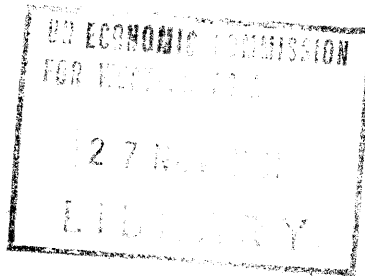




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FOREIGN ENGINEERING FIRMS AND THE PROBLEM OF
TECHNOLOGY IN MOROCCO

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* The opinions expressed in this document are those of the author and do not necessarily reflect the views of the United Nations Economic Commission for Western Asia.

The recent experience of most of the so-called under-developed countries that have entered the first stages of fixed capital formation reveals that foreign engineering firms have come to occupy a privileged position as intermediaries with the world market and the sources of technology. Moreover, most of the technology transfers that have taken place have been limited to the purchase of equipment. In effect, foreign engineering firms have been largely responsible for conception, execution and, in the case of production projects, direction of operations in most engineering projects undertaken in the developing countries.

The way foreign engineering firms have operated in the developing countries has evolved more in response to the negotiating methods and capabilities of some of these countries than to the actual needs of the more peripheral among them. This is true for the entire spectrum of engineering services that form part of projects executed under one or another of the following formulas: turn-key, plant-in-production ("en ordre de marche") sales-ready ("en ordre de vente") and, in some instances, guaranteed-market contracts ("marché en main").

In Morocco the function performed by international engineering firms and groups seems to be one of "organizer-prospector" of sites and opportunities for the construction of integrated complexes and of the disposition of the merchandise produced by component plants. This function will be dealt with in part I of the study. In part II the contours of the technological development model applied will be examined through a study of investment practices in Morocco.

I. Foreign engineering firms as a privileged channel for the introduction of technology

One of the more fundamental and more specific functions of the engineering factor is to intensify the capital accumulation process. The engineering factor has acquired a growing autonomy from the production process, specializing in the conception and execution of industrial, real-estate and infrastructural complexes. Its autonomy, however, is only relative, in that the engineering factor impinges on the production process at two points: the finished product and work methods.

One of the functions of the engineering factor is to promote greater co-ordination between the production and the marketing spheres. It does this by helping to adapt the finished product to the exigencies of the marketing process. The engineering factor is also responsible for adjusting the relationship between the manpower and the material resources utilized in the production process - in other words, the technical conception of capital. The major object or "prime contracting" firms is in both cases to increase their ability to valorize the capital (industrial capital in particular). To this end, they make use of existing engineering devices or else proceed to the creation of new ones. Another major engineering concern - one which has emerged rather unexpectedly - is that of providing responses to that specific phase of the free-enterprise mode of production wherein the risk of "capital devalorization" is becoming ever more real. One of the results of capital devalorization is a situation where technical progress requires the investment of ever-larger sums of initial capital. These sums, however, are provided with diminished opportunities for optimum profitable exploitation for the long term.

Thus it would seem that in the industrialized market economy, engineering is one of the ways and means available to the investor for the purpose of counteracting the tendency towards declining profitability rates. This is done primarily by assigning a portion of total capital investment to the engineering factor. This portion is then put to work to valorize the total capital amount. This "grafting" of engineering capital onto the total amount, is distinctive in that it does not set directly to modify the "formal structure of capital investments as does, for example, commercial capital, which raises capital funds for the purchase of capital equipment.

While these components of total capital investment operate outside the sphere of production, engineering capital would seem to have its incidence only within that sphere, affecting as it does the values of the utilization of the means of production and the nature and characteristics of the finished product. Engineering, then, represents a new kind of "specific productive force" similar to the "integration and application of science (or technology) in social life"¹

Other authors place the engineering function in the category of "scientific and technological know-how" and consider it part of a "third factor" of production alongside capital and labour^{2/}.

In this study engineering is seen to play a growing role in the promotion and application of science and technology, thereby tending to impregnate progressively the entire process of production and to play a relatively major role in the development of productive activities. The establishment of a

^{1/} R. Richta, ed., La civilisation au carrefour, Paris, 1969.

