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United Nations Industrial Development Organization

Second Consultation Meeting on
the Iron and Steel Industry

New Delhi, India, 15 - 19 January 1979

PROGRESS REPORT*

prepared by
the secretariat of UNIDO

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United Nations Industrial Development Organization

Second Consultation Meeting on
the Iron and Steel Industry

New Delhi, 15-19 January 1979

PROGRESS REPORT

Addendum

Note on aspects of financing steelworks and orefield development in developing countries*

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Introduction

1. The Progress Report ID/WG.286/1 circulated for the Second Consultation Meeting referred in paras. 41 to 49 to a consideration of the terms and conditions attached to international loans for development projects in the iron and steel industries of developing countries. There was a mention of a report commissioned from consultants and preliminary comments on the results. This addendum provides further background material for the discussion of the issue raised in para. 49.

2. The consultants' report reviewed eight financing arrangements during the past five years for development schemes for integrated steelworks ranging in total cost from $400 million to $3000 million, together with a small re-rolling plant estimated to cost $13 million. The report also included particulars of four orefield development schemes ranging in cost from $500 million to $3000 million.

3. A large number of banks and other financial institutions in the United States of America, Western Europe and the Far East were involved.

Terms and conditions

4. It was not possible to make a completely systematic comparison of the terms and conditions attaching to each scheme of financing since it was clear that such details were greatly influenced by the circumstances of each proposal, the economic assessments made of the operating results of the new plants, and the nature of the financial guarantees provided. Nevertheless the following summary notes indicate the type of financial terms and conditions which have been established in this field of financing.

A. Deposit notes with a life of three years were issued by the National Bank of the developing country in cooperation with a bank in USA, covering 10% of the total cost of the project and redeemable at six-monthly intervals. The rates of interest were calculated at ½% above the London Inter Bank offered rate for 6 month US dollar deposits.

B. Loans from the EXIM Bank in USA or with their guarantee covered 40% of the estimated cost of a project and were repayable at six-monthly intervals over periods ranging from 7 to 14 years including a grace period of 4 years. Rates of interest were quoted at 7/8% above the US prime lending rate, or 1% above the LIBOR*/ rate.

C. An unsecured loan for 20% of the cost of a project was negotiated for repayment at six-monthly intervals over five years starting three years after the first advance. The rate of interest was 2% above the LIBOR rate.

D. European Export Credit organisations provided finance for 15% of the cost of one project and 50% of another, with repayment at six-monthly intervals over 12 years starting six months after commissioning of the plant. Interest rates ranged from 7.5% to 8.5%.

E. A Eurocurrency loan was organised by a British merchant bank for 15% of the cost of a project, the finance being advanced in three tranches with maturities of 5,6 and 7 years. Rates of interest varied from 1 7/8% to 2 1/8% above the LIBOR rate.

F. The World Bank made a direct advance amounting to 7% of the cost of a project, with a term of 15 years including a five-year grace period. The loan was guaranteed by the national finance institution and carried an interest rate totalling 9%.

G. A country importing iron ore provided the whole capital cost of exploiting a new orefield, taking repayment and interest in the form of regular deliveries of ore to be completed over a period of twenty years. The effective rate of interest could be calculated as 13%.

*/ LIBOR - London Inter-Bank Offering Rate.

4. A government-to-government loan from USSR amounted to 50% of the cost of a project and formed part of a package deal including the provision of plant and consultancy services. The repayment period was 12 years and the rate of interest 2½% (these terms date from 1965).

5. The report makes the point that international arrangements for export credit guarantee terms categorise developing countries as poor, intermediate or rich, based on their per capita income. This categorisation determines the maximum length of credit from commissioning which will normally be available, and the interest rate which currently applies:

e.g. Per capita income less than $1,000 - 10 years credit
7½ interest
Per capita income $1,000 to 3,000 - 8 years credit
7 3/4 interest
Per capita income over $3,000 - 5 years credit
7 3/4% interest.

