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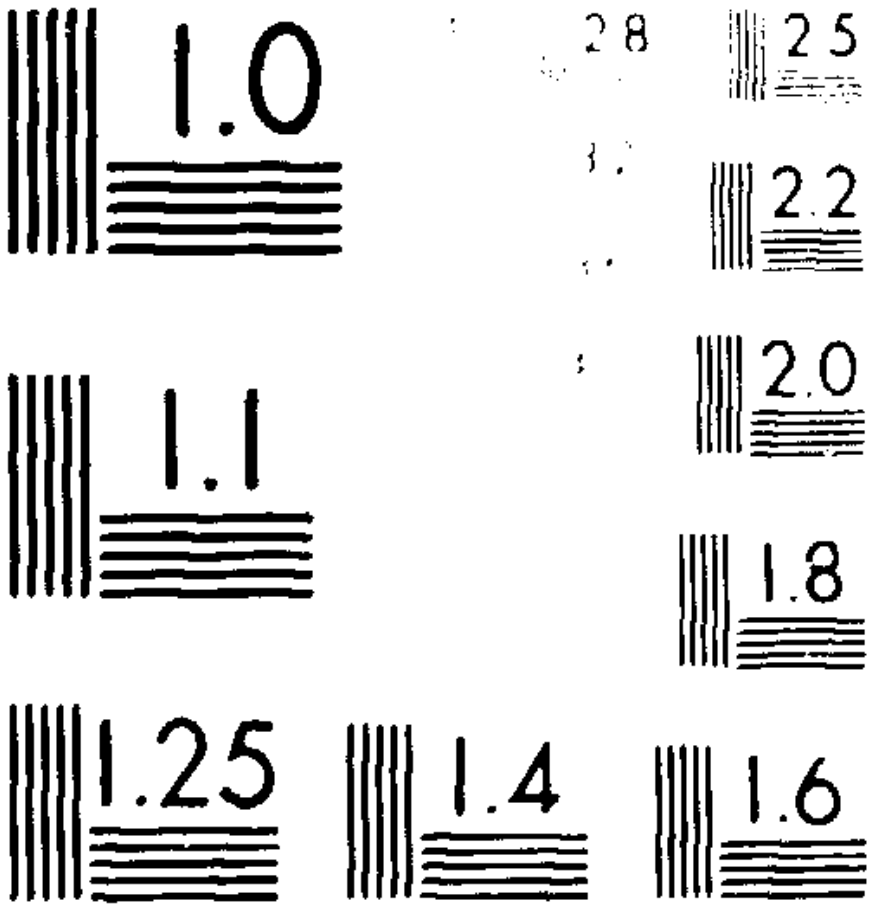
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PICTURE FOR 1985 OF THE WORLD IRON AND STEEL INDUSTRY*.

(Contribution to the preparation
of 1990 scenarios)

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INTRODUCTION

The general economic context for the world iron and steel industry is marked by the following:

- Uncertainty and tensions. In the autumn of 1974, the world iron and steel industry entered a period of crisis. There was a sharp drop in production in 1975, and hopes for a recovery were disappointed in 1976. In 1978, for the first time, world crude steel production equalled and exceeded the 1974 level. The figures for 1979 show progress by comparison with 1978, but the figures for the first quarter of 1980 again indicate a slight decline by comparison with 1979.[1/] The experts participating in the recent symposium organized by OECD agreed on the probability of a period marked by economic uncertainty and tension.[2/]

- Acute suspicion of all forecasts. While it is true that medium-term or long-term forecasts have not completely disappeared - far from it - it is also significant that many specialists have become allergic to forecasts. Some even go so far as to say that forecasts have become "futile", that they are more an exercise in futurology than in science and that they may even be dangerous, in that they encourage the adoption of policies of passivity.[3/] This in fact means that a certain type of forecast has ceased to be operational and that other forecasting methods must be perfected. This task has been undertaken by a number of institutions in different parts of the world, including the International Iron and Steel Institute (IISI), which, in its study of the causes of recession, attempts to make a systematic analysis of the new relationships growing up between iron and steel making and the various components of the world economy. UNIDO's effort has a place in this attempt, aiming as it does at leaving behind the time of "sight navigation" and helping to build the future.

1/ Metal Bulletin, 25 April 1980, -0.9 per cent for the production of countries belonging to IISI.

2/ OECD Symposium on the Steel Industry in the 1980s, Paris, 27 and 28 February 1980.

3/ Cf. statements at the Amsterdam conference (Metal Society, May 1979) by Mr. Bela Gold, Mr. Ditzel and others.

- Contradictory reactions which emerged, inter alia, at the OECD Symposium. While American companies were launching an aggressive anti-dumping operation against many European companies, a number of speakers maintained with notable force that co-ordination at the world level had never been so necessary, to guarantee the future of the iron and steel industry and, in addition, that this co-ordination should take into account the growing role of Governments in conducting the affairs of the iron and steel industry.[4/] While, furthermore, some still suggested that it was desirable to retard the growth of the iron and steel industries in the Third World, other experts advanced a different assessment of the place and role of the developing countries in the development of the iron and steel industry. According to E. Florkoski, this issue often evokes a fear response on the part of developed countries. Much of the fear has been generated by the March 1975 Lima Declaration. In fact, the developing countries as a group pose little threat to the steel industries of Europe, the United States, Japan and the rest of the developed world over the next decade.[5/] The cancellation during 1975 and 1976 of most major export-oriented projects has helped to put the situation on a sounder footing. In this connexion, all these major projects, while located, it is true, in several developing countries, had been launched at the initiative of major Japanese, American or European companies, the developing countries themselves being much more concerned, as we shall see later on, with achieving self-sufficiency than with winning foreign markets.

In a continuing atmosphere of uncertainty, where tensions sometimes suddenly increase, it does all the same appear that a screening process is taking place, leading to fresh analyses of factors and a better evaluation of the role of the actors.

4/ In this connexion, see the papers by Mr. Peco, Mr. Florkoski Jr., Mr. Wolff, etc.

5/ Edward S. Florkoski Jr., Policy Responses for the World Steel Industry in the 1980s, OECD Symposium on the Steel Industry in the 1980s, Paris 27 and 28 February 1978.

This is, incidentally, a relatively favourable atmosphere for undertaking, in accordance with the conclusions of the meeting of the Working Group on Scenarios for 1990 (Algiers, 3-5 December 1979), a consideration of the situation of the world iron and steel industry for 1985, and preparing a "picture for 1985".

This picture, which will be sketched below, may show some imbalance between the "supply" and "demand" factors.

While ascertaining the situation with regard to supply for 1985 is a simple problem of factual information which should, in principle, be quickly solved, evaluation of demand poses more complex problems involving many question marks which it will probably be difficult to remove.

However, it must be borne in mind that the objective of this paper is less to put forward a body of extremely precise figures for 1985 than to pin-point the most important problems involved in the development of the iron and steel industry and to elucidate the main components of this industry, with special reference to the developing countries concerned with achievement of the Lima objectives.

Focusing the analysis on the year 1985 does not mean confining it to a horizon which might be too close. On the contrary, it means taking an essential step towards the establishment of a firm foundation for projections, allowing for the construction of alternatives for a more distant horizon, i.e. the scenarios for 1990-1992.

The conclusions of this paper will therefore deliberately refer to the period beyond 1985 in listing questions about the future of the iron and steel industry - questions to which different answers may subsequently be given in the context of alternative scenarios.

1. A PICTURE FOR 1985 OF THE IRON AND STEEL INDUSTRY

This heading does not precisely reflect the objective of the paper, which is less to propose a meticulous and polished picture of the iron and steel industry for 1985 than to throw light on some of its main components and trends in their interrelationships.

1.1 Prospects for 1985

There is only too much choice here, since over the past six years, a host of pictures for 1985 have been proposed for the iron and steel industry by a large number of institutes or experts. The pictures proposed in 1976 in most cases forecast shortages beginning in the early 1980s. Some of these forecasts came from:

- The Japanese iron and steel industry: a deficit of more than 50 million tonnes; 6/
- The Bank of America: deficit during the 1980s; 7/
- W. F. Hogan: The iron and steel making capacities of the Western countries inadequate to guarantee economic development in the 1980s: 8/
- M. Moses (Puerto Rico): shortages in the United States after 1980; 9/
- The Cansteel Corporation: a deficit of at least 100 million tonnes in the early 1980s; 10/
- M. Benami: available capacity as of the end of 1977 saturated by 1980. 11/

The fresh recession in the iron and steel industry in 1977, on the other hand, inspired more pessimistic forecasts, coming for example from:

- The American Iron and Steel Institute (AISI), forecasting a situation of capacity in excess of supply up to 1985; 12/
- The British Independent Steel Producers Association (BISPA), seeing no notable sign of growth in demand before the middle of the decade. 13/

6/ In Actualitiés Industrielles Lorraines, June 1976, page IV.

7/ Metal Bulletin, 13 July 1976.

8/ In MOCI, 11 October 1976.

9/ Metal Bulletin, 26 October 1976.

10/ Metal Bulletin, 22 February 1977.

11/ Metal Bulletin, 11 October 1977.

12/ Metal Bulletin, 30 June 1978.

13/ Metal Bulletin, 15 December 1978.

In 1978-1979, forecasts tended to focus on the 1985 horizon and to circumscribe the objective, at least from the point of view of demand. World demand in 1985 should amount to:

- 896 million tonnes, according to WHARTON (October 1977) (tonnes of crude steel);
- 919 million tonnes, according to AMAX (March 1978);
- 1,015 million tonnes, according to the METAL SOCIETY (May 1978);
- 890 million tonnes, according to CITIBANK (June 1978);
- 920 million tonnes, according to CLEVELANDCLIFFS (July 1978);
- 970 million tonnes, according to SRI (April 1979);
- 880-920 million tonnes, according to W. F. HOGAN (1979);
- 884 million tonnes, according to DITTEL (November 1979).[14/]

The most recent "pictures", then, tend to take into account the fact that the depression is lasting. In any event, they tend to diverge sharply from the optimistic forecasts (which were still the rule in 1976), according to which world consumption in 1985 would amount to somewhere between 1,000 and 1,100 million tonnes, resulting almost certainly in shortages, in view of the delay in the establishment of new production capacities.

At the beginning of 1980, there are two opposing schools of thought which propose two contradictory pictures of the situation of the iron and steel industry in 1985 and in the first half of the 1980s.

According to the first school of thought, the weak over-all growth in demand will not be adequate to saturate available capacities. Therefore, no shortages are to be expected in the first half of the decade.

According to the second school of thought, available capacities are growing at an inadequate rate. They will be quickly saturated, and there will be shortages beginning in the first half of the 1980s.

14/ Metal Bulletin, 18 May 1979, and Usine Nouvelle, 7 February 1980.

In fact, it does seem that the majority of specialists tend to belong to the first school of thought. The Secretary-General of IISI made reference to this in saying at the Sydney conference that a world steel shortage could come about in 1985 only as the result of steady growth in steel demand at an average annual rate of 5 per cent,[15/] and that was virtually out of the question. This position was widely echoed at the OECD Symposium, in particular by Mr. Kono of Nippon Steel Corporation, who does not agree with "the view that the world steel supply capacity on a global basis will be such that a steel shortage can be expected in the period 1981-1982". Also, he thinks "that 5 per cent is an unrealistically high rate of demand growth for this period /1980-1985/." He therefore believes "that world steel supply capacity will stay well ahead of demand, and that there is little possibility of a steel shortage before 1985".[16/]

Predictions of probable shortages in the first years of the 1980s and, in any event, by 1985, appear to come primarily from American iron and steel industry circles, ranging from the statement of Mr. Stinson, who considered that taking into account trends in supply and demand, there is a great probability that a world steel shortage may appear in 1985 and subsequently develop,[17/] to the Orange Book of American iron and steel, according to which shortages may emerge early in the 1980s.[18/]

15/ IISI 1979, Report of proceedings, Thirteenth Annual Conference, Sydney, 15-17 October 1979, p. 30. In 1979, the real capacity of the Western world was 675 million metric tonnes, while production amounted to around 490 million tonnes.

16/ Already mentioned. Cf. T. Kono, Outlook for world steel industry up to 1985; demand, trade and supply capacity.

17/ President of the National Steel Corporation, statement before the annual conference of AISI, New Orleans, February 1979.

18/ Steel at the Crossroads: The American Steel Industry in the 1980s AISI, p. 30.

However, it is not surprising that the prospect of shortages by 1985 is suggested by American experts, since this in fact reflects the real situation in the United States, where production capacities are currently inadequate to meet the requirements of the domestic market and where there is a danger that this imbalance will worsen by 1985, since decisions have not as yet been taken on the execution of any major projects.19/ The Orange Book strongly emphasizes the dangers of shortage. However, some observers are not so pessimistic concerning the future of American iron and steel making. Mr. T. Kono, for example, thinks that "there are several ways to overcome this potential shortage... The United States has recently increased its electric furnace capacity... and it may add further capacity in this way in the future. In addition, there appears to be still more possibilities for expanding the actual steel supply capacity, such as improving coke and fuel ratios in blast furnace operations and increasing the continuous casting ratio. Therefore I feel there is little likelihood of any steel shortage in the United States before 1985".20/

Thus, we see that the many pictures for 1985 have gradually converged, and that - with the notable exception of the American iron and steel industry - the prospect of shortage has been discarded in favour of that of a global balance. In this connexion, it will be seen that this prospective view rests on the implicit hypothesis that the group of countries with centrally planned economies will continue to be largely self-sufficient. It can also already be seen that a global balance may conceal many partial imbalances in terms of specific supply in respect of products or regions.21/

We shall revert to the problems of balance between supply and demand after having examined the production capacity situation in 1985 on the basis of available information.

19/ The Conneaut project of United States Steel has not yet gone beyond the study stage.

20/ Op. cit., p. 12.

21/ In particular, it is a known fact that the developing countries are in a permanent state of shortage with respect to iron and steel.

1.2 Production capacities by major groups of countries

The industrialized countries

. The European Economic Community

The growth in iron and steel production capacities of the Community of the Nine continued on its impetus after 1974, until 1977, when restructuring was announced and then undertaken. Between 1974 and 1979, while Community production declined by 19 per cent, production capacities increased by 13 per cent.

Production capacities
(millions of tonnes)[22/]

	1974	1977	1979		
Crude steel	178.9	200.7	203.5	79/74:	+ 13%
Flat products	63.0	70.4	72.0	79/74:	+ 14.2%
Coils	56.3	67.1	68.7	79/74:	+ 22%

During this period, the share accounted for by continuous casting increased from 12 per cent to 29 per cent.

In coming years, crude steel production capacity is expected to increase slightly, to around 206 million tonnes in 1983, which would probably mean a little more than 206 million tonnes in 1985. Production capacity in respect of coils, on the other hand, will continue to increase appreciably (around 15 per cent between 1979 and 1983 and 40 per cent between 1974 and 1983), while the share accounted for by continuous casting will grow to around 50 per cent in 1985 (from 12 per cent to 50 per cent in 11 years), making possible a real increase in production capacity in respect of rolled products.

22/ Commission of the European Communities, official figures for the iron and steel industry of the Community, 1980. Annex 6.

