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UNITED NATIONS

05472

INTERNATIONAL SYMPOSIUM ON
THE APPLICATION OF MODERN TECHNICAL
PRACTICES IN THE IRON AND STEEL
INDUSTRY TO DEVELOPING COUNTRIES

11-23 NOVEMBER 1963

STEEL SYMP. 1963
Technical Paper A.16
3 November 1963
Original in ENGLISH

ECONOMIC CONSIDERATIONS FOR STEEL PLANTS IN DEVELOPING COUNTRIES

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1. Steel is such a widely used material and performs so many functions in manufacturing that the presence of an efficiently operated steel industry is of great benefit to the economy of a nation. This metal is essential in numerous manufacturing industries, as well as in the production of capital goods, and so has done much to help expand the economies of nations and raise their standards of living. The recognition of these facts has had significant influence on the expansion of the steel industry in those countries where it already exists and the desire for the establishment of an industry in the developing countries.

2. In 1946, there were some 32 nations throughout the world producing steel. For the most part these were well developed industrial countries, however there were 6 in this group with less than 250,000 tons of production, while 4 of the 6 had less than 100,000 tons. Since 1946, 23 additional countries have entered the steel business. They are well distributed throughout the world: 7 are in South America, 8 in Europe, 4 in the Far East and 4 in the Near East and Africa. One of these countries seems to have terminated production in the last few years.

3. As might be expected, most of the new producers are turning out relatively small tonnages. Ten of the countries produce less than 100,000 tons of steel a year, 7 produce between 100,000 and 250,000 tons, 3 between 250,000 and 500,000 tons, and 2 between 500,000 and 600,000. These are production figures for 1962. Thus, by the standard of the industrialized countries, none of the recent entrants into the field can be considered a large producer, although many have ambitious plans to increase steel capacity considerably by 1965. At present these 22 countries have a capacity to produce 16,200,000 net tons of steel and by 1965, their conservative estimates indicate that they will have an aggregate capacity for 27,800,000 tons of steel, an increase of 71 per cent.

4. The world steel producing capacity will be augmented still further in 1965 for 16 additional countries, who do not now produce steel, have signified

their intention of building steel plants. Some of these contemplate a very small operation. For example: 9 plan for capacities of 50,000 tons or less, and only 3 plan to produce more than 200,000 tons.

5. In addition to these newcomers into the steel industry, the veteran producers are also contemplating substantial additions to their capacities. Japan, for example, produced 30.4 million net tons in 1962 and hopes to have a capacity to produce 40 million tons in 1965. Soviet Russia produced 84.1 million tons in 1962 and plans to have a capacity to produce 107 million tons by 1965. The United States will have a capacity to produce in excess of 170 million tons by 1965.

6. It is also interesting to note that two countries, namely, Brazil and Mexico, who produced about 200,000 tons each in 1945, plan to have capacities of 5 million and 4.2 million tons, respectively, by 1965. Yugoslavia, which turned out only 78,000 tons in 1945, increased its production to over 1,750,000 tons in 1962 and expects to increase its capacity to 2,500,000 tons in 1965.

7. Thus, if current plans are carried out, there will be a great increase in the world's ability to produce steel two years hence. Total capacity in 1965 will be approximately 600 million net tons, which is 200 million net tons more than was actually produced last year.

8. The desire of a country to establish a steel industry may be motivated by a number of objectives. First, many-developing countries, who must import steel and who export raw materials, have found in the past few years that their foreign exchange position has deteriorated. For example: a number of South American countries exporting raw materials, which include substantial quantities of rich iron ore, find that the prices of these materials have remained relatively stable, while prices of imported finished steel products have tended to rise and, as a consequence, they find it difficult to maintain an equitable position in foreign exchange. Therefore, there is a great and understandable desire on the part of these countries and others to become manufacturers and, if possible, exporters of steel. For example: the Latin American countries at the present time produce about 6 million tons of steel and hope by 1972 to increase to 18 or 20 million tons. This increase, if achieved, would allow the Latin American countries to take care of their own steel requirements and have a surplus for exports. Such a situation is deemed desirable in order to improve their position in world trade by providing an added source of foreign exchange.

9. Second, the development of a steel industry also tends to encourage the growth of steel consumers at home, as happened in Chile where per capita consumption of steel rose sharply after its steel industry was developed in the post-World War II period.

10. Third, many countries have supplies of raw materials which in some instances are quite extensive, and there is a desire to develop these and exploit them for home production rather than see them exported for use abroad and then have the finished product shipped back to the source of the raw materials.

11. Fourth, it has been generally experienced that the development of a major industry such as steel, provides jobs and aids materially in the general economic growth of the country. This has a further impact in improving living standards.

12. Thus, investment in a steel industry in those countries which are industrially mature, as well as those which at the present time are developing their industry, is looked on as a desirable undertaking. A steel industry is widely regarded as a good thing for a nation to have but, at the same time, it is generally recognized that steel production of sufficient volume to provide for a nation's needs and attain the aforementioned objectives requires a substantial capital investment. Consequently, there are a number of factors to consider before such an investment is undertaken.