Improved terms and conditions for developing countries

6. There is considerable scope for reduction in the total burden of financing of steel development schemes. This can be done by the developed countries taking a lead and arranging for a right combination of government aid, government loans, and loans from banking institutions and suppliers credit, so that the cost of capital is kept at the minimum possible while the time of repayment of loan has maximum period of grace and of repayment. Further, the international financing agencies also need to reexamine their criteria for assisting such schemes as their present policies and norms do not help to make the projects economically viable. This results in depriving developing countries of the loan assistance from their agencies.

7. Keeping in mind these circumstances UNIDO proposes the following questions for consideration: -

- Can periods of grace be extended to a minimum of 10 years in recognition of the fact that new steel plants do tend to take longer to establish in developing countries than in industrialized countries?

- Similarly can repayment periods be extended in recognition of the longer time often needed in developing countries to bring a new plant up to full capacity working?

- What arrangements can be made through the World Bank or other internationally - organized financial institutions to make some part of the finance available at specially low rates of interests?

- Is there scope for the establishment of a special fund with UNIDO in association with the World Bank and similar international institutions? The objective of such a fund would be - after identifying the project and the resources of the developing country - to reduce the financial burden on the project of the interest and repayments by a partial subsidy. Contributions to the fund might have to come from both the developed and developing countries as well as from the manufacturers of steel and steel making equipment. If this proposal is accepted in principle, UNIDO could set up a working group to examine it in further detail and to determine the method of operation.

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PROGRESS REPORT

Addendum

Note on the changing pattern of world steel production *

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Introduction

1. The Progress Report ID/WG.286/1 circulated for the Second Consultation Meeting referred in paras. 50 to 56 to the changes taking place in the pattern of world steel production; and raised a number of questions relating to the consequences for steel industry development in developing countries. The changes, their economic causes, and their implications for the future are elaborated in this note as additional background to the discussion of the questions.

2. The following table gives details of the steel production in some of the developing countries: -

Steel production in certain developing countries

(thousand tons)

	1970	1974	1975	1976	1977
Algeria	31	181	221	356	400
Argentina	1,823	2,354	2,220	2,403	2,693
Brazil	5,390	7,507	8,309	9,194	11,238
India	6,271	7,068	7,989	9,313	10,400
Iran	-	557	551	549	550
Korea, Republic of	481	2,308	2,558	3,511	4,243
Mexico	3,881	5,138	5,272	5,297	5,500
Peru	94	450	431	349	350
Venezuela	927	1,058	1,100	927	820

3. The total output of steel in developing countries increased from less than 7 per cent of world production in 197[illegible] to 11 per cent in 1977. An analysis of steel production since 1974 shows that a downward trend in steel production in the industrialized (excluding the USSR) countries has continued and in 1978, their steel output will further register a possibly heavier downward trend, whereas in the case of the developing countries including China and People's Democratic Republic of Korea and the Socialist countries of Eastern Europe and the USSR (CMEA countries), the upward trend and a significant steel growth rate have been maintained and will be more so in 1978; the same trend and upward growth rate of steel capacity have been maintained in the developing countries including China and PDR of Korea and the CMEA countries and these upward growth rates will be maintained in these countries during 1978 and the coming year. One, therefore, cannot justificably refer to or depict the picture of a global recession or a depression in the world steel industry. It is obviously not so. The developing countries in particular are maintaining a good and stable growth rate linked primarily to their home markets.

Some economic causes of the changing pattern of steel production

4. [illegible]eady growth of the steel production in the USSR and other centrally planned economies both in Eastern Europe and elsewhere has been related to the strategy of industrial development adopted by the countries in question. The iron and steel sector has been recognized for years as one of the priorities in their general economic policies. These countries have had large internal markets for steel products.

5. The steel market recession in the market economy countries has been looked upon as a structural phenomenon which cannot be remedied by the existing lines of economic policy and requires increased intervention on the part of governments. Some analysts have stressed the excessive competition among steel producers as a factor leading to lower prices of steel products, undermining profitability and thus investment activities. Supporters of this view are also inclined to blame governments for giving preference to continuous employment instead of the modernisation of obsolete plants. Others have emphasized the importance of inflation which has discouraged investment by making credit very expensive.