. The United States

In 1978, the United States had a crude steel production capacity of around 160 million tonnes,[23] with the share accounted for by continuous casting being approximately 14 per cent. The Orange Book envisages an increase, of 10 million tonnes in crude steel production capacity (optimistic scenario 1988), accompanied by an improvement in yields, in particular as a result of the development of continuous casting (44 per cent in 1988). Assuming that the possibilities for development of American iron and steel making capacities are doubtless underestimated (cf. above), we shall estimate American iron and steel making capacity in 1985 at around 170 million tonnes, with a share of around 40 per cent accounted for by continuous casting.

. Japan[24]

The crude steel production capacities of the Japanese iron and steel industry amounted in 1977 to slightly less than 168 million tonnes. However, the facilities concerned were, of course, extremely modern, including oxygen steel making units (a little more than 75 per cent) and electric furnace steel making units. The share accounted for by continuous casting had exceeded 50 per cent in 1979 (52.6 per cent), enabling the Japanese iron and steel industry to produce more rolled products in that year than in 1973 (+ 76,000 tonnes) from a much smaller amount of crude steel (89 per cent yield). Japanese experts consider that Japanese crude steel production capacity will remain stable, while real yield will steadily increase.

In 1985, production capacity will be between 168 million and 170 million tonnes, with continuous casting accounting for 65 to 70 per cent.

. The other OECD countries (plus South Africa)

This group includes the following:

- Countries whose iron and steel industries are based on plentiful iron, coking coal and hydrocarbon resources, e.g. Canada, Australia and South Africa;

23/ Orange Book, op. cit. Capacity varies depending on the estimate (IISI methodology, Marcus, Hogan) from 155 million tonnes to 168 million tonnes. This poses a real problem concerning measurement of production capacity.

24/ K. Sanbongi and K. Komoda, Changes in iron and steel making, Amsterdam conference, September 1979; and Revue de la Métallurgie, April 1980.

- Countries whose iron and steel industries are being restructured and oriented towards high-quality products, e.g. Sweden and Austria;
- Countries whose iron and steel industries are passing through or entering phases of rapid development, e.g. Spain, Greece and Finland (share accounted for by continuous casting: 80 per cent in 1979);
- Small countries where iron and steel production will probably remain limited, e.g. New Zealand, Switzerland, Norway and Portugal.

It is estimated that the crude steel production capacities of this group will amount in 1985 to around 87-90 million tonnes.[25/]

. Countries with centrally planned economies

The crude steel production of these countries (excluding China, the Democratic People's Republic of Korea, Viet Nam and Cuba) amounted to 210 million tonnes in 1979,[26/] which might indicate a crude steel production capacity of around 240 million tonnes (rate of operation of 85-90 per cent). If the rate of growth of these iron and steel industries is estimated at between 3 and 3.5 per cent, their production capacity would amount to between 290 and 300 million tonnes in 1985.

25/

Canada	20 million tonnes	Greece	3 million tonnes
Australia	12 " "	Finland	3.5 " "
South Africa	12 " "	New Zealand	1 " "
Sweden	7-8 " "	Switzerland	1 " "
Austria	6 " "	Norway	1 " "
Spain	20-21 " "	Portugal	1 " "

Business Week, 14 April 1980; Spanish Union of Iron and Steel Enterprises and Entities (UNESID), February 1980; Revue de la Métallurgie, August - September 1979; Telex Mediterranée, 3 July 1979; Metal Bulletin, various issues; etc.

26/ Metal Bulletin Monthly, March 1980. The share accounted for by continuous casting is small in this group of countries.

Crude steel production capacities available in 1985 in the industrialized countries would, then, amount to approximately the following:

EEC	206	million	tonnes
USA	170	"	"
Japan	170	"	"
Other OECD countries	87	"	"
Countries with centrally planned economies	290	"	"
Total (rounded off)	920-930	"	"

These capacities will have to be evaluated, taking into account the rapid development of continuous casting and its consequences by way of appreciable improvement of the yield of crude steel in terms of finished products.

. The developing countries

On the basis of information available, listed in detail in an annex, crude steel production capacities available in the developing countries in 1985 can be estimated as follows:

. China, the Democratic People's Republic of Korea and other Asian countries with centrally planned economies

Production capacity for 1985: 52 million tonnes of crude steel, including China: 45 million tonnes,[27/] and the Democratic People's Republic of Korea: 6.5 million tonnes.

. Asian countries

The crude steel production capacity which will be available in this region in 1985 is estimated at around 50 million tonnes, distributed as follows:[28/]

27/ Metal Bulletin, 4 July 1973 and 14 March 1980, etc.

28/ Metal Bulletin and the South East Asia Iron and Steel Institute (SEASI), "Steel in South East Asia".

Iran	5.0-6.0	million	tonnes
Pakistan	1.5	"	"
India	20.0	"	"
Burma/Bangladesh	0.5	"	"
ASEAN countries	5.0-6.0	"	"
Republic of Korea	12.0	"	"

. Latin American countries

The crude steel production capacity which will be available in this region in 1985 is estimated at around 58 million tonnes, distributed as follows:29/

Trinidad, Cuba and Central America	1.7	million	tonnes
Bolivia	0.1	"	"
Paraguay	0.1	"	"
Uruguay	0.1	"	"
Ecuador	0.45	"	"
Colombia	1.0	"	"
Peru	1.0	"	"
Chile	1.5	"	"
Mexico	13.0	"	"
Venezuela	7.0	"	"
Brazil	25.0	"	"
Argentina	7.0	"	"

. Arab and Mediterranean countries

The crude steel production capacity which will be available in this region in 1985 is estimated at around 22-23 million tonnes, distributed as follows:30/

29/ Metal Bulletin and the review of the Latin American Iron and Steel Institute (ILAFA).

30/ Metal Bulletin, L'acier arabe, Maghreb Development, etc.

Algeria	2.0-3.0	million	tonnes
Tunisia	0.230	"	"
Libya	1.0	"	"
Egypt	2.5	"	"
Syria	0.3	"	"
Lebanon	0.3	"	"
Jordan	0.4	"	"
Iraq	1.250	"	"
Qatar	0.400	"	"
Saudi Arabia and the Gulf	1.0	"	"
Yugoslavia	7.5	"	"
Turkey	7.0	"	"

. African countries

The crude steel production capacity in this region in 1985 is estimated at around 5 million tonnes, distributed as follows:[31/]

Zimbabwe	1.0	million	tonnes
Nigeria	3.0	"	"
Zambia	0.2	"	"
Kenya	0.4	"	"
Ghana	0.2	"	"
Others	0.2-0.4	"	"

The crude steel production capacities which will be available in 1985 in the developing countries would therefore amount to a total of:

China + Democratic People's Republic of Korea + Asian countries with centrally planned economies	52.0	million	tonnes
Other Asian countries	50.0	"	"
Latin American countries	58.0	"	"
Arab and Mediterranean countries	22.0	"	"
African countries	5.0	"	"
Total	187.0	"	"

31/ Metal Bulletin, Industrie et Travaux d'Outre Mer, Afrique Industrie, etc.

distributed as follows:

Countries with centrally planned economies	52.0 million tonnes
Other countries	135.0 " "

Total crude steel production capacity available in the world in 1985 would therefore amount to:

Industrialized countries	920-930 million tonnes
Developing countries	187 " "
In other words	1,107-1,117 " "

Rounded off to 1,100 million tonnes.

These various elements help to bring the picture of the world iron and steel industry for 1985 into focus, as follows:

(a) It is confirmed that there is virtually no danger of production capacities being saturated by demand during the early years of the 1980s, and that a world-wide balance will therefore be achieved between a demand estimated at some 900 million tonnes[32/] and a production capacity estimated at 1,100 million tonnes.

(b) It must be pointed out in this connexion:

- That actual production capacity will be relatively greater in 1985 owing to higher yields resulting from the development of continuous casting (and also other improvements);
- That available capacities (in Japan, Europe and the United States) for the construction of new facilities are such that they may enable the growth rate of iron and steel capacities to be considerably accelerated;

(c) This world-wide balance does not of course rule out the possibility of localized imbalances and shortages which might emerge during the first years of the 1980s:

- Shortages of scrap, coke and certain categories of products;
- Regional imbalances, in particular in the developing countries, which will be closely analysed after more general comments on the construction of the picture for 1985 have been made.

32/ Cf. for example, the calculations made by T. Kono, op. cit. Apparent steel consumption would increase from 729 million tonnes in 1978 to 900 million tonnes in 1985, with an average annual growth rate estimated at 3.1 per cent for the world; 2.4 per cent for the Western industrialized countries; 2.9 per cent for the industrialized countries with centrally planned economies; and 5.8 per cent for the developing countries.

2. SOME PROBLEMS RAISED BY THE CONSTRUCTION OF A GLOBAL PICTURE (1985)

The picture for 1985 thus obtained is still fuzzy. In the current situation, it would appear difficult to achieve a more satisfactory clarity, because many problems remain unsolved. It is important that these problems should be stated.

- Problems of information: Any attempt to construct a picture for 1985 (and all the more for 1990) encounters the difficulty of obtaining a large number of reliable and detailed items of information. There is a problem of availability, content and exactitude of the information. These difficulties relate not only to the forecasting of demand but also to projects - their size, technical and financial structure, development, etc. The difficulties also arise out of the uncertainty concerning some categories, in particular that of "production capacity". in the sense that there is a tendency to draw a distinction between "nominal capacity" or "theoretical capacity" and "effective capacity", reflecting maximum annual production of crude steel actually available.[33/]

- Problems of environment and choice of external variables. The uncertainty in the development of the world iron and steel industry is one reflection of the uncertainty concerning the future of the world economy. Iron and steel experts are looking for stable frames of reference for the growth rates of the main components of the world economy during the 1980s. The points of reference usually referred to are the global ones provided by the World Bank (1980-1990) and by the "Interfutures" scenarios (1980-2000). T. Kono, for example, forecasts an average annual growth rate of 4 per cent for the world economy in the period from 1980 to 1985. The paper submitted to the OECD Symposium by S. Ostry shows that this rate lies between the low rates and the moderate rates assumed by the OECD Interfutures and the World Bank projections. It is lower than the growth rate of 5.4 per cent which the world enjoyed before the oil crisis (1960-1973), but higher than

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33/ K. Suzuki and Tudor Miles, The growth of steel-making capacity in the 1980s, OECD Symposium, February 1980.

that of 3.3 per cent recorded after this crisis (1973-1978). In conclusion, it seems very probable that, during the first half of the 1980s, the world economy will continue to find itself in an adjustment phase. Other projections by the Wharton School propose an average annual growth rate of 4.5 per cent for the world economy in the period from 1980 to 1985.[35/] This is a very hypothetical rate in the sense that achievement of it depends on many conditions.

If there were a firm frame of reference for understanding the world economy in the 1980s, this would not prejudge the choice of economic magnitudes (external variables) to be given preference with a view to forecasting the development of the iron and steel industry (as concerns apparent consumption and demand). In the past, many methods referred to the relationship between the development of the Gross National Product and the development of steel consumption. Henceforth, it will probably be necessary to make use of a set of more subtle relationships, since it appears that there is a special relationship between steel consumption, on the one hand, and investment, on the other. Mr. Signora, for example, indicates that "it has been demonstrated in France that, for the year 1974, the share of final steel consumption which can be correlated to expenditure in respect of final steel consumption was around 16 per cent, while 84 per cent of that consumption could be correlated to investment expenditures".[36/] However, during this same year, expenditure in respect of consumption and investment accounted for 75.6 per cent and 24.4 per cent, respectively. This is an interesting contribution (to be followed up) to the finalization of a general method for forecasting demand. The different groups (institutes) which are devoting their efforts to this task in the early stages rejected approaches which were too comprehensive, instead turning to consideration of the impact of more limited sectors which were particularly "sensitive" with regard to steel consumption, such as construction (including mining and railway infrastructure), mechanical engineering (capital goods), motor vehicles, shipbuilding, etc. The special interest attracted by expenditure in respect of investment also leads to a study of the pattern of investments and the shifts in this pattern. These shifts are not predetermined, for while it is

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35/ Dr. S. Ostry, The world economy in the 1970s and 1980s, OECD Symposium.

36/ A. Signora, "Causes structurelles de la baisse de la consommation d'acier, 1974-1977", Revue de Métallurgie, November 1978.

possible that in certain areas and over a given period of time more intensive investments (energy savings) may involve capital goods containing less steel,[37] it is also probable that systematic use of new energy technologies (nuclear power, synthetic fuels and solar or geothermal energy) will directly or indirectly involve the use of capital goods with a high steel content.

Can the rapid growth in the consumption and production of steel in Canada be correlated with the acceleration in that country of energy-related investments? Many phenomena are ambiguous and require close analysis.

- One of the problems is that of the steel intensity curve. The method based on use of a steel intensity curve was successfully established by IISI in 1972, when it prepared its projections for 1985. After the lull in the crisis, IISI found that this method was no longer able to provide satisfactory results and has abandoned it for the time being. However, this curve none the less continues to be used as a point of reference for following a particular movement in steel consumption, starting with accelerated growth, followed by a slowing, a levelling off and possibly a decline in relative terms during a post-industrial phase.[38] In this situation the question is whether the United States, the EEC, Japan and also the USSR and Czechoslovakia have not entered the post-industrial phase or the preceeding saturation phase. However, the answer to this question is also unclear, since there are those who think, on the contrary, that the consumption, after a phase of stagnation may rally. In the United States, this rallying movement might be based on the reconstruction of the enormous American infrastructure, which is looked upon as increasingly necessary. The analysts of Chase Econometrics have been inspired by this belief, which has led them to project an average annual growth rate of 5 per cent for steel consumption in the 1980s.[39] To what extent is the situation of certain EEC countries and Japan comparable from this point of view to that of the United States? In any event, the situation should be evaluated cautiously because countervailing tendencies are at work in connexion, in particular, with:

37/ Signora, loc. cit., p. 620.

38/ P. Coidan and M. Cuenod, "Forecasting cement and steel needs in developing countries", Prospectives engineering, Gestion, Geneva.

39/ Metal bulletin, 18 March 1980 (Editorial), Chase Econometrics Forecast for 1990. "Replacement is seen as representing an enormous lump of capital investment. This sentiment is much stronger in the USA than outside." Cf. also Donald B. Thompson in Industry Week, quoted in the Bulletin of the Arbed Company, 13 and 14 July 1978, Nos. 132 and 133.

- The problem of specific consumption. The various studies carried out on steel consumption per unit of manufactured product indicate that this specific consumption has steadily declined:

In Japan: from 2,900 kg in 1966 to 1,950 kg in 1972 per bus;
from 900 kg in 1966 to 620 kg in 1970 per private automobile;

In the Federal Republic of Germany, between 1970 and 1977:
from 412 kg to 370 kg of steel per 1,000 kg of electrical machinery,
from 873 kg to 668 kg of steel per 1,000 kg of shipbuilding output;
from 612 kg to 557 kg of steel per 1,000 kg of rolling stock;
from 883 kg to 783 kg of steel per 1,000 kg of nuts, bolts and similar products, etc. 40/

The decline in specific consumption, accelerated by the effect of the energy constraint, results in the following:

- Substitution for steel of cheaper or, above all, lighter materials.
- The quality shift taking place in iron and steel production itself.