^{2/} ?

specialized structure devoted to the conception of different types of projects, particularly in the industrialized countries must be viewed in this perspective. In concrete terms such a structure would involve the establishment of a sector comprising companies and consulting firms of different types: Engineering companies, consulting houses, general business firms, industrial complex designers and promoters, etc. The engineering firms operating in the so-called "peripheral" countries are, for all practical purposes, appendages of international companies. Moreover it would appear that foreign firms are for the most part meeting the needs of countries like Morocco for the design and execution of engineering projects in general and industrial projects in particular.

The activities of foreign engineering firms become more intelligible when it is understood that they form part of the activities of multi-national groups. Most of these firms are either affiliated to such groups or have been established by them. In fact the increase in the accumulation of capital has given rise to a world-wide trend towards the establishment of an integrated system of production under the control of multinational corporations. This trend, which is governed and oriented by finance capital (representing close collaboration between industry and banking), has encouraged international specialization and marks an important landmark in the evolution of world productive forces.

In order to be in a position to control the restructuring of production - which is facing ever-greater difficulty due to competition and the threat of devaluation of capital that is immobilized whenever new products appear on the market - international finance capital has been engaged in a growing "centralized domination" on the engineering function. Either directly or indirectly, through

local agents, mother companies have come to play a sort of strategic and key role in the promotion of a new type of division of labour.

This is accomplished mainly through the application of "technical", "economic", "financial" and similar standards to the study of various projects in the countries of the so-called "periphery". This practice is particularly pronounced where industrial projects are involved.

International finance capital is attempting to use this channel to adapt the development of world-wide productive forces to the prevailing constraints and to the need for improving the rate of return or, at least, maintaining this rate acceptable level, given the general conditions of capital valorization.

This may be behind the arguments for and the practices of inter alia, import-substitutions, the encouragement of industrial "sub-contracting" and "labour intensive" investments. Finally, the technical "standards" and "norms" introduced by multinational and, incidentally, "peripheral" engineering firms have tended to impose upon the developing countries of the "periphery" a type of growth that is compatible with the capital accumulation needs of the "centre".

The often determinant role played by the engineering factor is consolidated in studies of the rates of return of projects, the dimensions of local markets, transfers of activities retaining to the first generation of industrial development from the countries of the "centre" and studies of the "gaps" which countries of the "periphery" can fill in the international production of certain goods. This role could not be played to its conclusion if it were not that the engineering function were backed up and guided by international finance capital.

The system of supply credits, bank loans and direct foreign investments in support of foreign engineering firms favours the installation of fixed capital that is increasingly tied to the supply sources and markets of the more advanced market economy countries. It is with this in mind that the engineering function can be seen as a "conveyor belt" or spear-head for the exports of transnational corporations. These corporations, through their financial, commercial, engineering and similar structures, are highly active in a rapidly forming world market marked by integrated complexes that require expensive capital equipment for their production operations. The more or less sustained commitment of the developing countries to industrialization and the desire of the socialist countries to absorb rapidly the technology and techniques of the industrialized countries has made these two categories of country into the major buyers in that market. This is not to say that the engineering technology developed in the production industries in the socialist countries has not been offered on the market. In fact the socialist countries have supplied a number of developing countries with capital goods. Although these transactions take place in different ways, Morocco is a good case in point. Generally speaking, these transactions are a function of the over-all conditions prevailing in the country of the periphery, which affect the selection and the mode of reception of engineering technology.

In fact, engineering "companies" of the socialist countries working in the developing countries are obliged to operate in accordance with many of the techniques and procedures applied by transnational corporations.

It should be noted that the activities of these engineering enterprises are often the result of choices and political agreements whose purpose is to reduce the risks involved in the development of specific economic spheres that are guided exclusively by the profit motive. These enterprises generally concentrate their activities on branches of production with long-term maturation periods, such as power generation plants and irrigation systems. They tend to form part of efforts to develop forces that are upstream of the productive process or that make up the material backbone of the economic infrastructure needed for the growth of the final demand activities of the private sector. Of course, engineering organizations of the Socialist countries also are occasionally involved in the conception and construction of industrial units.