13. To begin with, many of the same economic problems governing steel investment are present for those countries which have a small industry and hope to expand it, as are present for those who propose to begin the development of an industry. (We are discussing not only those countries which are about to install very limited facilities, but also those countries which have plans for the installation of fully integrated steel mills). Any country contemplating the expansion of its steel industry or an initial entrance should first examine a number of factors:

a. A thorough market survey of the current and possible future steel requirements should be made. This will enable the country to make decisions on a national basis and will indicate its demands for steel, as well as the variety of steel products needed to fulfill them.

It is often surprising to note the diversity of steel products needed by nations whose economies are in a state of development.

A brief survey of the imports of 8 countries which are contemplating entry into the steel industry, or expansion of existing facilities, shows that virtually all of them import ten categories of steel mill products including ingots and semi-finished steel, rails and track materials, heavy and light structural sections, wire rods, wire, strip, plates, sheets, pipe, tinplate and wheels and axles. The countries included are: Colombia, Peru, Finland, Algeria, Iran, Morocco, the Federal Republics of Rhodesia and Nyasaland and Hong Kong.

A market survey could well indicate that the installation of a small facility would only satisfy one or two of the product needs of the country. To satisfy all of them, a fully integrated mill with a variety of finishing facilities would be required.

- b. The available raw materials should be thoroughly explored and analysed. If the country in question wishes to build a large plant, it is necessary to have sufficient iron ore, fuel and electric energy. If ore is to be used either in a blast furnace or an electric reduction furnace, such as is in operation in Venezuela today, it must be rich enough in iron content to work satisfactorily. It is quite true that in recent years there have been new developments in the beneficiation and concentration of low grade iron ores, and ores which heretofore were thought worthless have been used very effectively after proper treatment. However, a problem arises here for the installation of ore treating facilities represents a high capital cost. It is of little value to a particular country to know that it is possible to concentrate its ore supply if it does not have the installation or the capital to build such an installation which will perform this function. Such facilities are expensive. For example: one of the Taconite plants installed in the United States in Minnesota for the production of 7,500,000 tons of pellets annually represents a capital investment of over \$300 million. If ore is to be used without concentration or beneficiation, it must be relatively rich ore.

Fuel, whether it be coal to be turned into coke for the blast furnace, or low grade coal which is used in direct reduction, can present problems, and these, too, must be investigated thoroughly. Some countries with abundant coal supplies have found that the ash content runs as high as 22 per cent.

- c. Another principal factor in steel production is the availability of power. To provide for this adequately, it may be necessary for a country to construct electric power plants which require a large capital investment.
- d. In addition there are requirements which present difficulties of a more transitory nature which will be present once a mill is built. Its operation, depending on its size, will require either limited or large numbers of skilled employees, as well as a trained supervisory force. This problem is transitory because men can be trained to perform both supervisory and other tasks in the mill. However, this does take time, and the amount of time depends in great part on the level of prior training.
- e. Above all the most important consideration is the matter of available capital. This is without question the greatest problem in developing or expanding a steel industry in any country today. The amount of capital available will determine the size and capacity of any facility that is to be installed.

A nation desiring to expand an already existing steel industry can plan in terms of two kinds of mills: first, a fully integrated steel mill, and second, a smaller non-integrated operation. A country that chooses to build an integrated mill which will satisfy many of its steel requirements must construct one large enough to provide for economic operating costs. It must also have a variety of finishing facilities. Depending on the number of finishing facilities, such a mill would have to produce 2½ to 4 million tons of crude steel, if the finishing facilities are to be operated at a high percentage of their capacity. However, this combination of several million tons of steel ingots and a number of finishing facilities requires an enormous investment. Further, if it is necessary to import the technical skill, as well as the material for construction, the cost of building the mill may easily be in excess of \$350 per net ton of capacity installed. This was approximately the figure which was projected for the Bokara project in India, where it was estimated that 4 million tons of capacity could be installed for 1.5 billion dollars.

In another country, a recently constructed integrated mill was built at a cost of \$450 a ton without the conventional blast furnace and coke ovens.

The need to provide a large amount of crude steel to operate a variety of finishing facilities is evident, for one cannot install this costly equipment and operate it only a small portion of the time. A fine illustration of this can be had from a project which was contemplated in the New England section of the United States in the early 1950's. The mill was planned with a capacity to produce 1 million tons of crude steel, yet it was hoped that 5 to 6 different types of finished products would be produced. This was virtually impossible and the mill never materialized because 1 million tons would not sustain the required rate of operation for the number of finishing facilities that were planned.

Although a 4 million ton mill would probably be close to the optimum size for economical operations, if a number of finished products are planned, it is so expensive today that even fully industrialized countries cannot afford to build a mill that size at one time. Any such mill would have to be built in stages.