6. The steady progress made with steel production in most developing countries has been related in the main to their continuing need to reduce their dependence on imports and to provide and adequate steel industry base for their general industrial growth.

Opportunities for the future

7. The share of developing countries in the total world steel production since the First Consultation Meeting has been slowly increased. Bearing in mind both the reduced volume of the world steel production and the needs of developing countries related to the process of industrialization, the level of production achieved by them cannot be considered as satisfactory and this pace of development is to be accelerated.

8. Opinions have been expressed at different fora (e.g. International Iron and Steel Congress in Chicago, April 1978) that the present slowdown - both in iron ore mining and steel making - could lead to a shortage of steel in the foreseeable future. The efforts made by developing countries for the expansion of their iron and steel plants should therefore not be regarded as unrealistic in the context of the present situation in steel production.

9. Moreover projects which are worked out in the present circumstances described in para. 55 of the Progress Report can offer real benefit to both developed and developing countries. Already countries which have abundant finances but are deficient in raw materials are establishing steel making capacity with purchased technology and using imported raw material; countries which have raw materials in plenty, but lack financial resources, are seeking assistance from other countries; others again which are endowed with special resources like natural gas are cooperating in the extension of the new technology of the direct reduction - electric furnace route for steel making; some developing countries, realizing their own resource limitations - financial and technical - are treading more cautiously by producing intermediate, value added products only, e.g. sponge iron, pig iron, or billets and are making exchange deals with overseas partners.

10. The concept of cooperation on barter basis or production compensation basis has been applied in the relationship between developing countries and the USSR as well as socialist countries of Eastern Europe. This involves a supply of equipment for steel plants on soft credit basis while the repayment is realized through selling back of the products manufactured by the plants. It seems both rational and desirable to adopt the concept by other developed countries in their relations with developing countries.

11. Increasing cooperation between developed and developing countries in the steel sector has been an indicator of the fact that such arrangements are advantageous to the both sides. A developing country profits by being able to develop and exploit its natural resources and manufacture value added products while developed country by getting the opportunity to manufacture and supply the equipment (capital goods), to transfer technological innovations and professional expertise, to train manpower thereby enabling its manufacturing organizations to make full use of their capacities, experiences and skills. The convergence of interests - developing countries for steel production and developed countries for the export of capital goods transfer of technology, training etc. should be fully utilized in the years to come.*/

12. In this context it appears to UNIDO that answers to the following questions should be sought:

- Can this mutuality of interest be generalized? Should the consideration of each steel development project include as an essential step and assessment of shared interests with overseas partners, so that the purchase and installation of plant could be always combined with arrangements for finance, technology transfer, training of manpower?

- Given that the expansion of steel consumption in the engineering industries of developing countries proceeds faster than the expansion of steel production, can the concept of shared interests be extended to the exchange of steel products - ordinary and special qualities and the provisions of capital goods?

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*/ The convergence of interest has been also emphasized by some estimates according to which a creation of one job in an industry of developing countries involves creation of 3 jobs in developed countries.

- What guarantees should safeguard interests of partners on the both sides and thus make a scheme successful?

In the light of answers to these questions the Secretariat of UNIDO are ready to work out more specific and precise schemes of co-operation to be considered at the Third Consultation Meeting on the Iron and Steel Industry.

In the period between the Second and the Third Consultation Meetings UNIDO - if requested by interested parties is ready to serve as a forum for negotiations of new projects in the iron and steel industry.

CONTENTS

		Pages
1.	Summary	ii
2.	Introduction	1
3.	Iron ore	2
4.	Coking coal	4
5.	Plans and problems	6
6.	Exchange of technical information	9
7.	Training	11
8.	Financing	13
9.	The changing pattern world of steel production and development	16
10.	Appendix - Commentary on the replies to the Questionnaire on Plans and Problems	21

SUMMARY

This document reports on the activities organised by the UNIDO Secretariat following the first Consultation Meeting on the Iron and Steel Industry in February 1977 and sets out the proposals for further action which have resulted. The second Consultation Meeting is asked to appraise and make recommendations on the new proposals.