In the countries of the periphery, however, foreign engineering firms have the lion's share of major projects with only the occasional involvement of the engineering services of the Socialist countries in specific areas. This is certainly the case in Morocco.

Available figures which are only approximative in nature, indicate that the country's expenditure on engineering design represented almost 10 % of total investment made in Morocco between 1973 and 1975. Around 70 % of that amount went to international firms.

These figures, however, do not include expenditures on studies included in "turn-key" contracts or studies conducted in the form of technical assistance granted to local technical studies bodies and organizations.

The privileged and preponderant nature of the involvement of such foreign organizations in engineering, stricto sensu, represents in itself a structural characteristic of under-development.

II. Models of Technological Development and Various Types of Investment

The absence of any explicit technological development policy has limited the possibility of an effective and sustained involvement of the public authorities in the promotion of the growth of the productive forces of the country. The investment pattern that prevailed in Morocco, especially since the early 1960's, was marked by a division of labour between the Government and the public sector on the one hand and the private sector on the other. It would seem that investment in certain branches of the economy has been reserved to public sector initiatives. This is particularly true in these branches of industry that require relatively heavy investments and involve high technical and financial risks. On the other hand, the private sector, particularly the local private sector appears to favour investment in activities that present less serious technical problems.

A. The low technological risk strategy

While the coming of political independence seems to have opened up some new horizons before the development of the domestic private sector, the opportunities for favourable investment have remained for the most part limited.

Mainly Moroccan capital of the private sector continues to be drawn to the textile industry, small agro-industries and the building public works industries. The relatively low complexity of the technologies used in these activities has encouraged continued investment therein. Since the

technology required in these branches of industry is in most cases dependent upon the "know-how", the after-sales services and even the technical assistance of foreign suppliers of materials, the establishment of new enterprises meet on the whole, very few constraints.

These branches were implanted in Morocco during the French Protectorate and have remained ever since the quasi-exclusive concern of the foreign private sector which assured the role of the "modern" sector with the responsibility for "instructing" the various components of the traditional native sectors in the economic behaviour patterns and techniques of the modern world. In the first and the last analyses, the very definition of this sector as "modern" resides of course, in its ability to use effectively the tools, machines, techniques of modern production.

While imitation and mimicry tended to mark the technological transfer process in the Moroccan private sector just after independence, this was and remains true in selected areas only and is limited to activities that involve more immediate returns. With the exhaustion of such opportunities, the domestic private sector has progressively sought to acquire new technology and thereby extend itself to other industrial activities. The so-called "Moroccanization" process, however, has only touched these branches of the industrial sector that pose the least technological problems.

B. Free market investment and modern technology

Most of the investment of the public and the mixed sectors call for the application of relatively modern techniques and methods of production generally acquired from foreign suppliers through international engineering companies.

The orientation of the phosphate enrichment industry towards the manufacture of simple phosphoric acid and fertilizer compounds illustrates a category of investments that is typical of public sector initiatives in industrialization and corroborates the observation concerning the primordial role of international engineering bodies. It also illustrates the discontinuous way technology transfers take place and their dependence on the fluctuations of the world commodity market. Phosphate enrichment projects have tended to follow the classical "turkey" method of implementation^M.

Most of the plants that have been put up and those that are being established have depended closely and massively on provisions and equipment furnished by international groups that are specialized in the establishment of industrial complexes. The argument most often put forward by Moroccan prime contractors for calling in systematically transnational engineering companies is that the implementation of such projects involves highly complex technology (design and construction engineering, control of operation and materials, fittings, etc.).

Transnational companies are in a better position to apply the same norms and technical specifications that prevail in similar plants operating in the industrialized countries.

2/ MAROC-CHIMIE (Phosphate fertilizer plant in operation at Safi since 1965).

MAROC-PHOSPHORE (I) and (II) (Phosphoric acid plants).

International engineering firms played a somewhat determining role in the technical as well as the over-all development of Maroc-chimie, the first plant established in the country for the manufacture of phosphate fertilizer. In this particular case, the involvement of engineering firms was magnified in the context of a fierce competition between the owners and suppliers of chemico-mineral processes and equipment. Until then all the country's phosphate was exported. The attempt to process this abundant resource locally in order to turn Morocco into one of the major world suppliers of fertilizer was met with several attempts to block the project at the stage of its conception and, later, with attempts by several world-wide phosphate chemical groups to control it.