Ordinary steels are gradually giving way to high-quality steels such as high-resistance carbon steel and heavily or, more frequently, lightly alloyed steels. By comparison with 1979 (index 100), consumption of all steels by the EEC had reached an index number of 90 in 1978, while consumption of high-grade and special steels had attained an index number of 97.8 in 1978. The trend is even more clear-cut in Japan, where consumption of high-grade and special steels (October - December 1973 = 100) had reached an index number of 122.9, as compared with an index number of 84.8 for ordinary steels at the end of 1978.41/ The shift is so strong that it makes plausible the prediction that the services rendered in the year 2000 by one tonne of rolled steel would correspond to the same services rendered by 2 tonnes of rolled steel in 1974.42/ When these quality shifts combine, the final result is:

40/ For Japan, Source: JISF;
For the Federal Republic of Germany, Source: Commission of the European Communities.

41/ S. Hosoki and T. Kono, Japanese steel industry and its rate of development, paper for the Amsterdam conference, September 1979.

42/ Usine Nouvelle, 1 February 1979, and P. Emery, "Les besoins en énergie de la sidérurgie de l'an 2000", Annales des Mines, November 1978.

- Quantitative problems. The need to save energy (and more generally, raw materials) has triggered a process of increase in yields through more efficient operation of installations (blast furnace) and acceleration in the development of continuous casting.

A close correlation can be seen between the development of continuous casting and the decline in parts per thousand (crude steel per thousand kg finished products).

	Parts per thousand	Share accounted for by continuous casting (%) 43/
Japan (1979)	1 100 kg	51.5
Federal Republic of Germany (1976)	1 240 kg	28.3
Thyssen (1979)	1 190 kg	
Hungary (1979)	1 203 kg	32.8
Poland (1979)	1 390 kg	3.3

This explains why, in 1979, the Japanese iron and steel industry was able to achieve a record production of rolled products (cf. above) from a crude steel production which was much smaller than 1973 production. The average parts per thousand rate of the Japanese iron and steel industry should continue to decline, reaching a level of 1,075 kg in 1990.44/ As a result of these developments, which first affected Japan, then Europe, before spreading to the United States and other regions, crude steel no longer has the same importance:

- Either in terms of finished products, depending on whether or not there is continuous casting;
- Or in terms of iron ore or coking coal, depending on whether or not the pig iron comes from a high-performance blast furnace, etc.

From 900 million tonnes of crude steel - and this is precisely the estimated figure for requirements in respect of apparent consumption of steel in 1985 - the following can be obtained:

43/ Data from documents published by the Economic Commission for Europe, Geneva.

44/ Komoda, Amsterdam conference (Kawasaki Steel), September 1979.

- Either 692 million tonnes of rolled products with a parts per thousand rate amounting to 1,300 kg;
- Or 750 million tonnes of rolled products with a parts per thousand rate amounting to 1,200 kg;
- Or 818 million tonnes of rolled products with a parts per thousand rate amounting to 1,100 kg.

The discrepancy is so large that questions must be asked about the validity of evaluations in terms of crude steel, which take less and less into account the reality of situations or potential situations which vary increasingly from one iron and steel industry to another. Evaluations in terms of crude steel, which were long useful and adequate, have a tendency to conceal possibilities for rapid gains in real capacity (assessed simultaneously in terms of weight and of quality of the finished products).

They may also conceal new differences between the iron and steel industries in the industrialized countries and new iron and steel industries in the developed countries. This question has a direct bearing on the realization of the Lima objectives. What would be the point of producing 25 per cent or even 30 per cent of the crude steel if this production was not oriented towards the manufacture of an ever-expanding range of rolled products and high-quality steels, while economizing raw materials and energy? From this point of view, the Lima objective would be enhanced if it were amended to allow in a general way for a new method of evaluating shifts in the iron and steel industry giving preference to calculation in real terms of finished products rather than to the vague category of crude steel.45/

3. IMBALANCES AFFECTING THE DEVELOPING COUNTRIES

Until recently, the production of the iron and steel industries of the developing countries accounted for a small percentage of world production. The situation is changing, but it will take time for adjustments to be made and for the role of the iron and steel industry in the developing countries to be correctly evaluated as regards both its potential and the limits of its current development.

45/ The problem of the difficulties arising out of evaluation in terms of crude steel is now being raised in many quarters, e.g. by the European Confederation of Iron and Steel Industries (EUROFER), IISI, Mr. Signora, etc.

3.1 Some features of the iron and steel industry in the developing countries (picture for 1985)

The table appended as an annex shows that, in 1985:

- 50 developing countries will have crude steel production capacities;
- 62 developing countries will have rolled products capacities;

  Of the 62 countries: 36 will have production capacities of less than 500,000 tonnes;

  5 will have production capacities of between 0.5 and 1 million tonnes;

  12 will have production capacities of between 1 and 5 million tonnes;

  11 will have production capacities of more than 5 million tonnes;

- 23 countries will have integrated steel mills;
- 27 countries will have only semi-integrated steel mills;
- 30 countries will have direct reduction installations;
- 19 countries will have flat product capacities;
- 13 or 14 countries will have high-grade and special steels production capacities;
- 8 to 12 countries will have capacities for production of capital goods for the iron and steel industry (and also more or less highly developed design and engineering capabilities).

This means that, in 1985, whatever real stage of advancement the industry may have reached, there will still be very few developing countries in which iron and steel making will genuinely constitute a dynamic basis for industrialization. In addition, in 1985, over-all production capacities in the developing countries should amount to 187 million tonnes,[46/] while consumption by these countries (111 million tonnes of crude steel equivalent in 1976) could by that time reach 213 million tonnes, with an annual growth rate of 7.5 per cent,[47/] or around 200 million tonnes with a growth rate of 6.5 per cent. Real production, which can be estimated at around 140 million tonnes (187 x 0.75) will in any event be inadequate to meet demand. The deficit might amount to between 60 million and 75 million tonnes, depending on the level reached by consumption. There is therefore every reason to think that

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46/ Cf. above, in terms of crude steel, including 52 million tonnes for China and the Democratic People's Republic of Korea.

47/ This is the rate assumed by Dr. Nijhawan in his paper for the OECD Symposium: Global scenario of world steel industry growth particularly up to 1985, Paris, 27-28 February 1980, p. 19.

the imbalance will continue or even be intensified, for it is an imbalance which does not arise out of a lag in demand by comparison with supply, as is sometimes suggested, but out of a lag in supply by comparison with demand.

3.2 The impact of the developing countries on world steel demand

The emphasis thus far has been more on the developing countries' limited share of world iron and steel production than on their role in world steel consumption and trading. This role is now becoming increasingly significant.

In fact, the developing countries' share in both world steel production and consumption has increased and is expected to continue to increase as follows:

	Percentage of production	Percentage of consumption [48/]
1960	5.0 per cent	9.0 per cent
1977	11.3 " "	17.5 " "
1985	15.5 " "	24.0 " "

The developing countries are also on their way to becoming the world's leading consumer bloc:[49/]

Percentage of world steel consumption

	EEC Japan	North America	Rest of OECD plus South Africa	Socialist countries	Developing countries	Total
1960	30	28	6	27	9	100
1985	25	18	8	29	20	100
1990	23	17	8	28	24	100

It has also been accurately observed that, after having been strongly influenced by North America during the period from 1960 to 1965 and, later, by the EEC countries and Japan during the period from 1965 to 1970, growth in world steel consumption since the 1970s has, as T. Kono points out, been increasingly accounted for by the developing countries.[50/] The movement in

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48/ Helmut Wienert, World Trends in Steel Production and Consumption to 1990, OECD Symposium, Paris, February 1980, p. 12; and Nijhawan, op. cit.

49/ Wienert, op. cit.

50/ Source: ECE Geneva, quoted by T. Kono, op. cit., pp. 13 and 32.

international steel imports in the period from 1960 to 1978 is reflected in the following figures:

Annual growth rates in steel imports[50/]

	Industrialized countries	Planned-economy countries	Developing countries
1960-1973	9.1 per cent	7.9 per cent	7.7 per cent
1973-1978	2.8 " "	10.5 " "	7.5 " "

Thus, the steel purchases of the developing countries accounted for 37 per cent of world steel imports in 1978 as opposed to 27 per cent in 1970 and represented a major balance factor for European and Japanese steelmakers - balance for one group and imbalance for the other. The reasons for the persistence and worsening of this imbalance require analysis.

3.3 Causes of the imbalance

Against the background of a continuingly buoyant demand for steel in the developing countries, supply has lagged. In general, the causes of this lag lie in the cancellation of, or delay in, projects and also in delays in reaching scheduled production capacity at projects already completed. More specifically, the cause lies in:

- Outright cancellation of projects, representing the following approximate capacities of crude steel:

Iran	3.0 million tonnes[51/]	
Bolivia	0.3	" "
Peru	3.0	" "
Brazil (Itaqui I and II)	5.0	" "
Tunisia (Gabès)	1.0	" "
Mauritania	1.0	" "
Saudi Arabia (Marcona Steel)	3.5	" "

50/ See footnote on preceding page.

51/ Excluding the Australian project (5.0 million tonnes), the Italian project at Gioia Tauro (3.0 million tonnes), and the Spanish project at Sagunto (5.0 million tonnes).

- Indefinite postponement of projects:

China (Shanghai and other projects)				
Brazil:	CSN II	5.0	million	tonnes
	Central do Aço	3.0	"	"
Argentina (SIDINSA)		4.0	"	"
Morocco (Nador)		1.0	"	"
Total		13	"	" (minimum)

- Delays in starting project construction:

Republic of Korea (Ulsan I)	3.0	million	tonnes
Venezuela (Zulia I)	2.0	"	"
Argentina (SOMISA)	1.8	"	"
Algeria (West)	5.0	"	"
Algeria (Jijel)	1.0	"	"
Colombia (Paz del Rio)	0.5	"	"
India (Vishakhapatnam)	1.2	"	"
Total	-13.5	"	"

- Reductions in the scale of projects:

Trinidad (Iscott)	From 1.1 to 0.6	million	tonnes	
Brazil (Mendes Junior)	" 1.8 to 0.6	"	"	
Venezuela (Zulia)	" 3.2 to 2.0	"	"	
Total	-3.0	million	tonnes	

- Delays in the completion of work:

Iran (Ahwaz and Isfahan)	Relating to 3.0	million	tonnes	
Pakistan (Pipri)	" " 1.1	"	"	
India (Bokaro, phase 2)	" " 1.5	"	"	
India (Bhilai, phase 2)	" " 1.5	"	"	
Brazil (Tubarao)	" " 3.0	"	"	
Brazil (Usiminas, phase 4)	" " 1.5	"	"	
Brazil (CSN, phase 2)	" " 1.5	"	"	
Zambia (Tika)	" " 0.2	"	"	
Turkey (Iskenderun II)	" " 1.0	"	"	
Algeria (El Hadjar II)	" " 1.5	"	"	
Relating to a total of	15-16	million	tonnes	

- Delays in reaching scheduled production at new units:

  Venezuela (SIDOR II)

  Indonesia (Krakatau)

  Turkey (Iskenderun I)

  Egypt (Helwan)

  etc.

Obviously these millions of tonnes of capacity cancelled, delayed, temporarily poorly used or unused cannot be simply added together to yield a uniformly expressed and exactly quantified delay or loss figure. Nevertheless, it will be noted that the preceding list represents a minimum of 60 million tonnes of production capacity at a time when it is estimated that by 1985 the gap between supply and demand in the developing countries will amount to something like 60 to 70 million tonnes. In any event, it will be appreciated that the slowing down in the building of new capacities will make it difficult to raise supply to the level of demand, not only for the period up to 1985 but also, beyond that, through the period from 1985 to 1990.

3.4 Causes of the cancellations and delays

Is the problem one of markets, as is sometimes argued? This view seems to be borne out by a number of projects that were abandoned as soon as the crisis (1974) took hold: giant projects in Australia and Saudi Arabia, stages I and II of the Itaqui project in Brazil, projects in Mauretania, Tunisia (Gabès), and others. All these projects, which were initially designed to produce for the export market, were launched as initiatives of European, Japanese or United States firms as part of a policy of dispersing their production operations. It is noteworthy that none of these projects was the outgrowth of a local initiative to satisfy an internal market.

In a few limited cases, cancellations or delays have been the result either of an overly optimistic market evaluation (Peru) or of a profound political upheaval (Iran).

In general, the limitation of local resources of iron ore or energy does not appear to have represented a major obstacle to the on-schedule completion of projects. A number of steelworks have developed very rapidly even where there have been substantial shortages of raw materials, while conversely other countries with abundant raw materials have had projects cancelled or delayed.

On the other hand, rising costs and problems in financing are among the principal causes.

The increase in the cost of building a steel plant has been dramatic. In 1967-1968 the average cost per tonne of installed capacity was estimated at about $350; in 1976, experts estimated that this figure had risen, in the United States, to $800 at new construction sites. In 1980, this figure has been left far behind: it is routinely as much as $2,000 in developing countries, and at the 1979 Amsterdam conference, figures as high as $3,500 per installed tonne, taking into account the necessary infrastructure costs, were even suggested. Furthermore, a study group has concluded that between 1973 and 1979 the cost of equipment for basic industries had increased, on the average, three times faster than the average cost of inflation.[52/] The rise in costs has been of such magnitude that the internal resources of the developing countries are proving increasingly inadequate to ensure the financing of new iron and steel works.[53/]

The lion's share of the funds required must therefore be raised through external financing. Assistance from the World Bank and multinational institutions is limited and far from automatic. Foreign participation in equity capital is tending to become something of an exception since the cancellation of the large "redeployment" projects. The bulk of the credits are obtained in the form of suppliers' credits and loans negotiated with private banks. However, against the background of the increasing indebtedness of the developing economies, the sheer size of these credits and loans is posing an increasingly difficult problem. In 1978, the Brazilian Government's steel plan envisaged investment expenditures in the amount of $25 billion

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52/ New Investment in Basic Industries, British North American Committee, London, June 1979.

53/ The mills already in operation can contribute in only a limited way to the creation of new capacities. In Argentina, for example, the steel industry could finance only 30 per cent of its own expansion in 1977, 6 per cent in 1978, and 19 per cent in 1979.

over ten years, in other words, $2.5 to 3 billion a year or the equivalent of the total annual investment in this sector by the European Economic Community. The far less ambitious Nador project in Morocco would have absorbed the equivalent of all Moroccan investments over a one-year period. These examples reveal the extraordinarily heavy burden on the economies of the developing countries represented by the establishment of a steel industry.

It is not surprising therefore that costs and financing have been identified as the principal cause of cancellations and delays in the following projects:[54/]

- The new projects in India: Vishakhapatnam, Mangalore and Paradeep;
- The Philippine project on Mindanao, which has suffered endless delays for lack of financing;
- The Venezuelan project at Zulia, which has been delayed and scaled down because of financing problems;
- The SIDINSA project in Argentina, for which all that is lacking is a financing programme, or the SOMISA project, which cannot proceed until the necessary credits are obtained;
- The delay in phase 2 of the Iskenderun project in Turkey and in the fourth Sivas project;
- The cancellation of the Nador project in Morocco (scaled down to a 350,000-tonne rolling mill) because of financing difficulties;
- Numerous other projects in Latin America, Africa, the Mediterranean area, the Middle East and Asia.