INTRODUCTION

1. The first Consultation Meeting on the Iron and Steel Industry was held in Vienna on February 1977 as part of the programme of industrial consultations set up by the second General Conference of UNIDO in Lima in 1975. The report of the Consultation Meeting was circulated as document ID/WG.243/6/Rev.1 dated 1 March 1977.

2. The first Meeting recommended that the UNIDO Secretariat should undertake a number of follow-up activities designed to assist developing countries in the establishment and expansion of their steel industries, but recognised that the programme of work was heavy and asked the Bureau of the Meeting to set out the priorities among the recommended tasks.

3. The Bureau met in April 1977 and proposed that raw materials and fuels should be given prime consideration since they formed the basis for all further consideration of the steel industry in developing countries. Second was the proposal that developing countries should be invited to present their plans for steel development and the specific problems they had been encountering. The Bureau went on to draw attention to a meeting to be convened later that year consisting of representatives of selected research and development institutes interested in the subject of the adaptation of steel technology to the needs of developing countries. It was further agreed that reports should be presented to the second Consultation Meeting on the nature and magnitude of present and future manpower training problems, and on specific training problems reported by developing countries in the submission of their plans and problems. Finally the Bureau asked that as part of the consideration of financial problems disclosed by developing countries the questions of terms, conditions and guarantees should be pursued.

4. This Progress Report describes the activities undertaken. Meetings of various working groups have been held and their reports are noted below. Other activities are continuing including further work resulting from the meetings, and reports on them will be made available at a later date. The Report makes proposals for further measures of international cooperation selected from the recommendations made at the meetings and derived from the detailed information supplied by developing countries on their plans and problems in steel industry expansion.

IRON ORE

5. A meeting of a Working Group on Iron Ore was held in Vienna on 3-5 April 1978, and a copy of the report UNIDO/EX.38 dated 20 April 1978 will be available to participants. Among the conclusions reached were that reserves of iron ore in the world were adequate to meet requirements for many years to come; that orefield development already in progress would ensure that as a whole ore supplies would not be a limiting factor on steel production in the year 1985; and that looking ahead to the year 2000 there was time for the exploitation of known deposits to be carried out in relation to the evolution of demand.

6. The Working Group discussed the structure of the iron ore market and the problem of access to supplies for small-scale buyers and buyers in developing countries coming into the trade for the first time. The meeting agreed that there was scope for developing countries to cooperate in making their purchases of iron ore and drew attention to the existing cooperation between developed and developing countries on orefield development and the related commercial questions of the purchase and supply of ore.

7. In this connection it is relevant to recall comments in a recent UNCTAD document. The international trade in iron ore was strongly influenced in the past by ownership ties which caused an important proportion of the trade to be based on intrafirm transactions. It has been estimated by the UNCTAD Secretariat that "with the nationalization of mines in Venezuela, Peru and Mauritania, and the growth of non-captive sources of supply elsewhere in Latin America, Africa and Australia, the proportion of total trade which may be described as 'captive' has declined rapidly in recent years, but it still remains the dominant framework within which trade in iron ore from the United States and Canada takes place"[1/].

1/ UNCTAD document TD/B/IPC/IRON ORE/2 of 2 August 1977, p. 19.

8. The significant capital investment associated with orefield development has created a need for long term contracts assuring a market for the additional production of iron ore. The move has been reinforced by the participation in the investment by large-scale buyers who wish to make sure of future deliveries of ore. Estimates by the UNCTAD Secretariat suggest that long-term contractual arrangements now cover up to 60 per cent of international movements of iron ore[2/]. The captive arrangements and long term agreements might be factors limiting the future scope for action by small scale-buyers of iron ore, although at the present time there is a relative oversupply of iron ore resulting from the reduction in steel production in some developed countries. Nevertheless the fears that have been expressed for the future are important enough to lead to the suggestion that developing countries which are buyers of ore should be given some exposition of the methods and problems of making long-term purchase contracts so that either singly or in combination they could set up appropriate arrangements in good time. This forms the basis of the first proposal below in this section of the Report.

