

The contractor is not penalized if the estimated production has not been reached, except if the units to be started up have absolutely conventional characteristics.

Personnel training for mechanical acceptance is carried out by the contractor's teams who will start up the plant. The contractor's teams, previously or simultaneously trained, will take over the client's personnel training. These arrangements make it possible for homogeneous teams to be built up where men have mutually accepted each other. Depending on the number of men concerned and on circumstances, arrangements can be made for them to be sent on specialized courses.

Generally, this personnel training is not completely included in the lump-sum price because no provision can be made for variations in the natural ability of the personnel involved.

Once the test runs have been accepted by both parties, the handing over of the property takes place.

Contractor and client have mutually agreed upon a one-year plan for the use of detached personnel and for the introduction of the client's personnel, and this, [illegible] of the [illegible] or services of the client.

The contractor's personnel are paid by client on an hourly rate which can be near the contractor's cost price; if so, the contractor is, to offset this, interested either in the total production of this first year of operation, or in the improvements made in the plant during this period and confirmed by a new test run carried out at the end of the year.

The system can also be used during the second year, provided that the contractor's personnel on the site remain in sufficient number.

The method of total contractor has not yet often been used. It presents for the client, the following advantages:

- greater interest of the contractor in the success of the plant, for the greater profit of the client
- clearer responsibilities, mainly as regards mechanical guarantee
- thorough professional training of the client's personnel, with constitution of homogeneous teams, basis of the start up success
- reduction of the expenses relating to the client's personnel thanks to better planned employment which can be postponed until periods of real need.
- more rational organization from the beginning, preventing hold ups, changes of management during start up etc.

Doubtless, the contractor's responsibilities and risks are greater.

But with this working method he is perfectly sure that the plant he has constructed is going to work and that it will not be held up by unforeseen difficulties.

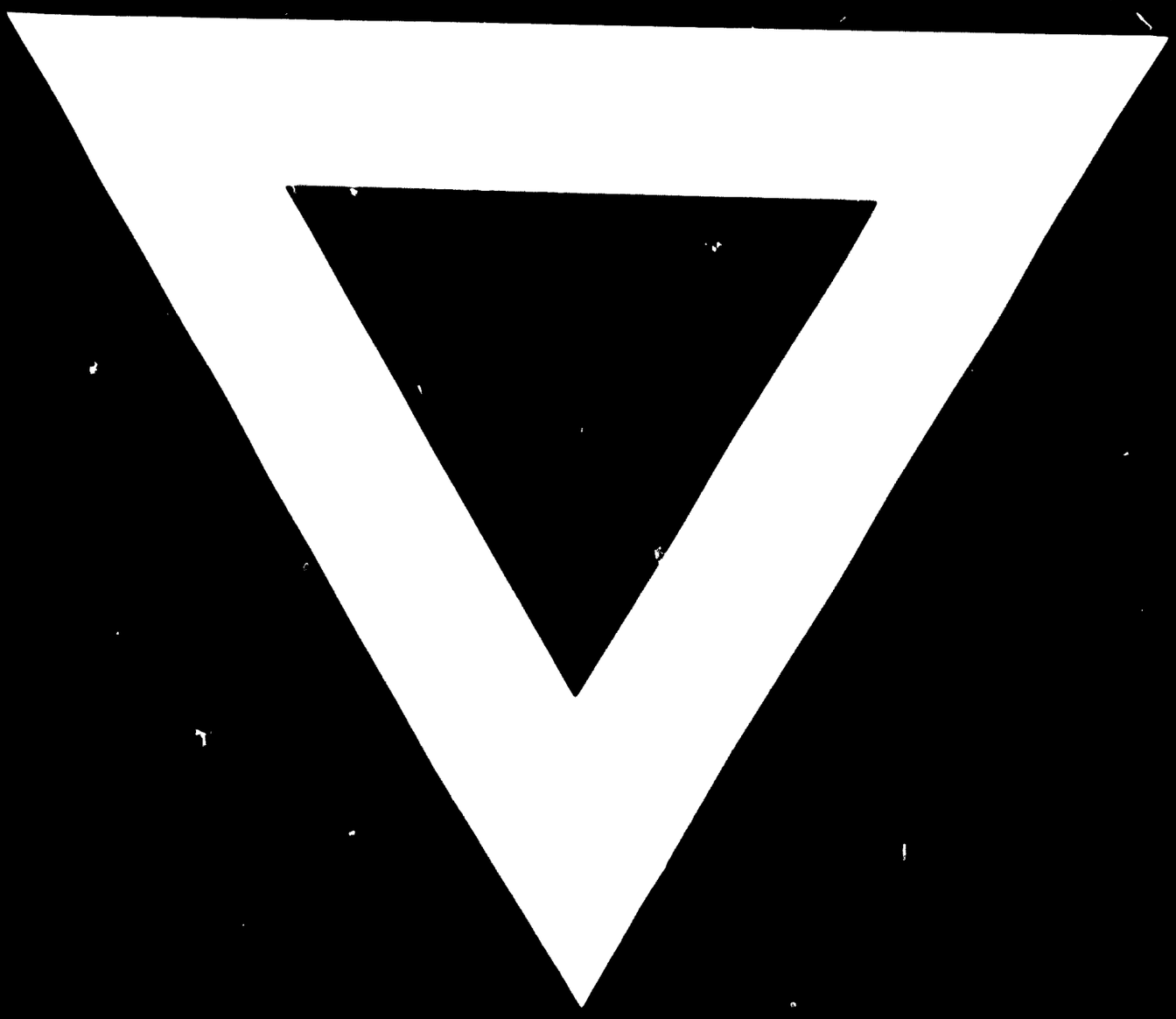
And after all, isnt' it more logical that the one who has designed and constructed a plant, should start it up and prove to himself that it is a success.

To construct satisfactory industrial installations is, and will remain an essential condition of success, but in a developing country, the problem is far more intricate; clients and contractors will succeed only if they work in close collaboration, combining their knowledge, their experience and their men. The difficulties of modern techniques are such that the wide and deep transmission of knowledge whatever its form may be, cannot be considered as a sum of isolated actions left to the good will of a few people.

On the contrary, it requires organization but also and above all a close collaboration at the same level.

To constitute these common teams, [illegible] persons in doing something, to create the bonds of mutual confidence in an atmosphere of true collaboration and friendship, this is the only answer to give when one speaks of personnel training and technical assistance.

But how could it be done unless such collaboration has taken place right from the start by drawing up the contract in such a way that a powerful motive is created to work for the interests of both parties.



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