Financing problems are particularly acute in the case of entirely new integrated steelworks. This category includes the following facilities:

Paradeep, Mangalore and Vishakhapatnam in India;

CSN II and the Central do Aço in Brazil;

SIDINSA in Argentina;

Zulia in Venezuela;

Sivas in Turkey;

Nador in Morocco;

Mindanao in the Philippines, etc.[55/]

54/ See the information published on this subject by Metal Bulletin (covering India, Venezuela, Turkey, Argentina and Morocco). Regarding Argentina the Bulletin reported on 18 March 1980 that there was little likelihood of a financial involvement on the part of Nippon Steel in the SOMISA project. Regarding the Philippines, on 19 February 1980, the same publication reported the refusal by the Japanese to make available the credits requested.

55/ None of these projects has yet been begun.

The fact is that investment of this kind is the most costly, since in addition to construction of the large production unit itself, the infrastructure and urban facilities without which the plant cannot properly operate must be established.

Costs and financing have thus become one of the critical factors in t future of the steel industry in the developing countries. There has been a great deal of discussion at the general meetings of the Latin America Iron and Steel Institute (ILAFA) on the negative effects arising out of the growing financing difficulties confronting the steel industries of the developing countries. The time seems past when one might have imagined that the easy extension of credit to these countries would permit the building of excess capacities that could pose a threat to the markets of the industrialized countries.

Steel industry officials in developing countries are looking for new arrangements to enable them to overcome problems of financing. Their efforts have concentrated on:

- The search for foreign partners to contribute to the equity capital. The examples of Argentina (SOMISA and SIDINSA), the Philippines (Mindanao project), and Venezuela (Zulia project) point to a refusal or hesitancy on the part of foreign investors in the face of the risks;
- The search for formulas linking external credits to payment in kind, using the output of the plant to be built, in the form of pig iron, intermediate products, or rolled stock. No such barter deal or buy-back agreement - of the kind that India, for example, has been negotiating with Soviet or West European suppliers - has yet been concluded. The agreement reached by SIDERBRAS in the case of the Turabao project is one of the very few so far concluded that links together external financing, capital participation, deliveries of capital goods and the acceptance of a part of the production with the promise of opening up a vast national market. This type of complex agreement involves a great many factors and variables. It provides an indication of the linkage which is forming, and which will probably become increasingly close, between iron and steel financing in the developing countries and more comprehensive negotiations.

However, questions of cost and financing should not obscure the problems connected with gaining technical expertise in countries where the iron and steel industry has only recently been established or is still being introduced. It is generally recognized that this technical expertise involves:

- Expertise in design extending from the initial idea of the project to the plans for its execution;
- Expertise in the production and installation of capital equipment;
- Expertise in the assimilation of industrial experience and the organizational machinery required to transmit it.

Weaknesses in technical expertise manifest themselves in delays in project implementation, delays in reaching scheduled production capacity, production stoppages or slowdowns, and in the protracted peaking of output at less than satisfactory levels of operation, etc. In this connexion, a cumulative negative process sometimes results from the interaction of financial difficulties and constraints and a low level of technical expertise. The more difficult the problems of financing, the greater the power of the financial backer to impose his conditions, including in particular the obligation to purchase equipment which he manufactures and which the recipient country could but will now not produce. The result is that a decisive component of technical expertise - the production of capital goods along with the supporting engineering studies - will be inhibited, that it will not be possible to make up this lag, and that it will therefore continue to be necessary to rely on external sources, etc. The examples of Brazil and India, among others, indicate that solutions to the problem of acquiring technical expertise could advantageously be sought in conjunction with solutions to problems of financing.

An examination of the factors of imbalance affecting the iron and steel industries of the developing countries suggests three observations:

(a) These imbalances are more or less severe and their characteristics vary from region to region. Thus, the main difficulties for iron and steel industries involve:

- In Asia: problems of financing;
- In the Arab countries: problems of technical expertise;
- In other Mediterranean countries: problems of financing;
- In Africa: problems of financing and technical expertise;
- In Latin America: problems of financing, which are reflected in a slower acquisition of technical expertise, etc.

Overall, it is the African countries which face the most difficult problems in developing their iron and steel industries.

(b) Experts now appear to agree that "the developing countries as a group pose little threat to the steel industries of Europe, the United States, Japan and the rest of the developed world over the next decade". 56/

Taken together, the factors we have been discussing point to a situation which is in reality less threatening to the industrialized nations, but is a source of concern to the developing countries themselves.

(c) During the period just elapsed, the developing countries have been unable to catch up with a continuingly buoyant internal demand because supply has been severely constrained by the difficulties analysed above. For these countries the problem through 1985 - and beyond - is less a problem of demand than one of supply.

4. THE INTERNAL DYNAMISM OF THE IRON AND STEEL INDUSTRY: THE EVOLUTION OF A NUMBER OF KEY VARIABLES

The analysis of the reasons for the imbalance affecting the iron and steel industry in the developing countries has highlighted the importance of the financing factor. Financing in this sector is a knotty problem. Numerous examples, however, show that the availability of abundant financial resources alone does not suffice to ensure the rapid development of this industry. Rather it is necessary but does not suffice in itself. The analysis has also revealed the correlation between financial constraints and technical expertise. We shall revert to this subject, but first let us consider a factor which demands attention in any industry processing raw materials which is a major consumer of energy, i.e. natural resources.

4.1 Development of the iron and steel industry and the availability of natural resources 57/

The iron and steel industry consumes millions of tonnes of iron ore, manganese, coking coal, limestone and refractory products; in addition, it requires thousands of hectares of space and millions of cubic metres of water. Historically, the production of iron and later of pig iron and steel has been linked to proximity to sources of iron ore and reducing agents: charcoal (forests) and then coke (coking coal). It should be recalled that less than thirty years have elapsed since six West European States brought iron, coal and steel under a common organization (the European Coal and Steel Community).

56/ Florkoski, op. cit., p. 11.

57/ See, in this connexion, P. Judet, The steel industry: prospects for the 1980s, paper for the OECD International Symposium on Industrial Policies for the 1980s, Madrid, 5-9 May 1980.

In 1976, UNIDO's first study on the world steel industry proposed a classification of developing countries based on the existence (or absence) of iron ore and reducing agents (coking coal, forests, hydroelectricity, hydrocarbons, etc.). It would appear that the major "redeployment" announced in 1974-1975[58/] was based on the same scheme, since the projects cited were located in regions where there were both ample space and abundant resources:

- Iron ore: Brazil, Australia;
- Hydrocarbons (natural gas): Saudi Arabia, Tunisia, Libya, Trinidad;
- Coking coal: Australia, South Africa, etc.

The redeployment process envisaged thus favoured the classical relationship between natural resources and the future development of the iron and steel industry. However, more than 15 years had passed since the appearance of steelmills "at the water's edge" had marked the first dissociation between steelmaking, on the one hand, and mining basins (natural resources), on the other. The general ebb in the redeployment movement has, in any event, provided an instructive indication that the existence of natural resources no longer represents the most influential factor for ensuring the dynamic growth of an iron and steel industry.

The fact is that history shows that for two centuries world steelmaking was dominated by countries rich in iron ore and coal, the leaders being, chronologically:

- Great Britain, which until 1850 accounted for more than 50 per cent of world production;
- Western Europe (Great Britain, Belgium, Luxembourg, Germany and France), which accounted for 68 per cent of world production in 1870;
- The United States, accounting for 60 per cent of steel production in 1920 and 63 per cent in 1945;
- The USSR, whose steel production surpassed that of the United States in 1971.

On the other hand, in the last 25 years the emergence of the Japanese iron and steel industry has introduced a new element into this history. The Japanese iron and steel industry is now the world's most modern. Between 1956 and 1976 it created a new production capacity of 137 million tonnes of

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58/ See, in this connexion, The World Iron and Steel Industry (second study), prepared by the International Centre for Industrial Studies (UNIDO/ICIS.89, 20 November 1978).

crude steel - four times more than the EEC, but at a lower total investment cost. More than 99 per cent of Japanese steel is produced in oxygen converters (LD steelmaking) and electric furnaces; slightly more than 50 per cent of this steel is continuously cast. Automation of production is proceeding at a rapid pace. Japanese consumption standards (for coke, for example) and the productivity of Japanese steelmakers are becoming the common standards of reference the world over. However, unlike the iron and steel industries of Great Britain, continental Western Europe, the United States and the Soviet Union, the Japanese iron and steel industry has access within its own territory to neither iron ore nor coking coal (except for a small share), both of which it must import from Australia, Canada, Brazil, India and other countries. What is more, Japanese steelmaking is becoming less of an isolated and exceptional case as its methods are copied in the Republic of Korea. It is precisely in the Korean iron and steel industry that the highest growth rates in production (and consumption) were recorded during the 1970s:

+300 per cent in the Republic of Korea between 1974 and 1979.

Conversely, it appears that the existence of abundant local resources of iron ore or reducing agents is not by itself adequate to trigger rapid development of the iron and steel sector. Colombia, for example, which has Latin America's largest reserves of coking coal, produces less than 500,000 tonnes of steel a year, while in the oil-producing countries, such as Saudi Arabia or Venezuela, steel production is expanding more slowly than expected.

In addition, the direct-reduction processes, which are based primarily (for the time being) on the use of natural gas,[59/] have not spread as rapidly as anticipated in the hydrocarbon-producing countries. In 1980, only 10 per cent of the world's direct-reduction capacity was installed in the countries of the Mediterranean basin and in the Middle East and 30 per cent in Latin America, as opposed to 60 per cent in the rest of the world.[60/]

59/ HYL and MIDREX processes.

60/ This pattern will, however, evolve in the period up to 1985.

4.2 Lower raw material costs linked to lower transport costs

This is the first explanation put forward to account for the physical separation between raw materials, on the one hand, and steel production, on the other. For nearly a decade there has been a decline in the prices of raw materials, in particular iron ore, on world markets. This drop in prices has been coupled, since the end of the 1950s, with a drop in the cost of ocean transport,[61/] which was a consequence of the increase in the size of ore carriers. "By the 1960s, virtually any country in the world with a deepwater port could obtain its basic raw materials at costs competitive with the United States or Western Europe",[61/] in other words, the traditional producers of these materials. The most striking example of this internal development since the second half of the 1950s is that of Japan, which has succeeded in profiting from the decline in the cost of raw materials and where, as a result, steel production costs have fallen throughout the entire subsequent period.[61/] The following table indicates how the cost of raw materials per tonne of finished steel has evolved in Japan and the United States:

	Japan[62/]	United States[62/]	Japan/US ratio
1956	93.17	56.17	1.66
1966	51.18	47.28	1.08
1976	112.29	151.10	0.74

Source: Federal Trade Commission of the United States. Staff report on the US steel industry and its international competitiveness, November 1977, table 3.1.

Today, it is fair to wonder to what degree this trend may be undergoing a radical alteration as a result of:

- The increase in the cost of energy (oil and natural gas) and the impact of the increases in hydrocarbon prices, which also affect the price of coking coal;
- The sharp upturn which has begun in the price of iron ore;
- The increase in ocean freight charges, which threatens to create an entirely new situation in the transport of heavy products.

61/ Dr. Robert W. Crandall, The economics of the current steel crisis in OECD member countries, OECD Symposium, Paris, February 1980, pp. 1 and 2.

62/ In US dollars.

The question, therefore, is to what extent these new factors will operate, again and to an increasing degree, in favour of the major producers of raw materials and energy, namely:

- Australia, Canada and South Africa;
- The USSR and Poland;
- Venezuela, Mexico and Brazil (and possibly Argentina and Algeria).

In any event, the comments of the Australian representatives during the last IISI Conference stressed the desirability and "need" for a return to these conditions.63/

As Sir Charles pointed out, the great iron and steel industries of the northern hemisphere have gradually restructured themselves to process imported rather than local ore. This development was made possible thanks to the lowering of transport costs. Today, however, with this restructuring already completed, the cost of transport has begun to increase and has nearly drawn even with the cost of the ore itself. As a consequence, three options are available: (1) to continue as hitherto, accepting the consequences as regards higher prices; (2) to shorten the distances by sacrificing diversity of supplies in favour of closer and cheaper sources; and (3) to break with the trend by developing iron and steel production near the mines in order to reduce the cost of transport in relation to the value of the product. In Sir Charles' view, it is this third option which will become increasingly inevitable. Established steelmakers must take this phenomenon into account whenever they plan the construction of new capacities.64/ The question for the 1980s, therefore, has been clearly formulated and deserves to be studied with care. It does not appear, however, that the decline in raw material and transport costs is sufficient to explain the phenomenon of the physical separation of raw materials and iron and steel production. At this point, we must reintroduce the factor of "technical expertise".

63/ Report of the proceedings of the thirteenth Annual Conference of IISI, Sydney, 15-17 October 1979. Statement of Sir Charles Court, pp. 32-35.

64/ Court, op. cit. Emphasis added.

4.3 Natural resources and technical expertise: The energy constraint

A great many countries which are suppliers of raw materials and energy have their own deepwater ports. This has enabled them to increase the rate of export of their natural resources, but not necessarily to develop or even to set up iron and steel industries. It would appear, therefore - and here we come face to face with the trend reflected by developments in Japan or in countries which have followed its example - that a reordering of factors is at work in the iron and steel sector and that the historically heavy emphasis on the "resource" factor is tending to give way to a focus on the "technical expertise" factor (or set of factors).

As the term is used here, technical expertise means the ability to organize information (collection and processing); to design, build, and manage complex systems; to select, assimilate, and adapt techniques; and to gear the range and quality of products to on-going and anticipated market trends. Technical expertise refers to engineering services, management skills, the organization of research and national integration of capital equipment.

Through technical expertise, costs can be reduced. It has a simultaneous impact on:

- Capital costs, whether in the execution of studies, the manufacture of equipment or the efficient and rapid building of installations, etc.;
- Operating costs, by achieving the most efficient use of the low cost of labour while at the same time making it gradually possible to absorb a substantial increase in the cost of this labour (the case of Japan).

Technical expertise also provides the means of applying optimum combinations of factors of production, including iron ore (or scrap iron) and energy, which it is generally agreed will represent a major constraint during the 1980s. The steel industry, it should be remembered, is the leading industrial consumer of energy, accounting for:

- 3.8 per cent of national energy consumption in the United States;[65/]
- 16.9 per cent of national energy consumption in Japan, where the iron and steel industry consumes more energy than the transport sector.

These statistics indicate that dependence on imported energy resources in the form of oil and coking coal will weigh most heavily on the Japanese iron and

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65/ According to Nippon Steel News, December 1979, the figures for 1976 were as follows: 6.6 per cent of national energy consumption in Great Britain, 8.0 per cent in France and Italy and 9.5 per cent in the Federal Republic of Germany.

steel industry. Actually, the situation is more marked by complexity and subtleties. It is not merely a question of the amount of energy consumed and of dependence on foreign suppliers; the ways in which this energy is used all along the steel production process routes must be taken into account, so that we are again dealing with the dynamic relationship between resources (in this case energy) and technical expertise that we have already discussed. At the limit, the development of this relationship leads to a reversal of the terms, since the energy constraint, far from paralysing the technical expertise capacity, actually operates to induce and promote it. The experience of Japan provides an excellent illustration of this phenomenon through the organization of technical and economic advances in the following two directions:

- Energy savings through the combined effect of plant modernization, the installation of specially designed equipment and the improvement of plant operation. In late 1973, Nippon Steel Corporation set itself the objective of a 10-per-cent saving in energy by 1980. This target had been surpassed by the end of 1978 (11.4 per cent), making it possible to launch a new campaign for an additional 7-per-cent saving by the end of 1983; 66/
- Mobilization of new forms of energy through systematic research to develop coke production formulas economizing on high-quality coking coal, coupled with the use of direct-reduction processes, charcoal-fired blast furnaces, etc. 67/

Taking the dynamic form of an immediate rebound, these advances reflect the response of the Japanese iron and steel industry to the challenge of the new energy constraint. The very vigour of the response has itself become an asset enabling the Japanese iron and steel industry to strengthen its influence everywhere in the world:

- In the marketplace, in the form of competitive steel products;
- In the form also of studies, engineering services and technical and financial assistance to many steel industries, either new or expanding, not only in Asia, Latin America and the southern and northern Mediterranean areas, but also in Europe and North America.