9. Recent decisions to delay orefield development may exert an impact upon the future supply of iron ore. Among 81 projects representing known additions to capacity in iron ore mining and processing there are 5 projects delayed or abandoned. The consequent reduction in the output of iron ore would represent however only 1.45 per cent of the expected additional capacity. More significant is the reduction of the expected additional production of pellets - 11.8 per cent[3/].

10. The Secretariat were asked by the Working Group to investigate a number of questions more deeply, including the estimated demand and supply of ore in 1985 and 2000 with particular reference to sinter fines; the stages reached by current orefield development schemes; the provision of up-to-date estimates of the capital costs of mining and processing ore; and the

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2/ UNCTAD document TD/B/IPC/IRON ORE/2 of 2 August 1977, p. 20.

3/ The conclusions based upon the data from UNCTAD document TD/B/IPC/IRON ORE/AC.4 (table XVI) of 29 March 1978.

formulation of criteria for decisions concerning the exploitation and processing of local ore reserves. This last point is taken up in the recommendation in the section on Plans and Problems of this Report.

11. The Working Group noted that there were examples in various parts of the world, notably Africa and Latin America, of iron ore deposits stretching across a number of neighbouring countries. It was suggested that there could be substantial savings in capital and operating costs if the countries concerned at each location were to set up an international company to work progressively through the deposits instead of having each country establish a separate infrastructure and mining installation on its own national territory.

12. Two specific proposals for international action emerged from the discussions at the Working Group and are submitted to the second Consultation Meeting for appraisal and recommendation:

- UNIDO is preparing to work out arrangements among developed and developing countries interested in exporting and importing iron ore to help developing countries towards an understanding of the structure of the market and the nature and content of long-term contracts for the purchase of iron ore;
- UNIDO will identify instances throughout the world for possible cooperation between neighbouring countries in the exploitation of shared ore deposits, and seek to promote constructive discussions

COKING COAL

13. A meeting of a Working Group on Coking Coal was held in Vienna 6-8 April 1978 and a copy of the report UNIDO/EX.39 dated 20 April 1978 will be available to participants.

14. A report prepared by Polish consultants had drawn attention to the uneven geographical distribution of world reserves of coking coal. Three countries, China, USA and USSR, possessed 72% of the total world reserves and ten countries in all held practically the whole of the reserves.

Developing countries other than China and India together held less than 1% of the reserves. This situation gave rise to the two main areas of problems for developing countries, first the need to make the fullest use of their own fuels and adopt processes which economised in the use of the best grades of coking coal, and second the need for assured access to supplies for the tonnages of coking coal which still required to be imported.

15. The Working Group reviewed the range of technical methods available for economising in the use of coking coal such as blast furnace injection with oil, natural gas, tar, pitch, and pulverised coal slurry; and the utilisation of briquette blending coking and other processes. The advantages and limitations of the direct reduction processes were also discussed and appraised.

16. The different interests of countries exporting and importing coking coal need to be reconciled within stable international trade arrangements. The Working Group emphasised that the planning of any steel industry development scheme which required the use of coking coal should include early arrangements with producers for regular supplies in order to allow time for any necessary mine development. Such action would help to ensure that adequate supplies would be available in spite of the doubts created by short-term difficulties in the recent past.

17. There are two lines of activity involving international cooperation which UNIDO could undertake if the second Consultation meeting agrees:

- with the help of the developed countries concerned to organise a study tour for developing countries to see practical examples of modern methods of economising in the use of coking coal;
- to assist developing countries towards an understanding of the construction and use of long-term purchase contracts to ensure access to supplies of coking coal, in combination with the similar activity proposed above for iron ore.

PLANS AND PROBLEMS

18. The Bureau of the first Consultation Meeting laid stress on the point that a knowledge of the plans of the developing countries for steel industry development and of the problems they had been encountering would enable the UNIDO Secretariat to begin to assess the practical issues arising as distinct from generalities. Accordingly, a detailed questionnaire was circulated in September 1977 to 112 developing countries, yielding 41 replies by the end of August 1978.