Further, if a country has raw materials, particularly iron ore with a low iron content which must be beneficiated or concentrated in some manner, an additional investment is required for the construction of facilities to perform this function. The size of this investment has already been referred to in connection with the Tacconite plant in the United States where, as it was said, a plant with a capacity to produce 7½ million tons of usable ore in the form of pellets, represents a capital investment of \$300,000,000.

Another plant, which was recently built in Canada to concentrate soft ores from their original 30 per cent iron content up to 65 per cent iron, cost more than \$200,000,000.

Thus fully integrated plants with ore-concentrating facilities, if they are necessary, are for the most part beyond the reach of many countries. It is therefore necessary to examine what is within the reach of countries desiring to expand their capacity for the production of steel. Where a steel industry already exists and the economy is developed to a point where many steel products are needed, it would be well to use the available capital, or capital that can be readily obtained, to build finishing facilities. If these cannot be adequately supplied from existing steelmaking operations, it might be well to import semi-finished

steel. After finishing facilities have been installed, it would then be appropriate to think of adding more basic steel-producing equipment and, if necessary, ore-concentration equipment. Before ore-treatment plants are built, however, it would be well to consider the economics of importing ore. There is an abundance of rich ore available in the world today and the existence of large bulk cargo ships with capacities for carrying up to 60,000 tons of ore make it possible to transport ore cheaply.

Those countries who have a small industry now, i.e. less than 250,000 tons, and who wish to build up to 500,000 tons or more, are obviously not thinking of an integrated steel mill, but rather of a smaller operation, perhaps an electric furnace with finishing facilities such as bar mills. Here the expense is far less than an integrated mill, but the cost of such a project could well be in excess of \$100 million. This amount of steel capacity will establish the country to a limited extent in the steel business, but it cannot supply the total steel needs of the economies in question. The same is true of those countries who at present have no steelmaking capacity, but plan to install some within the next few years. Their aspirations are limited and, even if fully realized, will not begin to provide for total needs. In both these instances capital is a problem.

14. Since capital does pose a problem, it would be well to consider what can be done with a minimum amount of capital. The steel requirements of any economy, even a relatively small one, are diverse enough so that a small industry could not supply them. Where limited capital is available there are at least two possibilities open to a country to provide for its steel requirements. First, it can build small facilities which will take care of only part of its needs. For example, a bar mill which would be flexible enough to roll concrete reinforcing bars and small structural steel sections. The steel for this could be supplied by an electric furnace using scrap and, if necessary, some of it might be imported in semi-finished form. Other facilities could be added gradually over a period of time when and if capital was available.

15. The second possibility would be the importation of steel. This has become more attractive in the last few years and should continue to be attractive into the foreseeable future.

16. It is a fact that many nations have been opposed to importing steel in the past because its price has put them in an unfavourable position in respect to foreign exchange. However, if prices decline substantially, this will no longer be true, and imports will become attractive. Recently there has been a price decline. This decline in price which has already set in arises from the phenomenal growth in steelmaking capacity all over the world. By 1965 there will be approximately 600,000,000 tons of steelmaking capacity available, and more than 550,000,000 tons of this will be located in industrialized countries. This amount of capacity will generate considerable competition for export markets. Under these circumstances, there is bound to be pressure exerted on steel prices. There is already some evidence of this in a number of European countries, including West Germany, France and England, as well as Japan.

17. In Western Germany, steel production in 1962 declined by one million tons as compared with 1961. This gave rise to the statement by the president of a large German steel company to the effect that "the German iron and steel industry has rarely had to face as great difficulties as during these last two years." Further, it has been stated that the expanded capacities which were planned for 1964 and 1965 in Germany have been reduced by 2 million tons. The problem in Germany arises in great part from a weakening price structure which has been brought on by imports coming into the country.

18. A report on the French steel industry recently issued stated that a number of factors, including the drop in production and, to some extent, exports, have created such a pressure on prices that the increase of French steel prices granted in August, 1962, by the Government could not effectively be put in force. France, like Germany, has reduced the projected increase in steel capacity by 2 million tons.

19. Reports on Japan indicate that the steel industry there experienced its worst post-war slump in 1962, and that this recession at home spurred export business to a new record high. There is every indication that the over-capacity in Japan will remain for the next few years, and that the need to adapt production to actual demand will present a serious problem. This has already had its effect on prices which have declined during the past few months.

20. In addition to these developments, there is a possibility that the United States, because of its balance of payments problem, will restrict its expenditures abroad, and this could well reduce the liquidity in many industrialized and developing nations. Therefore, it is quite conceivable that with less liquidity on the one hand, and greater steel capacity with consequent pressure on steel export prices on the other, it would be far more reasonable for some countries to buy steel on long term credit which is available, than it would be for them to invest in steelmaking facilities of their own. In this way they can take full advantage of the economics of the situation and use the capital that would have been invested in steel facilities for other needed projects.

21. This would be a most intelligent application of the time honoured economic principle of comparative advantage.





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