66/ Nippon Steel News, March 1979, July 1979 and December 1979. Japanese companies are not the only ones to have taken these measures. Consider also the results achieved by the German firm Thyssen (ATH), which in 1979 succeeded in reducing its energy consumption by 10 per cent in comparison with the 1960s level (Financial Times, 15 May 1980).

67/ For example, the Philippine charcoal-fired blast furnace project in conjunction with research into a fast-growing ligneous plant (ipil-ipil).

To summarize, then, the following seemingly paradoxical question must be asked: On the basis of the Japanese experience (i.e. of the most advanced iron and steel industries), can it be predicted that the iron and steel industries of the 1980s will be less characterized by problems of supply and energy availability than by an increasingly systematic emphasis on technical advances and expertise?[68/] It would be well to initiate a discussion on this question, a discussion which it would be beneficial to broaden to take into account the close relationship between:

4.4 Technical expertise and the availability of an experienced and cohesive manpower pool

The enormous importance of an experienced and cohesive work force is reflected in the measures taken by the iron and steel industry to cut back on energy consumption. Of the energy savings of 11.4 per cent achieved by Nippon Steel, 6 per cent - more than half - was attributable to technical improvements in operations,[69/] that is, to improvements in team performance (by engineers, technicians, foremen and workers) in every plant shop. Furthermore, it can be seen that the introduction of energy-economizing measures, in the Japanese iron and steel industry, is coupled with a development of the activities of "volunteer groups", which assume the responsibility, in each shop, for constant improvement of performance.[70/] Allowing for the particular characteristics of any individual national context, there are other examples which suggest that the cohesion and competence of "teams" of workers provides the foundation on which technical and economic advances are based. It is also a striking fact, however, that a great many advances currently being introduced or perfected contribute simultaneously both to technical progress and to an improvement in working conditions, for example, through:

68/ It must also be remembered, in this connexion, that it is necessary to relate, in terms of quantity and quality, the use of new energy forms and the dynamic evolution of steel production and consumption.

69/ See Nippon Steel News, December 1979.

70/ See "Voluntary group activities in Japanese steel industry", Nippon Steel News, September 1979.

- Improvements in the quality of refractory materials, leading to a reduction in time spent in the laborious task of relining furnaces;
- The development of the continuous-casting method, resulting in fewer costly and laborious scarfing operations. 71/

These brief remarks indicate the existence of an area inviting more detailed inquiry. It is altogether likely that, during the 1980s, technical expertise will come to be recognized as one of the key factors in the iron and steel industry, all the more so, as problems relating to the promotion of the labour force and the rapid improvement of working conditions will be regarded as a critical technical/economic component of the industry, and no longer as merely a so-called "social" component.

5. THE TECHNICAL AND ECONOMIC DEVELOPMENT OF THE IRON AND STEEL INDUSTRY: MARKERS FOR THE 1980s

In recent years statements have been made, suggesting that the iron and steel industry may be following the same path as the railways.72/ A basic industry, responsible for supplying industry with indispensable products, the iron and steel sector, it is said, is an old industry which has matured and is now in a state of decline; more and more ponderous, less and less profitable, and increasingly subject to State control, the iron and steel industry, according to this view, is becoming a kind of public service, offering customers an ordinary product, in which technical developments occur only slowly. Today, however, many specialists in different quarters are challenging this pessimistic view and are expressing regret that "policy-makers as well as many academicians labour under the characterisation of the steel industry as a mature or declining industry. This mistaken attitude has tended to reinforce protectionist policies and to thwart the readjustment process...". These same specialists are voicing the desirability for "policymakers.../to/ understand that the steel industry is one of the most important sectors of any industrial economy and is therefore still dynamic..."73/ provided that the dynamic forces are not stifled.

71/ On this point, the reader is referred to the work programmes of the French Iron and Steel Research Institute (IRSID).

72/ See "Off the Rails?", an editorial in Metal Bulletin, 15 September 1978.

73/ Florkoski, op. cit., p. 2.

Without taking a position on the relative place of this industry with respect to others, it would seem that the many technical and economic developments emerging in the iron and steel industry today hardly fit the image of an industry in decline.

5.1 Stabilization, but with intensification of technical progress

There is general agreement that the 1980s will witness the consolidation of the main coke ⟶ blast furnace ⟶ oxygen converter process route, supplemented by the scrap iron ⟶ ultra-high-power electric furnace route, as the predominant steelmaking process.[74/]

Thomas and Bessemer converters, along with open hearth furnaces, will have been phased out almost completely early in the 1980s. This process has already been virtually completed in Japan.

The drive for economies of scale has slowed down and would not seem likely to continue in the next few years. After the period 1979-1980, which was one of adjustment, the decade of the 1980s should witness the introduction of a process of technical intensification as a follow-up to the period of mass production interrupted by the crisis of 1974.[75/] In parallel to the firmly established main route, there will be a wide range of measures aimed at improvements and systematic modernization, from dry quenching in coke production to controlled-temperature rolling, and including more sophisticated management of the blast furnace (for such parameters as pressure, temperature and gas distribution) to make it a high-performance instrument, the achievement of higher grades of the steel, the general use of continuous casting (expected to account for 80 per cent in Japan by 1990), etc. At the same time, the established main route will be entirely redesigned not only to economize energy and raw materials, but also to operate in a continuous cycle, turning out high-quality steel products of great uniformity. The "secondary" route (scrap iron ⟶ electric furnace) will also undergo rapid development.

74/ See, for example, Sanbongi and Komoda, op. cit., p. 30.

75/ "Technology Developments in the Industry in the 1980s", Nippon Steel News, October 1979.

1960	1970	1980
Techniques of mass production	Adjustment: temporary measures (energy problems)	Advanced technologies

This intensification of the technical aspects of steelmaking will flow not only from the operational improvements that will be made, but also from the transformation of plant and equipment. The introduction of advanced technology will require costly investments and the mobilization of available research capabilities. An objective of this investment and research will be to promote optimum "sophistication and systematization" as regards the process routes already well established. During this decade, steelmakers in Japan, Europe, the United States[76/] and, no doubt, the USSR will allocate the bulk of their resources to upgrading already available capacities (and process routes). This means that there may be little room and few genuine opportunities left for other routes geared to major alternative approaches likely to interest a number of developing countries, such as the direct-reduction route.

The direct-reduction processes have been the subject of very optimistic predictions. At the time of the Bucharest conference it was estimated that installed capacities operating by direct-reduction methods would total 35 million tonnes by 1980. Actually, expansion has been much slower than expected. Direct-reduction capacities will not exceed 17 million tonnes in 1980, only 6.75 million tonnes of sponge iron having been produced by these installations in 1979.[77/] This accounts for a small percentage of world pig iron and steel production (about 1 per cent). The rate at which this proportion will increase by 1985 and 1990 is a matter of speculation. The fact is that the spread of the direct-reduction process has been hindered by:

- Technical developmental difficulties. The Brazilian facility at Cosigua has just been shut down and there are still problems at the Skoplje plant in Yugoslavia;
- The increase in energy prices and, in particular, the rapid rise in the price of natural gas. It was this factor that led to the closing of Oregon Steel's unit in the United States [78/] since sponge iron produced under these conditions cannot compete in price with scrap;

76/ This sophistication and systematization will no doubt enable the United States steel industry to acquire the additional capacity it requires (continuous casting).

77/ Metal Bulletin, 15 April 1980.

78/ The price of natural gas has increased by a factor of 10 in eight years, the rise having been 50 to 60 per cent between April and October 1979 alone, see Metal Bulletin, 23 November 1979.

- The limited interest in direct reduction by the world's leading steelmakers, who regard sponge iron as nor more than a marginal supplementary product. (The Japanese steel industry will require no more than 2 to 3 million tonnes of sponge iron in the 1980s for supplementing its scrap supply, while the European Confederation of Iron and Steel Industries (EUROFER) has also estimated its sponge iron requirements for the period 1985-1990 at about 3 million tonnes over and above its supplies of scrap; it is also probable that neither the United States nor the USSR will show a decisive interest in this route during the 1980s.)

The trend will be for the world's major steelmakers to regard direct-reduction processes as a marginal route merely offering an alternative to the use of scrap iron. Direct reduction is a promising approach for a large number of developing countries with extensive hydrocarbon resources, but whether this will be enough to ensure the mobilization of research and development capabilities in the 1980s on a large enough scale to bring about a breakthrough in this area is a question to which there is no clear answer.

5.2 "Quality-oriented" steelmaking

Recent developments in steelmaking (1975-1980) throw some light on the trends emerging at the beginning of the 1980s - a downturn in steel plate (as a result of the crisis in shipbuilding), general stagnation in ordinary steels, but considerable interest in high-quality and special steels.[79/] The increased demand for high-quality and special steels is in response to the needs of many customers seeking steel products which will enable them to reduce the weight and vulnerability to corrosion of their products (for example, in the motor vehicle industry) or will withstand very low temperatures (for the transport of hydrocarbons in arctic regions or the haulage of liquefied gas) or very high pressures (as in the chemical industry), etc. This trend is coupled with a desire on the part of manufacturers for

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79/ Using the figures for October-December 1973 as a base of 100, in Japan in 1978 the index was 122.9 for high-quality and special steels, but only 84.8 for ordinary steels and 56.4 for steel plate; see Hosoki and Kono, op. cit.

cheaper steel products without sacrifice of quality: stainless steels which have a lower nickel content[80] and are easier to work, tinless sheet steel for cans, silicon-free sheet for electric motors, etc.[81]

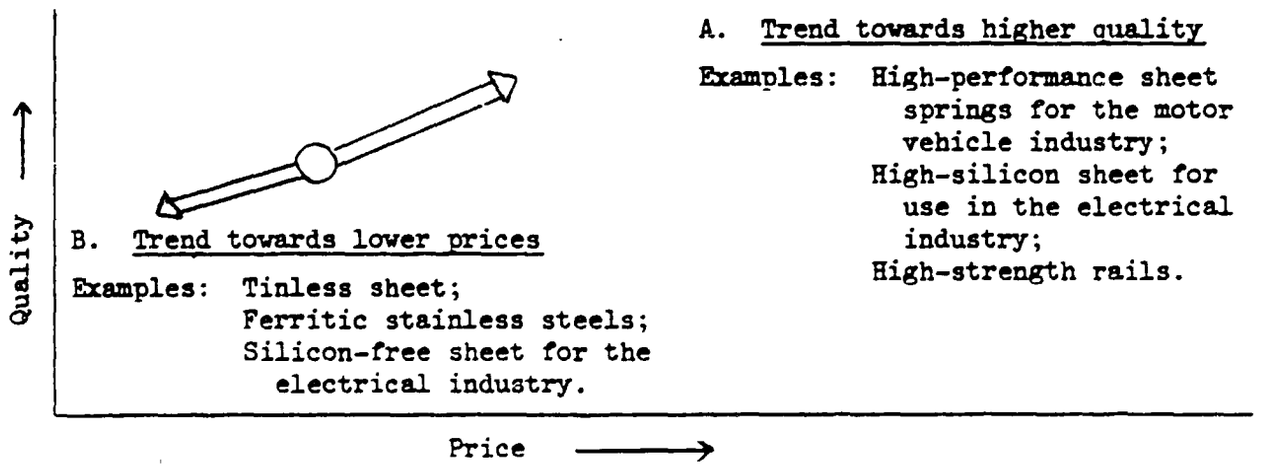
These trends reflect the converging interests of the steelmakers and their customers, both of whom are looking for uniform quality and savings in energy and raw materials. The two parallel and, ultimately, coinciding objectives of high-performance steels and steels which cost less but offer improved characteristics flow from the quest for uniform high quality and the application of advanced technology, reflecting the shift in priorities alluded to above - that is, away from research into new systems and processes and towards the development of increasingly sophisticated products designed to satisfy specific market requirements.

Seen in this light, research may be said to be unfolding in two directions. On the one hand, there is a reliance on quality control coupled with the development and new introduction of constantly improved products, and on the other hand, also essential to the improvements, there is research of a more basic type into the chemical composition, physical structure and behaviour of steels.

One of the effects of these trends on the pattern of structural changes within the steel industry is that what until recently was a very clear-cut distinction, in the production area, between ordinary steels and high-quality and special steels has been blurred as it becomes increasingly possible to produce quality steels using traditional routes:

80/ Saving on all metals, such as nickel, which are highly energy-intensive.

81/ See Nippon Steel News, October 1979. The diagram below illustrates the two-pronged development trend in market requirements:



- Rolling at controlled and low temperatures, and controlled cooling;[82/]
- Above all, ladle metallurgy and secondary refining, permitting the high-volume production of high-quality and special steels. 83/

The special steel plate used in the building of oil and gas pipelines for arctic regions is produced today at large LD shops. This development explains the mergers between the producers specializing in high-quality and special steels and the major large-volume steelmakers[84/] working with oxygen converters and high-power electric furnaces, and it reflects the increasing trend towards multi-purpose design of installations which can operate optimally only when producing both in mass and to very high quality standards.

In the light of these developments, one must again stress the inadequacy of evaluation of production in terms of crude steel. These same developments also pose the problem of the new distinctions which are likely to arise between advanced, integrated and multi-purpose iron and steel industries operating at a high level of technology, on the one hand, and new industries slowly making their way from the techniques of mass production to the stage of technological intensification on the other. This is almost certain to be one of the fresh challenges of the 1980s.

5.3 "Giantism" and economies of scale

"Economies of scale are finished!" This was the outburst of a former leading figure in the French steel industry.[85/] Moreover, this opinion is in line with the comments and analyses of others who stress the vulnerability of large complexes, seeing in them just so many signs of the transition away from mass-production technology towards an advanced technology geared to performance, cost-effectiveness and quality. It does appear that, at the end

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82/ TORSID process in France (Metal Bulletin, 22 February 1980).

83/ See Sanbongi and Komoda, op. cit., and Kono, op. cit.

Ladle degassing processes
ASEA - SKF - VAC;
DH;
RH.

84/ See, in France, the mergers between Sacilor and Pompey, Sacilor and Ugine and, possibly, between Usinor and Creusot-Loire (Le Monde, 16 April 1980).