19. UNIDO expresses its gratitude to the countries which replied to the questionnaire and to all the Resident Representative Offices of UNDP concerned for their assistance in obtaining replies from Governments. At the same time, UNIDO regrets that the replies do not give a complete picture of the plans and problems of the iron and steel industry in developing countries because several developing countries which might influence the picture considerably did not complete the questionnaire. Nevertheless, about two-thirds of the picture can be drawn from the replies received.

20. An extended commentary on the answers to the various questions is given in the Appendix, and the following paragraphs summarise the main conclusions to be drawn.

21. Most of the countries replying have formulated programmes for the development of their steel industries, 87% looking ahead for at least five years and 55% up to ten years. The programmes were based on the positive results of professional studies made mainly by consultants with international reputations on the markets to be served and on the other essential subjects such as supplies of raw materials and fuel, technological process routes, manpower training, and economic factors.

22. On the basis of the forecasts made by the replies it would appear that developing countries are expecting to increase their steelmaking capacity by some 12% a year over the next ten years. Allowing for the possibility that some schemes will be realised more slowly than is forecast and that capacity is unlikely to be fully utilised but also bearing in mind that othe schemes not yet formulated may come into operation during the next decade it is estimated by the UNIDO Secretariat that crude steel production in developing countries including China in the year 1985 will be of the order of 140 million tons. This would represent a growth rate of about 8% a year from the production of 67 million tons reached in 1975 and is about the same rate as was achieved over the decade 1967/77 when steel production rose from 37 to 76 million tons. The production of 140 million tons in developing countries would be 15% of the world total production of steel in 1985 estimated at 950 million tons, and, compared with the 10% share achieved in 1975, would represent substantial progress towards creating a basis for balanced industrialisation in the countries concerned. Still further progress would be required and more countries would need to be involved to foster the more general industrial development implied by reaching the Lima objectives in the year 2000.

23. From the description of individual projects identified in the replies it appears that steelworks" capacities will be notably increased in the future. The existing largest steelworks in developing countries of 3.8 Mt/y will be a medium-scale works in future and the production of steel from integrated steelworks of 4 Mt/y to 10 Mt/y capacity will make a major contribution to the expected production increase. At the same time relatively small-scale steelworks less than 0.5 Mt/y which use direct reduction and electric furnaces or the scrap-based EF route will be playing an important role in providing the production facilities required in developing countries with small markets to serve.

24. Although the blast furnace-basic oxygen furnace route is likely to remain the most important steel production route for many years the direct reduction route will play an increasing part. By 1982 steel production through this route may rise to more than 20% of the total compared with 7% in 1977. The direct reduction route opens the way to the establishment of economically-operated integrated steelworks in countries with small markets and thus provides important opportunities for many developing countries. All the direct reduction projects notified are expected to use locally available natural gas, confirming that this direct reduction process is viable only where natural gas is available at low cost. If and when a direct reduction process based on solid fuel is fully developed industrially many developing countries without natural gas resources will be benefited, thus ensuring further possibilities for the growth of the steel industry in developing countries.

25. As far as problems are concerned the replies indicated that countries with development programmes for their steel industries have based the proposals on a systematic assessment of the technical and economic problems involved in relation to the general economic development of their countries and regions. The problems encountered and expected were described mainly in general terms with few specific comments apart from technical subjects. They covered topics such as the elimination of specific impurities from iron ore, the training of manpower including the difficulty caused by the rapid turnover of labour, the task of mastering intricate technological procedures, and financial problems including tight credit.

26. The experience gained by a country in working steadily through the series of problems involved in the creation of a steel industry could be of great help to other developing countries which have not yet formulated their plans. The description of the stages in the consideration of a project including the nature of the technical choices and the economic assessments to be made, the integration of a steel works with the social and industrial infrastructure and with steel consuming industries, and the method of programming the installation and start-up of plant, all would represent a most useful service from countries with a steel industry to those considering steel industry

development for the first time. Such a service, useful though it would be from any country with an established steel industry, would be particularly valuable from the developing countries which have gone through the stages as a new venture in recent years.