The difficulties encountered at the conception stage involved the obvious ties that existed between the engineering firms that were retained and the manufacturers of equipment. This type of relationship gave rise to the conceptualization of a plant that was limited in both technical capacity and objective.

Before independence this type of project could not see the light because of the organized opposition of a segment of the French chemical industry (the Saint-Gobin group and Pechiney-Ugine-Kuhlmann). After independence, the plant was to be designed in association with the major European buyers of Moroccan phosphates, which is to say, with the participation of the phosphate fertilizer quasi-cartel. This was necessary in order to surmount the opposition and hostility of European fertilizer manufacturers to the construction of any plant in Morocco. That hostility was expressed clearly by their boycott of the first

international consultation for the establishment of a simple triple superphosphate plant which was launched by Morocco in 1958.

Having failed to stop the construction of that plant the international fertilizer manufacturing "cartel" definitely succeeded in preventing the establishment of a truly integrated plant that would have turned Morocco into a major competitor.

The rather lively competition among international phosphate chemical agglomerates such as Dorr-Oliver, Monsanto, Lurgi, Saint-Gobain, Kuhlmann, Chemiebau and Chemico, which played from time to time on internal political contradictions of the moment gave way to an entente "against all attack" between Krebs and Lurgi, representing, respectively, Saint-Gobain-Kuhlmann and Metallgesellschaft/AG. From the view point of this study, the formation of that entente had a special significance beyond the attempt to win a major market for capital goods; from the strictly technical viewpoint, the formation of such European consortium willingly or unwillingly gave Krebs and Lurgi the opportunity to make of the projected plant a sort of "testing bench".

One such experiment of special interest to the French group, was the utilization of non-enriched phosphates mined in the vicinity of the plant. To the extent that it succeeds, this experiment could prepare the way for the adaptation of low-cost equipment for the use of traditional buyers of highly enriched phosphates. The relatively rapid vat corrosion, for example, seems to have been quite instructive to European phosphate based fertilizer plants.

Then again, considered as part of the effort towards a greater integration of the domestic industrial sector and the exploitation of pyrrhotite, the experiment was not without risk. The use of pyrrhotite as a raw material for the production of sulfur (needed for the production of sulfuric acid, which is an indispensable intermediate material used in the manufacture of phosphoric acid) continues to this day to limit the efficiency of the Moroc-chimie plant.

Although the principle of giving priority to the use of local materials cannot be questioned here, the problem remains that there is a high risk in installing a technology that is still at the laboratory experimental stage. That was the case with the use of pyrrhotite until the chemical complex commenced operations. During the sixties, a limited variety of pyrites were used or experimented with in pilot workshops in Scandinavia and Japan for the abovementioned use.

Globally speaking, while that option was in principle the right one, it was not the right one in this particular case. It turned out to be burdensome and technically of low operational value: It was found necessary to add to the Moroccan pyrrhotite imported sulfur in order to improve its consistency and in order to produce sulfuric acid, Moroc-chimie had to install two processing lines, one for pyrrhotite and a second for sulfur, with the attendant over-extension of its installations.

Fifteen years have passed since the various workshops commenced operations and the thorny technical problems of the utilization of the pyrrhotite

"cinders" (waste product) and their storage in the meanwhile have not been solved.

The outlook for future industrial investment in the development of phosphates in Morocco is for a specialization in the manufacture of intermediate products, particularly phosphoric acid. The Maroc Phosphore group of plants that have been established, are under construction or are planned for the medium term fall under this Reading.^{1/}

Morocco, which has about 75 per cent of the world's probable phosphate reserves, decided to manufacture this product which is indispensable to the production of the entire line of phosphate-based fertilizers, in order not to jeopardize the country's status as a major exporter of phosphates. This was done by directing the sale of phosphoric acid only to developing countries that have fertilizer manufacturing plants. This choice can also be explained by the expected self-imposed limitations on heavy investment in the fertilizer industry in Europe and Japan in favour of the phosphate importing developing countries (such as India, Pakistan, Bangladesh, Indonesia, the Philippines and the Latin American countries) as well as the phosphate producers such as Morocco.