85/ Mr. J. Ferry, during a seminar held in Geneva in April 1978 by the International Institute.

of the 1970s, the large steel production units have attained their maximum size[86/] and that the proliferation of small plants based on the performance capacity of the ultra-high-power electric furnace and popularized by the rapid spread of the "Brescianis" (so-called mini and medi-mills) will continue. The world's large steelmakers will operate with a combination of large and small, or very small, production units, integrating the manufacture of high-quality steels within their mass-production (BOF) programmes, while at the same time holding their positions in the area of less sophisticated products.[87/]

However, the question of size continues to be a problem for many small developing countries, particularly with respect to rolling mills. Is there a chance that it will become possible during the 1980s to design "made-to-order" rolling mills capable of being extended in stages?[88/] Or, considering that it is in the production of flat stock that the problem of size is most critical, should we look for a return to a modernized Steckel mill or to an extension of the use of the Sendzimir mill? These are the intriguing but apparently highly controversial views of a number of experts.[88/] It is a fact that a small English mill is producing hot-rolled sheet. Just what is the significance of this similarly controversial experiment? Under what conditions might it develop into a wide-spread practice? Will these questions, which are of paramount interest to small and medium-sized developing countries, be able to generate sufficient interest to lead to satisfactory solutions being found - or even seriously sought - during the 1980s? As matters now stand, it would seem difficult to answer in the affirmative. The entry into an era of advanced technology, the trend leading "upwards" and towards improved quality and the development of economies of scale, inescapably pose the following problem: how, under these conditions, can the orientation imparted to the steel industry by the interests of the producers in the vanguard be reconciled, during the 1980s, with the endeavour to realize the conditions required to promote the steel sector in many developing countries?

86/ New Investment in Basic Industries, British-North American Committee, London, June 1979. It appears that the possibilities of economies of scale have reached their limit, pp. 9 and 10.

87/ Examples are the TORSID process (Sacilor) and also the modernization of the steelworks at Oberhausen by ATH involving the acquisition of two 120-tonne electric furnaces (Metal Bulletin, 29 February 1980).

88/ See the paper by Mr. E.C. HEWITT, Director of the firm Davy Loewy, who referred to this possibility at the Amsterdam conference. (Metal Bulletin, 25 September 1979.)

6. DEVELOPMENT OF THE IRON AND STEEL INDUSTRY IN DEVELOPING COUNTRIES: A THREAT OR A PROMISE?

This question is gradually losing its emotional colouring; several statements at the OECD Symposium indicated a less dramatic and more realistic evaluation of the situation.

6.1. Historical development and "place in the sun"

It is difficult to see why the development of what is merely a further stage in the very long process reaching back over the ages, of the world-wide spread of the steel industry could be looked upon as a threat.

The British iron and steel industry dominated world markets in the middle of the nineteenth century and, in 1890, most ships launched in the world were built with plate produced in Great Britain.[89/] However, between 1895 and 1913, while steel production increased by a factor of 1.66 in Great Britain, it increased by a factor of 3.6 in the United States and by a factor of 4.25 in Germany.[89/] The Soviet iron and steel industry, followed by the Japanese iron and steel industry, subsequently came into their own, showing the same accelerated growth rates which had been previously experienced by the British, American and subsequently the German iron and steel industries. Accelerated growth rates are today being achieved by the developing countries or, more exactly, by a certain - limited - number of developing countries. This is in the logic of things: the astonishment caused by this development is undoubtedly attributable to the delay with which this new stage is beginning. The point is that this delay will have to be made up for.

89/ See B. Elbaum and F. Wilkinson, "Industrial relations and uneven development: a comparative study of the American and British steel industries", Cambridge Journal of Economics, 1979, Vol. 3, No. 3, pp. 275-303. Steel production in the United States increased by a factor of 23 between 1875 and 1900.

There was a time when the British iron and steel industry controlled the world market; every one of the iron and steel industries which have since come to the fore - German, American, Japanese - has in turn made inroads into this market and claimed a share for itself, and sometimes, as in the case of the EEC and Japan, a very large share. Every rapidly developing iron and steel industry has carved out its own "place in the sun". This is what the "newcomers" are also demanding at the beginning of the 1980s. Even if the iron and steel industries of the developing countries have not set themselves priority export targets, they still want to participate in foreign trade for the following reasons:

- To solve problems of temporary surplus capacities (effect of scale);
- To adjust their foreign exchange balances, which are burdened by imports of equipment, services, ore or coking coal;
- To verify, in some cases, the "international" quality of their products on foreign markets.

The developing countries (especially in ILAFA) are demanding participation in international trade and are protesting against the protectionist tariff measures and policies applied by many industrialized countries. It is interesting to note that certain Western experts talk about "discrimination" in this connexion. For example, Dr. Florkoski acknowledges that "... exclusion of steel mill products from preferential tariff schemes of developed countries and failure to make allowance for developing country exports (which do not have the benefit of historic market share in contrast to exports from more established sources) in the application of quantitative import restraints are cause for legitimate criticism by developing countries ... Attention must be focused on a number of issue areas, some of which are highly controversial and have tended to be shunted aside.

"Industrialised countries must seriously consider removal of tariff and non-tariff obstacles to develcping country steel exports".90/

90/ Florkoski, op. cit., p.13. (Emphasis added.)

There is nothing untimely, therefore, in this demand by the developing countries; it is part of a historical trend which has already repeated itself several times.

6.2. The 1980s: overtures towards co-operation?

In the world iron and steel industry, the second half of the 1970s was characterized, on the one hand, by fear, which gave rise, on the other hand, to distrust.

As Dr. Florkoski points out, "... the emergence of some developing country producers as steel exporters is regarded by some as a potentially disruptive factor in the world steel market. In general, this fear is exaggerated. But, it has resulted in generating mistrust and deep suspicion on the part of developing countries. Efforts to persuade developing countries to actively participate in international forums on steel are proving difficult. Vituperative complaints by some industrialized countries against the granting of preferential export credits for financing new steel plants in developing countries contribute to the distrust."91/

This is the situation, but it is of note that more and more voices are expressing the hope that, in the coming decade. we shall be able to move beyond it, for the future of the world iron and steel industry depends on achievement of the necessary co-operation, relating, inter alia, to the following:

- Organization of the market:
- Development of new production capacities, linked to problems of financing;
- Technical developments and research planning, etc.

Such co-operation must be comprehensive and worldwide: for this purpose, if it is to be realistic, it must take into account the growing involvement of Governments in the operation of the world iron and steel industry. "In this connexion, it must not be forgotten that the bulk of world steel production, i.e. more than 50 per cent, is now directly or indirectly controlled by public authorities."92/

91/ Op. cit., p. 12

92/ F. Peco, How steelmaking enterprises can become internationally competitive", OECD Symposium, Paris, February 1980, p. 18. See also the statement at the Symposium by Mr. Alan W. Wolff, former Chairman of the OECD Steel Committee.

According to Mr. Kono, this co-operation should also take the form of assistance by the industrialized countries in developing the iron and steel industry in outside countries: "... it is ... important that the industrialized countries act to meet the strong demands of developing countries that desire to be more self-sufficient in steel supply. We believe that a reasonable approach to this problem is for industrialized countries to provide suitable economic and technical co-operation for such steel plant construction projects as deemed appropriate in the light of ... the degree of economic development achieved in that country."93/ It will be noted that this statement describes assistance to the developing countries - technical and financial assistance - as an important task for the industrialized countries; it will also be noted that several of the lines of action indicated give rise to debate, especially as regards the self-sufficiency of the developing countries and the appropriateness of technology.

As regards self-sufficiency, we may question whether an iron and steel industry of any standing can refrain from participating in world trade, to however limited an extent: this question has already been referred to. But we may also question the dynamism of an iron and steel industry which, in the long run, would be unable to find on the spot either the capital goods or the services which it needs in order to extend and renew its capacities, as well as to assimilate and adapt techniques effectively. Can co-operation in the iron and steel industry for long disregard and avoid co-operation for the production of the equipment and services on which the very existence and progress of the industry depend?

As regards the appropriateness of technology, it is essential to explain what is meant by appropriateness, as this expression is used with very different meanings. The question is whether appropriateness of technology is reduced to small, non-essential modifications to a few local factors, or whether it means genuinely taking into account the specific needs of the

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93/ Kono, op. cit., p. 16.

developing countries, and precisely those which do not necessarily coincide with the "weight" of the interests of the industrialized countries and which, for example, might direct their resources and energies (R and D) into:

- Direct reduction: extending its possibilities and applications as regards reducing agents, the range of ores used, etc.;
- Enlargement of the production range of small plants (flat products):
- More generally, the optimum utilization of local resources and factors of production.

The impressive ability of the advanced iron and steel industries e.g. the Japanese iron and steel industry) to meet the challenge of the new international environment shows that it would be possible to find solutions to important problems relating to the promotion of the iron and steel industry in developing countries, provided that the means devoted to this aim attained a "critical mass". Of course, it should not be forgotten that these solutions would probably prove to be of just as much interest to the advanced iron and steel industries as to the new ones in the developing countries.

It is perhaps reasonable to think that broad areas of common interest will be systematically explored and gradually developed during the 1980s. These will include areas of common interest between the South and the North, but also between the South and the South, e.g. between the oil-rich South and the South which is already more advanced in iron and steel industry development.

7. CONCLUSIONS. THE PICTURE FOR 1985: THE QUESTIONS ASKED

These are not, in fact, so much conclusions as a series of questions drawn from our previous discussion and submitted for the Working Group's consideration with a view to making progress in preparing scenarious for 1990.

(A) An initial series of questions relating to the development of the iron and steel industry and more directly to the picture of the iron and steel industry for 1985

1. On the basis of the factors discussed above, is it reasonable to think that in 1985 there will be a balance between an over-all demand estimated at about 900 million tonnes (crude steel equivalent) and an over-all production capacity estimated at about 1,100 million tonnes (crude steel equivalent)?

2. We know that this over-all balance is consistent with partial imbalances:

- Either in terms of products, e.g. relating to coke, scrap-iron, etc.;
- Or in regional terms.

In this connexion, is it reasonable to estimate at an order of magnitude of 60 million tonnes (crude steel equivalent) the imbalance between supply and demand (i.e. the deficit) which will affect all the developing countries in 1985?

3. Does adequate explanation appear to be offered by the analysis of the causes of the persistent lag in supply as opposed to demand in the developing countries which stresses:

- The rapid rise of costs and the difficulties of project financing, on the one hand; and
- Weakness in technical expertise on the other.

4. Do not the various analyses make possible a better evaluation of the role of the developing countries in the iron and steel industry, and, if the threatening aspect is eliminated, a more dispassionate contemplation of the implications of comprehensive co-operation?

(B) A second series of questions arises out of an analysis of trends in the iron and steel industry, not only up to 1985, but also through the 1980s. These questions are sometimes comprehensive questions: they cannot be strictly classified in terms of supply and demand, inasmuch as one variable which is considered important may trigger a sequence of interrelations and feed-back effects influencing other variables.

Questions relating to the world industry as a whole, beginning with demand and the place of steel demand in general economic trends.

1. Are the general projections for the world economy now available for 1990 (and for the year 2000) ("Interfutures", World Bank, Wharton School, etc.) an adequate basis for making reliable iron and steel industry forecasts? If not, how can we construct (or devise) some satisfactory framework? Is this considered possible at the present time?

2. It would seem that a 1:1 ratio to the growth of the GNP (per capita) must be looked upon as an inadequate basis for calculating the development of steel demand. Studies in progress (in IISI, in particular) are concerned with the development of investments as well as with the development of the pattern of these investments. Can we expect a method to be perfected in the near future (1 or 2 years), making allowance for these new key variables, while at the same time taking account of the implications of the cost of energy, the fluid nature of the international monetary system, etc.?

3. If it would also seem that the calculation of demand should have concrete reference to the important user sectors, how can this forecast take account, not only of the cost of conventional types of energy, but also of the mobilization of new sources of energy capable of allowing for increasing quantities of steel?

4. This raises the problem of the possible development of the "steel intensity curve": in the case of the United States and other advanced countries, is it reasonable to think that this curve will take a fresh upswing as a result of the necessity to rebuild infrastucture or of the mobilization of new forms of energy?

5. If future developments in the steel industry are correctly evaluated, must we not take into account the (rapid) decline in the specific consumption of steel per product unit, a shift which is the result both of a tendency to substitute other products for steel and of a general trend towards the use of high-quality steels?

6. Has not the evaluation of consumption, production and production capacity in terms of crude steel equivalent been rendered obsolete by the rapid decline in parts per thousand (crude steel per thousand kg finished product) due in particular to the increasingly widespread use of continuous casting? Should we not move towards evaluations in real terms and in terms of finished products?

Questions relating to technical and technical/economic developments

1. We are faced with one initial, all-embracing question: is the steel industry considered to be an industry in decline? Is such an allegation compatible with the following:

(a) First, the prospect of a "stabilization" of the two main routes (HF - LD and electric furnace), when these two routes are nevertheless undergoing intensive improvements of various kinds (systematization and optimalization);

(b) Secondly, the effective movement from an era of "mass" technology into one of "advanced technology";

(c) Lastly, the rapid trend towards quality and towards high-performance steels, based on quality control and uniformity and on reliance on reseach (including basic research on physical structure and chemical composition)?

2. Is there a real and irreversible attenuation of the distinction between the manufacture of ordinary steels and that of high quality and special steels, conferring a new advantage on integrated complexes able to take advantage of polyvalency of plant sizes and installations?

Questions relating to the readjustment of the key variables

1. "Natural resources" long constituted the decisive variable in the iron and steel industry (iron and coal). Does there appear to be a real question as to this pre-eminence today?

2. What part has the development in transport costs (big ore carriers) played in this trend and what part is it likely to play in the future? Can we expect a return to countries which are rich in natural resources?

3. Is the "natural resources" variable now yielding to the "technical expertise" variable (and the complex set of factors of which it is composed)? In this connexion should energy be considered only as an onerous constraint or rather also as a challenge which, once accepted, will open the way to decisive technical advances?

4. Would it not be helpful to present a clearer picture of the importance, not only of work experience, but also of the cohesion of manpower as a basis for a dynamic technical expertise? In this connexion, is not improvement of working conditions becoming a factor of prime importance in furthering technical progress?

II. QUESTIONS PARTICULARLY CONCERNED WITH THE POINT OF VIEW OF THE DEVELOPING COUNTRIES

The iron and steel industry was chosen as one of the priority industries for implementation of the Lima targets. At the First Consultation Meeting, the share of world iron and steel production to be accounted for by the developing countries by the year 2000 was fixed at 30 per cent.

In this connexion, it will first be noted that the share of the developing countries in world steel consumption will approach 25 per cent by 1990, considerably outstripping their share in production, and that this percentage would be much higher if account were taken not only of direct steel products but also of steel imported in the form of machinery and miscellaneous equipment.

Consequently, the following questions centre on this gap and on the "weight" which the developing countries may or may not be able to bring to bear in influencing the development of the steel industry in a way which will be more or less conducive to their endeavour to close this gap.

1. Is the claim that the BF/LD and EF routes have been "stabilized" consistent with the claim that sufficient attention has been paid to alternative routes (direct reduction, for example); in particular, is it consistent with the mobilization of an adequate "critical mass" of research along the lines desired by the developing countries?

2. Many developing countries are interested in the possibility of setting up small steelworks. There seem to be possibilities for widening the range of products manufactured by these units, but can we hope that adequate interest and resources will be mobilized to perfect techniques along these lines?

3. It is possible that the developing countries are moving towards a share in world iron and steel production of between 25 and 30 per cent by the year 2000. In the next few years, however, what will be the meaning of production measured in terms of crude steel, when the process of differentiation in terms of steel qualities will be gaining momentum? From this point of view, is it not becoming necessary to amend the Lima targets in order to take account of the realities of the steel industry, where the trend is towards the manufacture of quality products?