27. The following proposal designed to encourage cooperation among developing countries is therefore submitted to the second Consultation Meeting for appraisal and recommendation:

- UNIDO should organise meetings among groups of developing countries which are working through their steel industry development programmes together with other interested developing countries in order to set out the technical and economic criteria to be assessed in establishing a steel industry including the exploitation of orefields, and to expound the nature of the successive stages in the consideration of plans and projects.

EXCHANGE OF TECHNICAL INFORMATION

28. A meeting of representatives of selected research and development institutions engaged in the adaptation of iron and steel technology for developing countries was held in Jamshedpur, India from 28 November to 2 December 1977. A copy of the report UNIDO/EX.31 dated 11 January 1978 will be available to participants.

29. The recommendations in the report may be summarised under three headings:

(a) proposals for the exchange of technical information on a regular basis among interested parties nationally, regionally and internationally, and the provision of a technical enquiry service;

(b) the provision of an advisory service to developing countries to guide them through all the necessary stages in the creation of a steel industry with an indication of the range of technical and management consultancy services available to elaborate each stage, and to provide an assessment of consultants' reports;

(c) the establishment by UNIDO of a network of contacts among research and development institutes in developed and developing countries with the objective of fostering the fulfilment of work required for the solution of technical problems encountered by developing countries.

30. The recommendations under (a) and (b) imply the intensive and purposeful use of the services provide by the technical information and technical assistance sections of the UNIDO Secretariat responding to requests by developing countries related to their own specific problems. The services should increasingly have the benefit of the International Technological Information bank which was created in July 1977 following a decision of the Industrial Development Board in May. Item (b) also calls for the creation of a panel of experienced steel industry men who would be called upon by a developing country in the early stages of the consideration of a steel industry project to advise on the basic soundness of the proposal before substantial sums are committed for studies and reports by consultants.

31. The recommendation under (c) is more far-reaching. Although the Jamshedpur Meeting accepted that it would not at this stage be feasible for a new international centre to deploy large resources of technical staff, laboratories and pilot plant to carry out original work, it expressed a clear need for UNIDO to keep itself fully informed of the range of work undertaken by established centres, their facilities and special fields of interest. The recommendation thus envisages continuing cooperation among research and development institutes in developed and developing countries to undertake and share information on investigations relevant to the more general technological problems encountered by the steel industries in developing countries. Since the Jamshedpur meeting, the UNIDO Secretariat has begun a series of visits to the principal research and development institutes in the endeavour to enlist their help in such continuing cooperation.

32. The Consultation Meeting is asked to approve that UNIDO should continue with the tasks of:

- establishing a panel of independent expert advisors to act at the request of countries in the early stages of the consideration of steel industry development projects;
- establishing a network of contacts among research and development institutes in developed and developing countries.

TRAINING

33. A meeting of a preparatory expert group was held in Vienna on 9-11 January 1978 and a meeting of a further expert group on 24-26 April 1978. An informal note of 16 January 1978 covering the first meeting and the report of the second one (ID/WG.276/5, dated 8 May 1978) will be available to participants.

34. The nature and magnitude of the training problem facing developing countries in relation to the development of their steel industries was examined from the point of view of general education and of the specific industrial training required by the various levels of staff. As far as general educational requirements were concerned estimates provided by UNESCO of the numbers of university graduates and high-school graduates expected to be available in developing countries in the year 2000 were compared with the numbers needed by the steel industries in those countries to attain the steel production implied by the full realisation of the Lima target. It was concluded that the numbers of persons at those educational levels appeared likely to be sufficient in total for the steel industries' needs allowing for the growth of the steel industries as part of balanced industrial development in each country. There might however be problems of the proportions of graduates and others within the totals which would need the attention of each country's educational authorities. UNESCO undertook to prepare a note on the importance of the general education policies of developing countries for assessing the educational requirements of their steel industries. The note will be circulated as soon as it is available. UNESCO also undertook to provide estimates of secondary school graduates by the year 2000 to compare with the steel industries' needs for staff at that educational level.