^{1/} A World Bank study of September 1979 devoted to the world fertilizer market envisages the establishment of 80 plants with a capacity of 1000 tons of p 205 between 1983 and 1993, corresponding to \$ 19 million investment.

^{2/} Thus Maroc-Phosphore concluded long-term agreements with four major Indian companies that import phosphoric acid. The agreement involved the sale of about 440,000 tons of P 205 in 1984. One of these companies is Indian Farmer Fertilizer Co-operative, Ltd. (IFFCO), which is the major buyer of phosphoric acid in India. (Bulletin-OCP No. 16, April 1980)

It is expected that by the year 2000 the several plants that will be operational in Morocco will transform about 20 per cent of the tonnage extracted at that time, thus preserving for Morocco its traditional place as the first exporter of phosphate minerals.

The technological profile of these investments is practically the same as that describing the Maroc-phosphore plants: highly capitalized but weakly integrated into the general industrial fabric. These investments have given rise to considerable experience in industrial operations, which, however, cannot be taken as a mastery of the technology of phosphoric acid that would justify autonomous control of some elements of the basic structure of these plants. It would not have been pretentious to try to develop an expertise in the chemistry of phosphates that would pave the way eventually to a leading position in the world. This could have been done as part of the effort to integrate the branch into the industrial sector as a whole so as to reduce its external ties.

Thus, during the first stage, it may be appropriate to reinforce the involvement of only integrated Moroccan engineering services that are tied to the group of the Office Cherifien des Phosphates.

The Société Marocaine d'Etudes Spéciales Industrielles (SMESI), which was established in 1959, is an offshoot of the Société d'Etudes Industrielles (SEI), which was based in Paris and provisioned phosphate plants. Due to financial difficulties, SEI was taken over just after independence by the Moroccan phosphate group, which bought up 85 per cent of its shares. With

its practical experience in the installation and handling of phosphate plants for almost half-century, SEI was in a good position to help launch SMESI. Intended initially as a second "new activities" service of the Phosphates Office, this company later extended its study and construction activities to cover a major segment of the Moroccan mining and port sector. It frequently became involved in turn-key type operations related to plants for the handling and storage of minerals and port equipment.

The tasks performed by SMESI are similar to those generally undertaken by generalist firms which co-ordinate the design and execution of the different parts of a project and sub-contract certain parts thereof. Through its relationship with the French company SEI, this Moroccan company used to have the advantage of an "antenne" abroad, which put it in contact with scientific and technical organizations not found in Morocco.

The expansion of its activities, however, have been limited both domestically and externally by the competition of highly active general companies belonging to international groups. If the proper conditions were made available, the company could participate actively in the expansion of Moroccan experience in a branch where investment is in operations of a repetitive nature.

The establishment of a plant for the assembly of work engines and pipes (Union Industrielle et de Montage, UIM) could be one instance of that effort. A new site is needed for the Centre d'Etudes et de Recherches Phosphatières, which took the place of CERPHOS-France upon its voluntary liquidation in 1975

and which has inherited its technical equipment and documentary archives. In addition to studies on phosphate enrichment and phosphate transformation work in Morocco, this Centre can promote the development of a theoretical and applied research structure based on phosphate chemistry, which is still lacking in Morocco today.

Moreover, research in progress on the extraction of uranium from phosphoric acid presently taking place at a pilot plant could be developed into an institution for advanced research with a world-wide reputation alongside Westinghouse, Uranium Recovery Corporation and the national laboratory at Oakbridge, USA.

Naturally, isolated activities of the nature described above involving a single branch of the industry are no substitute for a global and integrated effort aimed at drawing the broad lines of the path towards technological competence.

Thus the initiative taken to date in the present example has tended to favour the acquisition of plants whose functioning is technically dependable, from highly referenced international groups without making a parallel effort to understand and assimilate the capital goods and embodied techniques acquired.

The emphasis, in the opinion of the present writer, ought to be placed on a strategy for the progressive reinforcement of the technological capabilities of countries like Morocco with an ever-greater stress on the engineering function and the establishment of a national infrastructure.

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