III. QUESTIONS RELATING TO CO-OPERATION

As there does appear to be general agreement about the importance of world-wide harmonization in view of the fact that Governments are taking an active part (accounting for more than 50 per cent) in the establishment and operation of world iron and steel industry facilities, and as the industrialized countries also seem to be planning to provide assistance to the developing countries in steelmaking, the questions arise as to whether this assistance should not first help to solve what are apparently the most serious difficulties, relating to:

1. Financing of the steel industry. In this connexion, are new formulas of the "barter deal" or "buy-back agreement" type practicable?

2. Progress in technical expertise. Can it be considered that genuine technical expertise in the iron and steel industry may even play a part, not only in the operation of facilities but also in the ability to plan and build them and start them up?

3. Orientation of research not only in the light of the weight of the vested interests of the industrialized countries, but also in that of the interest shown by the developing countries in new approaches and alternative techniques.

4. Lastly, non-discrimination in the organization of international trade, so as to take account of the newcomers as well as of the older partners.

These questions, which arise out of an analysis of trends in the iron and steel industry for the coming decade, are suggested for discussion and evaluation by the Working Group. The answers given will make it possible to evolve hypotheses for developments in respect of the key variables which will be involved in the construction of alternative scenarios for 1990.

A N N E X E S

ANNEX I — DEVELOPING COUNTRIES

ESTIMATED PRODUCTION CAPACITIES FOR 1985

ANNEX II — ESTIMATED PRODUCTION CAPACITIES PER COUNTRY - 1985

A. AFRICAN COUNTRIES (south of the Sahara)

B. ARAB AND MEDITERRANEAN COUNTRIES

C. ASIA

D. LATIN AMERICA

ANNEX III — DEVELOPING COUNTRIES

PRODUCTION CAPACITIES FOR 1985 - DELAYS (some examples)

ANNEX I DEVELOPING COUNTRIES: ESTIMATED PRODUCTION CAPACITIES FOR 1985

	Rolled products only	Steel	Integrated steel mills	Semi-integrated mills	Direct reduction	Flat products	High-quality and special steels	Capital goods	Production capacity (millions of tonnes)			
									⩾ 5.0	1 to 5	0.5 to 1.0	⩽ 0
IRAN		X	X		X	X			X			
SINGAPORE		X		X								X
THAILAND		X		X						X		
PAKISTAN		X	X			X				X		
MALAYSIA		X	X		X						X	
BANGLADESH		X		X	X						X	
BURMA		X		X								X
INDIA		X	X		X	X	X	X	X			
REPUBLIC OF KOREA		X	X		X	X	X	X	X			
CHINA		X	X		X	X	X	X	X			
NORTH KOREA		X	X		(?)	X	X	X	X			
PHILIPPINES		X	X		X	X	X			X		
PAPUA NEW GUINEA		X										X
HONDURAS		X		X								X
DOMINICAN REPUBLIC		X		X								X
GUATEMALA		X		X								X
PANAMA		X		X								X
EL SALVADOR		X		X								X
BAHAMAS		X		X								X
CUBA		X	X				X				X	
COLOMBIA		X	X		X	X				X		
CHILE		X	X		X	X	X	(X)		X		
PERU		X	X		X	X					X	
BOLIVIA		X		X								X

ANNEX I (continued)

	Rolled products only	Steel	Integrated steel mills	Semi-integrated mills	Direct reduction	Flat products	High-quality and special steels	Capital goods	Production capacity (millions of tonnes)			
									⩾ 5.0	1 to 5	0.5 to 1.0	⩽0
TRINIDAD		X		X	X							
PARAGUAY		X		X								
URUGUAY		X		X								
ECUADOR		X		X	X							
MEXICO		X	X		X	X	X	X	X			
VENEZUELA		X	X		X	X	X		X			
BRAZIL		X	X		X	X	X	X	X			
ARGENTINA		X	X		X	X	X	X	X			
YUGOSLAVIA		X	X		X	X	X	(X)	X			
TURKEY		X	X		X	X	X	(X)	X			
SYRIA		X		X								
LEBANON		X		X								
JORDAN		X		X								
IRAQ		X		X	X					X		
KUWAIT	X											
QATAR		X		X	X							
U.A.E.	X											
ABU DHABI	X											
OMAN		X		X	X							
SAUDI ARABIA		X		X	X						X	
EGYPT		X	X		X	X		(X)		X		
LIBYA		X		X	X					X		
TUNISIA		X	X									
ALGERIA		X	X		X	X		(X)		X		

ANNEX I (Continued)

	Rolled products only	Steel	Integrated steel mills	Semi-integrated mills	Direct reduction	Flat products	High-quality and special steels	Capital goods	Production capacity (millions of tonnes)			
									⩾5.0	1 to 5	0.5 to 1.0	⩽0
MOROCCO	X											X
MAURITANIA	X											X
SOMALIA	X											X
SENEGAL	X											X
IVORY COAST	X											X
GHANA	X											X
TOGO		X		X								X
ZAIRE		X										X
ANGOLA		X										X
ZIMBABWE		X	X							X		
ZAMBIA		X		X	X							X
NIGERIA		X	X		X	X				X		
MOZAMBIQUE	X											X
TANZANIA		X										X
UGANDA		X										X
KENYA		X		X	X							X

ANNEX II. PRODUCTION CAPACITIES PER COUNTRY - 1985

A. AFRICAN COUNTRIES (south of the Sahara)

SENEGAL - Mini-mill project (rolling mill?)
Capacities: from 0.018 to 0.036 million tonnes

LIBERIA - Feasibility studies (by MECON-India)
for a capacity of 0.200 million tonnes?

IVORY COAST - Expansion of capacity of rolling mill now in planning
from 0.045 to 0.060 million tonnes
Electric furnace project - capacity of
0.030 million tonnes (Tiers Monde Ingénierie, 23 February 1979)

GHANA - Project for a unit at SEKONDI with KRUPP
Capacity: 0.200 million tonnes (?) (Afrique Industrie, 1 November 1977)

TOGO - Project for expanding the mini steel mill capacity from
0.020 to 0.40 million tonnes (Metal Bulletin, 17 February 1978)

ZAIRE - Project for expanding the MAKALU unit (with Italian companies?)
from 0.120 to 0.250 million tonnes

BURUNDI - Foundry project

ANGOLA - Present unit: crude steel: 0.030 million tonnes
rolled steel: 0.50 million tonnes
(2 electric furnaces - 18 tonnes)

ZIMBABWE - RISCO expansion project
(present capacity, 1.0 million tonnes)

ZAMBIA - In construction (with Yugoslave co-operation):
TIKA unit, 0.200 million tonnes (2 electric furnaces - 55 tonnes)

MOZAMBIQUE - Small unit, 0.045 million tonnes
(plus 2 units: pipe and tube works and wire drawing mill)

- Western project (ore from Gara Djebilet)
  Capacity from 5.0 to 10.0 million tonnes
  First stage after 1990?
  Beginning with the first rolling mill at Tiaret or Saïda?

MOROCCO - NADOR (SONASID) project, revived earlier project with an integrated steel mill, 1.0 million tonnes, but again reduced at the end of 1979 to a rolling mill, 0.350 million tonnes, for long products (1982-1983)
- SIDERMA project at Tangiers
  Rolling mill: 0.160 million tonnes (private group)
- Other projects with private Moroccan and Italian groups
  Rolling mill: 0.100 million tonnes to 0.120 million tonnes

MAURITANIA - Pre-existing project with Kuwait; capacity: 1.0 million tonnes: cancelled
- New, mini-capacity project: 0.020 to 0.040 million tonnes

SOMALIA - Mini-project: feasibility study by Italian consultants (1975)

PORTUGAL*/ - Sines project to raise capacity from 0.5 to 2.0 million tonnes (flat products)
- In 1979 the project was reduced to an expansion (long products only) of the Seixal unit from 0.5 to 1.0 million tonnes (1983)

SPAIN*/ - SAGUNTO project (AHM): expansion cancelled
- Direct reduction project
  SIDERAR and PREPELSA - frozen for the time being
- The pre-existing plan for a production capacity of 20.0 million tonnes in 1982 was abandoned in 1978 and replaced by a new, less ambitious plan: production capacity in 1985: from 18 to 20 million tonnes

ITALY*/ - GIOIA TAURO project cancelled except for one cold rolling mill of 0.250 million tonnes

ALBANIA - Production capacity of 0.7 million tonnes (?)

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*/ The production capacities of the countries marked with an asterisk are not counted among the production capacities of the developing countries.

NIGERIA - Projects under construction

- AJAOKUTA (with the USSR and Sofresia participation) BF/LD
  Capacity of first phase: 1.3 million tonnes (planned for 1982 but actually very much delayed)
  (second phase: 2.6 million tonnes)
  (third phase: 5.0 million tonnes)
- DELTASTEEL - DR (Korf and Lurgi) with the German company GHH
  Capacity of first phase: 1.3 million tonnes (Metal Bulletin, 22 June 1979 and 16 May 1980)
- 3 rolling units
  Capacity: 0.210 million tonnes x 3. For 1982 (Afrique Industrie, 1 April 1980)
- 3 pre-existing small units = 0.170 million tonnes plus processing units (Japanese interests)

SWAZILAND - Joint project with KENYA, with Swaziland supplying the iron ore for the Kenyan unit (?)

TANZANIA - TANGA project (with Italian companies?)
0.90 to 0.160 million tonnes (MOCI, 29 January 1979)

UGANDA - Small unit, 0.015 million tonnes

KENYA - Project: capacity 0.3 to 0.400 million tonnes
Direct reduction (Mombasa refinery gas)
Cost: US$ 375 million (financing) (Metal Bulletin, 21 July 1978)

ETHIOPIA - Project for a general study of the steel industry

B. ARAB AND MEDITERRANEAN COUNTRIES

SYRIA - HAMA unit, project for expansion from 0.120 to 0.300 or 0.600 million tonnes
Studies carried out by MECON (Master plan for Syrian iron and steel industry)

LEBANON - At present: 3 units (rolling mills and semi-integrated steel mill)

JORDAN - ZARKA unit: expansion from 0.120 to 0.260 million tonnes?
Establishment of a new steel company (with the co-operation of Danieli)
Capacity: 0.150 million tonnes by the end of 1980
Another unit for the 1980s

IRAQ - KHOR EL ZUBEIR unit - HYL direct reduction
1.2 million tonnes of sponge iron
0.800 million tonnes of steel (four EF 70 tonnes)
Capacity increased to 1.25 million tonnes?
Baghdad project (DR with Kobe Steel), feasibility study
Project with Kawasaki for 1983 (1.5 million tonnes)

KUWAIT - Expansion of pipe and tube mill from 0.035 to 0.100 million tonnes
Direct reduction project: 0.400 million tonnes; abandoned for the time being.

QATAR - Qatar Steel unit (with Kobe Steel)
DR: 0.400
Steel: 0.400

U.A.E. - DR/EF project. Capacity: 0.400 to 0.500 million tonnes
Appears to have been abandoned or deferred.

ABU DHABI - DR project: 0.400 million tonnes, seems to have been abandoned, but there is a new project with India (MECON)

OMAN - DR project (with DASTUR)
Capacity: 0.120 million tonnes

BAHRAIN - Project mentioned, 4.0 million tonnes (Saudi Arabian, Kuwaiti and Iraqi interests) (Metal Bulletin, 20 May 1980)

SAUDI ARABIA - Projects cancelled:
- With MARCONA STEEL
  DR/EF, capacities: 3.5 million tonnes
- Expansion of the Jedda unit (with BHP)
  from 0.045 to 0.250 million tonnes

Projects under construction:
- SABIC unit at JUBAIL (with Korf and Lurgi)
  Direct reduction (MIDREX), to be completed by the end of 1982
  Capacity: 0.850 million tonnes

- Pipe and tube mill (with SUMITOMO)
  Capacity: 0.085 million

EGYPT - Expansion of the HELWAN unit (with the USSR) from 0.300 to 1.5 million tonnes. Long and flat products: completed.
- 3 pre-existing semi-integrated units = 0.300 million tonnes
- Recently revived DEKHEILA project (with Japanese co-operation)
  Direct reduction
  0.725 million tonnes (Proche Orient Economique, 10 May 1980)
- Unit project (Sadattown)
  0.400 million tonnes

LIBYA - Misurata project
First phase, DR, capacity: 1.2 million tonnes
EF: 1.0 million tonnes
In principle, to be completed in 1984
(First stone laid at the end of 1979)

TUNISIA - Expansion of the Menzel Bourghiba unit from 0.170 to 0.230 million tonnes (now in doubt)
- Gabès project: DR, capacity 0.5 to 1.0 million tonnes (with Brazilian and Japanese participation), cancelled
- Project in co-operation with FINSIDER mentioned

ALGERIA - Pre-existing ORAN unit: capacity recently doubled up to 0.080 - 0.100 million tonnes (open hearth furnace)
- Expansion of EL HADJAR (SNS) unit from 0.5 to 2.0 million tonnes (to be completed by the end of 1980)
- JIJEL project (studies by TRACTIONEL-BEL)
  DR (process not chosen)
  1.0 million tonnes of sponge iron, or 2.0 million tonnes (?)
  Steel: 1.0 million tonnes
  Billets: 1.8 million tonnes, completion: 1982-1985
- AIN MILILA project, special steels
  Studies with BOFORS (Sweden)
  Capacity of 0.180 million tonnes (for 1986?)

YUGOSLAVIA - JESENICE, capacity increased to 0.920 million tonnes
- SMEDEROVO, capacity increased from 0.950 to 1.650 million tonnes
- ZENICA, capacity increased from 2.125 to 2.360 million tonnes
- SKOPLJE, capacity increased from 0.900 to 1.750 million tonnes
- SISAK, capacity increased from 0.410 to 1.0 million tonnes
- NIKSIK, capacity increased from 0.180 to 0.360 million tonnes
- SPLIT, capacity increased from 0.180 to 0.050 million tonnes
- SISAK (pipes/tubes), capacity increased from 0.100 to 0.300 million tonnes

GREECE*/ - Halyvourgiki unit (near Athens)
Capacity of 1.5 million tonnes (LD: 1.0 million tonnes)
(EF: 0.5 million tonnes)
- Hellenic Steel (Salonika)
Expansion of cold rolling mill
from 0.350 to 0.700 million tonnes (1.0 million tonnes?)
- 3 mini steel mill projects, capacity: 0.360 million tonnes
- Several small existing units: 0.7 to 1.0 million tonnes

TURKEY - Existing units:
Golakyl: capacity - 0.350 million tonnes
Metas: 0.260 million tonnes
MKEK: 0.050 million tonnes
- Expansion of:
KARABUK unit from 0.600 to 1.0 million tonnes
EREGLI unit from 0.830 to 1.9 million tonnes
ISKENDERUN unit (with USSR)
Capacity increased from 1.0 to 2.2 million tonnes
Second phase delayed
ASILCELIK unit from 0.125 to 0.350 million tonnes
- Projects planned for:
SIVAS, capacity: 2.6 million tonnes
Feasibility study by Kaiser Engineering
Competition for construction between Japan, Romania, three other Western groups
Construction not yet started

- EDAS (Izmir)
  Direct reduction: 0.400 million tonnes
  Feasibility study
- CUKOROVA: capacity - 0.300 million tonnes

C. ASIA

IRAN - Projects for high-quality and special steel units with Bolher et Creusot Loire - cancelled
- ISFAHAN: expansion from 0.550 to 1.9 million tonnes under way with the USSR. The units which it had been planned to build at Bandar Khomeiny (with FINSIDER) probably to be transferred to Isfahan: direct reduction units
- AHWAZ - direct reduction units

  3 Midrex)
  3 HYL) under construction
  3 EUROFER) (with considerable delay)

  Capacities of 1.5 to 2.5 million tonnes
  Estimated production capacities for 1985: 5.0 to 6.0 million tonnes

PAKISTAN - PIPRI unit, phase 1: 1.1 million tonnes (scheduled for completion in 1984)
(Second phase later on)
Cost estimate revised from US$ 1.3 to 1.9 billion
- DR unit project: 0.400 million tonnes (?)
  Estimated production capacities for 1985: 1.5 million tonnes

INDIA - 1976 plan for expansion by the year 2000 cancelled
- Projects for expansion of the BOKARO unit from 2.5 to 4.3 million tonnes
- Projects for expansion of the BHILAI unit from 2.5 to 4.750 million tonnes
- VISHAKHAPATNAM project - first phase: 1.6 million tonnes negotiated with the USSR (buy-back agreement)
- Other projects mentioned and studied:
  . MANGALORE: negotiation with several groups (USINOR) with buy-back agreements

. PARADEEP (negotiations with Davy Demag)

. Several other projects, some with direct reduction:

ORISSA, capacity: 0.140 million tonnes
BIHAR: " 0.120 million tonnes
SURAT: " 0.400 million tonnes
Other projects: 0.300 million tonnes
" " 0.160 million tonnes
" " 0.030 million tonnes

190 mini steel mills (not counting 100 re-rolling mills) in India, of which 82 are in operation and produced 1.2 million tonnes in 1976-1977

Estimated production capacity for 1985: 20.0 million tonnes

BANGLADESH - Project for a direct-reduction unit, 0.500 million tonnes

BURMA - One small unit, 0.030 - 0.040 million tonnes (1 EF, 15-17 tonnes)
Estimated production capacity for 1985: 0.500 million tonnes
(Bangladesh - Burma)

MALAYSIA - Expansion of Malayawata unit to 0.250 million tonnes planned
- Amalgamated Steel Mill: 0.200-0.250 million tonnes
- Study for another unit with Austro-Mineral

SINGAPORE - National unit: 0.420 million tonnes, plus seven re-rolling mills

PAPUA NEW GUINEA - Rolling-mill project: 0.035 million tonnes

INDONESIA - KRAKATAU unit - Direct reduction, HYL
Five modules, production capacity: 2.0 million tonnes
The second module went on stream in April 1980.
The third will go on stream in 1980.
(Metal Bulletin, 6 May 1980)
- About ten other units: 0.500 to 0.600 million tonnes

THAILAND - Seven units producing steel
- 70 re-rolling mills
- One direct-reduction project: 0.400 million tonnes (1984-1985)
- One other project: 1.5 to 1.8 million tonnes
(Austro Plan studies)
- Expansion of rolling-mill capacities, 0.340 million tonnes, by 1981

PHILIPPINES - Ten units producing steel; 29 re-rolling mills:
present (1978) crude steel capacities: 0.460 million tonnes
long products: 1.030 million tonnes
flat products:
(hot-rolled): 0.350 million tonnes
(cold-rolled): 0.450 million tonnes

- MINDANAO project: 1.0 million tonnes
  Estimated cost: US$ 1.7 billion
  Financing refused by the World Bank and, for the time being, by Japan.
- Armco-Marsteel project - special steels
  Capacity: 0.050 to 0.100 million tonnes

Estimated capacities for 1985 for all ASEAN countries: 5 to 6 million tonnes

REPUBLIC OF KOREA - POHANG (POSCO) unit
Production capacity: 5.5 million tonnes
To be increased to 8.5 million tonnes in 1982

- Changwon special steels unit: capacity - 0.250 million tonnes
- Special steels unit: capacity - 0.150 million tonnes

Production capacity, excluding Posco, now amounts to between 2.3 and 2.5 million tonnes.

- ULSAN project, first phase, 3.0 under study: decision deferred for the time being.

Estimated production capacity for 1985: 12.0 million tonnes.

DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA - Present production capacity: approximately 4.0 million tonnes
- Projected capacities for 1985: 6.5 million tonnes.

CHINA - Preliminary plan for production capacities of 60.0 million tonnes in 1985, and 100.0 million tonnes in the year 2000 (Metal Bulletin, 13 June 1975) sharply revised (see Le Monde, 24-25 June 1979)

- Expansion projects:
  ANSHAN, 6.0 to 8.0 million tonnes
  PAOTAO, 1.0 million tonnes

WUHAN, 3.0 to 6.0 million tonnes (indefinitely postponed)
PAOSHAN: first phase in 1982 - final capacity of 6.0 million tonnes
MAANSHAN (Built by China): 0.700 million tonnes (Metal Bulletin, 18 April 1980)

Estimated production capacity for 1985: 45.0 million tonnes (Metal Bulletin, 14 March 1980, an increase of 15 per cent over 1979)

D. LATIN AMERICA

TRINIDAD - ISCOTT project. Direct reduction

1.2 million tonnes:

Kawasaki	11.5 per cent
Mitsui	5.0 per cent
Industrial Development Corporation	67.0 per cent
Estel	16.5 per cent

Mitsui and Estel having withdrawn (end of 1976), the project has been reduced to 0.800 million tonnes of sponge iron,
first module 1980,
second module 1982
and
0.600 million tonnes of steel (Metal Bulletin, 21 September 1979).

CENTRAL AMERICA - Units in the Dominican Republic: 0.060 million tonnes
Guatemala: 0.130 " "
Honduras: 0.100 " "
Panama: 0.125 " "
El Salvador: 0.100 " "
Bahamas: 0.100 " "

CUBA - José Martí unit - second phase: 0.350 million tonnes
third phase: 0.675 " " (1981-1985)
(with the co-operation of the USSR)
- Stainless steel unit: capacity: 0.050-0.060 million tonnes
(cost: US$ 500 million - Metal Bulletin, 7 November 1978)

- Project: 2.6 million tonnes - 1990 (USSR co-operation)
(ILAFA review, February 1979)
Estimated production capacities for this group of countries in 1985: 1.7 million tonnes.

BOLIVIA - Steel production plan (ILAFA, June 1979) and MUTUN project: 0.450 million tonnes
Study contract with McKEE (project for exporting 0.400 to Brazil)
Project reduced to a capacity of 0.100 million tonnes (Metal Bulletin, 27 July 1979)

PARAGUAY - Project: capacity: 0.100 million tonnes (loan amounting to 95 per cent of cost by Banco do Brazil)
Capital: 40 per cent Tenenge BRA - 60 per cent Government of PARAGUAY (Metal Bulletin, 21 July 1978)

URUGUAY - Mini steel mill project (ILAFA, November 1977)

ECUADOR - Project for a direct-reduction unit, 0.400 million tonnes (0.432 million tonnes of steel) (Metal Bulletin, 15 June 1979)

COLOMBIA - Development plan: capacity of 1.5 million tonnes of crude steel in 1985 with financing from the World Bank, envisaged, but this plan must be re-evaluated (ILAFA, May 1980)
- Expansion of Paz del Rio to 1.0 million tonnes, but a loan of US$ 500 million is being sought
(Tiers Monde Ingénierie, 8 January 1980,
Metal Bulletin, 9 March 1979)
- Direct-reduction plant project: 0.400 million tonnes to supply sponge iron to four already existing plants
Estimated production capacity for 1985: 1.0 million tonnes

PERU - Sider Peru project: 2.2 million tonnes in 1982
4.0 " " " 1988
deferred because of its excessively high cost
At present:
- Project approved for expansion of the Chimbote unit to 0.720 million tonnes and for one direct-reduction unit, 0.400 million tonnes of sponge iron and 0.400 million tonnes of steel
(Expected cost: US$ 352 million, of which $ 300 million are to be obtained by loans) (Metal Bulletin, 25 January 1980)

Estimated production capacity for 1985: 1.0 million tonnes

CHILE - Expansion of Huachipato CAP units (up to 1 to 2 million tonnes)
Estimated production capacity for 1985: 1.5 million tonnes

VENEZUELA - Units in operation: capacities of approximately 1.0 million tonnes (including one special steels unit)
- SIDOR: being completed - full production expected for 1983-1984
(1.28 million tonnes produced in 1979, Metal Bulletin, 9 May 1980)
Capacity: 4.8 million tonnes (6 EF)
- ZULIA: First phase - 1.4 million tonnes, to be completed by 1982
(Cost: US$ 2.5 billion plus coal mines)
(Metal Bulletin, 10 August 1979)
Capital: 20 per cent Fondo de Inversiones de Venezuela
40 per cent Corpozulia
40 per cent foreign partners (?)
First phase subsequently reduced to 1.1 million tonnes and deferred
(construction to begin in 1982 and be completed in 1984)
(Metal Bulletin, 28 December 1979)
Estimated production capacity for 1985: 7.0 million tonnes

MEXICO - Steel plan for 1979-1990 (Metal Bulletin, 27 November 1979)
Demand should rise to 10.4 million tonnes in 1981
15.0 " " " 1985
Production capacities should increase as follows:
(Cost: US$ 25.4 billion in 10 years) (ILAFA, May 1979)

AHMSA	from	3.75	to 4.5	million tonnes
FMSA	"	1.5	" 1.87	" "
SICARTSA (Las Truchas)	"	1.3	" 2.75	" "
HYLSA	"	1.5	" 3.0	" "
TAMSA	"	0.425	" 0.750	" "

Other units: approximately 1.0 million tonnes
(Campos Hermanos and others)
Estimated production capacity for 1985: 13.0 to 14.0 million tonnes

BRAZIL - The 1973 steel plan anticipated the following capacities:

40.0 million tonnes in 1985
37.0 " " " 1985 (after revision)
33.5 " " " 1985 (after revision in 1978)
28.0 " " " 1985 (1979-1980 ILAFA, August 1979)

Investments in the steel industry amounted to
US$ 5.9 billion between 1971 and 1977
US$ 2.0 billion in 1978

- Expansions:

CNS: phase III up to 4.6 million tonnes in 1982, but delay probable (ILAFA, July 1979)

USIMINAS, phase IV, up to 5.3 million tonnes in 1983, but delay probable

Phase IV to include one hot rolling mill, 3.0 million tonnes (Metal Bulletin, 6 June 1980)

COSIPA, phase III up to 3.5 million tonnes in 1983

Partial financing (5.5 per cent from the World Bank and the IDB)

ACESITA - expansion (high-quality and special steels) for 1982 up to 1.0 million tonnes

ACOMINAS - First phase: 2.0 million tonnes for 1981, but with delay (negotiation of a loan of US$ 505 million, euro-dollars; 98 banks, Morgan Grenfell), not counting US$1,204 million in internal loans and

US$ 699 million (suppliers' loans)

255 Morgan Grenfell
242 Ferrostaal
152 French banks
50 Eximbank

Total: US$ 2.700 billion

TUBARAO - First phase: 3.0 million tonnes for 1982, but delayed
(Cost estimated at US$ 2.7 billion)
(Capital participation: US$ 600 million:
51 per cent SIDERBRAS
24.5 per cent KAWASAKI
24.5 per cent FINSIDER)
Loan of US$ 700 million from Japanese banks

MENDES JUNIOR - Project reduced from 2.0 million tonnes to 0.600 million tonnes for July 1982 (ILAFA, February 1980)
(later 2.0 million tonnes instead of 4.0 million tonnes)

SIDERSUL (Santa Catarina)
Direct reduction - First stage 0.500 million tonnes for 1985
Other producers: capacity of approximately 5.0 million tonnes
New plants of CSN No.2 and CENTRAL DO ACO: projects indefinitely postponed
Estimated production capacities for 1985: 25-27 million tonnes

ARGENTINA - In 1976 (Metal Bulletin, 25 May 1976) it was estimated that production would amount to 18.0 million tonnes in 1985.
In 1979 (ILAFA, May 1979), demand for 1985 was estimated at 8.6 million tonnes
Production in 1979: 3.244 million tonnes of crude steel
Present capacities estimated as follows:

SOMISA:	2.5 million tonnes
ACINDAR:	0.700 million tonnes (Gillettes)
GURMENDI:	0.450
DALMINE:	
SIDERCA:	0.700 to be increased to 1.0 million tonnes
PROPULSORA:	

plus eight other units: 0.7 to 0.9 million tonnes (including ZAPLA)

- Expansion of SOMISA from 2.5 to 4.0 million tonnes
Approval of the plan was expected in May 1980, but the financial problems have not yet been settled. Nippon Steel was asked to participate in the capital but has refused (Metal Bulletin, 18 March 1980)
- SIDINSA project (south of Buenos Aires)
Capacity: 4.0 million tonnes (estimated cost in 1976: US$ 3.5 billion)
These studies are continuing, because the financial plan has not been approved (financial backers being sought)
(Metal Bulletin, 27 July 1979 and 5 February 1980)
(Agreement on technical co-operation with Nippon Steel in Metal Bulletin, 5 February 1980)
Estimated production capacities for 1985: 7.0 million tonnes

ANNEX III - DEVELOPING COUNTRIES: PRODUCTION CAPACITIES FOR 1985: DELAYS (some examples)

	CANCELLATION	REDUCTION IN SCALE	DELAY OR POSTPONEMENT OF PROJECT	DELAY IN CONSTRUCTION	DELAY IN REACHING SCHEDULED PRODUCTION
IRAN	- Special steels units - BANDAR KHOMEINY			AHWAZ - ISFAHAN 2	
PAKISTAN				PIPRI	
INDIA			New coastal units	Expansion of BOKARO BHILAI	
REPUBLIC OF KOREA			ULSAN I		
CHINA			SHANGHAI and others	WUHAN and others	
INDONESIA					KRAKATAO
PHILIPPINES			MINDANAO		
COLOMBIA			Expansion of PAZ DEL RIO		
PERU	SIDERPERU project, 4.0 million tonnes				
BOLIVIA		MUTUN			
TRINIDAD		ISCOTT			
MEXICO				SICARTSA 2	
VENEZUELA		ZULIA 1	ZULIA 1		SIDOR
ARGENTINA			SOMISA SIDINSA		
BRAZIL	ITAQUI I and II	MENDES JUNIOR	CSN 2 plant Central do Aço	TUBARAO USIMINAS IV ACOMINAS CSN III	
ZAMBIA				TIKA	
PORTUGAL			SINES (in favour of the expansion of SEIXAL)		

	CANCELLATION	REDUCTION IN SCALE	DELAY OR POSTPONEMENT OF PROJECT	DELAY IN CONSTRUCTION	DELAY IN REACHING SCHEDULED PRODUCTION
SPAIN	SAGUNTO, phases 2 and 3		2 DR units		
ITALY	GIOIA TAURO (except CR mill)				
TURKEY			SIVAS	ISKENDERUN I	ISKENDERUN II
ABU DHABI			X (DR?)		
UAE			X (DR?)		
EGYPT			Dekheila (DR)		Helwan II
TUNISIA	GABES (DR)		Expansion of EL FOULADH		
ALGERIA			WESTERN (5-10 million tonnes) JIJEL (DR) Fine and special steels	EL HADJAR II	EL HADJAR
MOROCCO	NADOR (except rolling mill)				
MAURITANIA	Project for 1.0 million tonnes				
SAUDI ARABIA	MARCONA project (3-4.0 million tonnes) Expansion of JEDDAH (BHP)