35. In relation to the specific industrial training requirements it was estimated that by the year 2000 developing countries would need to be training a maximum of 235,000 persons a year for the various levels of management, technical, commercial, craftsman and process tasks. It was emphasised that in preparing to fulfil such a substantial training programme the most important requirement was to ensure that each steel industry development project should include as an integral part a complete training scheme including estimates of the numbers of different levels of staff

needed to bring the plant into operation and then raise it to its full rated output, together with the continuing needs for replacement manning, refresher and up-grading training. The training scheme should make adequate provision for the teaching staff and facilities required permanently at the new plant together with the use in the initial stages of extra facilities at other works in the country concerned or in association with the consultants and the suppliers of equipment.

36. The cost of such a complete training scheme might appear large - possibly about 10% of the total cost of a development scheme - but neglect of the subject could lead to much greater losses resulting from the inadequate operation and use of the plant after installation.

37. An adequate and attractive social infrastructure is needed for each steelworks project since working conditions in orefields and in iron and steel works are often more arduous than in other sectors of industry. Housing, recreation facilities, shops and schools must be provided to reduce the turnover of manpower and thus avoid too heavy a load on the training facilities.

38. Beyond the training related to each development project it was recognised that any established steel industry had a special need to provide further training for senior staff with management and technical responsibility in order to keep them informed of new ideas, methods and processes appearing throughout the world. A number of developed countries have management training colleges which provide courses on production, sales, labour and general management as part of the normal career development for experienced staff. Qualified scientists and engineers undertake exchange visits with steelworks abroad and take part in technical conferences and seminars.

39. To help developing countries in securing the benefit of this type of career training, UNIDO is taking action on the following lines which the second Consultation Meeting is asked to approve:

- setting out a proposed model constitution for regional steel industry management training colleges for developing countries, showing the working arrangements, facilities, courses of study, staffing, and financing involved;

- seeking the cooperation of more developed countries with established steel industries in providing in-plant training schemes for qualified and experienced engineers from developing countries.

40. The Industrial Development Board at its twelth session in May 1978 decided that the UNIDO Secretariat should examine the ways of maximising the use of industrial manpower training facilities existing in developed and developing countries and explore their potential for expansion in relation to the needs of developing countries. The work done on the specific problems of training in the steel industry will provide a useful contribution to this more general task.

FINANCING

41. The iron and steel industry lays claim to very large funds for each project. Even a small scale plant based on one module of a direct reduction sponge iron plant with electric steelmaking furnaces, continuous casting and a simple rolling mill for reinforcing bars will scarcely cost less than $25 million, while the cost of a large scale integrated works with blast furnaces, LD vessels and rolling mills will run into billions of dollars. The discussion at the first Consultation Meeting drew attention to the magnitude of the financing problem facing developing countries, but the Bureau in setting priorities recommended that the suitability of terms and conditions and the nature and content of the guarantees associated with the financing of steel plants in developing countries should first be pursued.

42. As part of its responsibilities in the field of financing for industrial development generally in developing countries the UNIDO Secretariat issued in March 1978 a directory of "Financial Resources for Industrial Development Projects in Developing Countries". It gave particulars of many organizations providing finance for industrial development including 140 national financial institutions, 13 regional development banks and funds, 9 international institutions and 15 commercial banks active in this field. The terms, conditions and guarantee requirements were quoted for many of the organizations included.

43. Most of the new steelmaking plants in developing countries in recent years have been financed by a combination of local funds - provided by the State or by private banks - loans from the World Bank or other international institutions or consortia, and bilateral loans from suppliers of equipment often backed by export guarantee or export promotion organisations in the supplying countries. A detailed report has been commissioned from consultants to show the structure of the financing of a number of steelworks and ore mining projects during the past few years, the participating institutions and the terms, conditions and guarantee requirements. The final results of the investigation will be circulated as a separate document, but a number of comments may be offered from the preliminary findings.

44. The terms and conditions associated with the financing of a development project include commercial factors such as the tendering and other purchasing procedures for locally manufactured and imported equipment, together with the margin of preference to be allowed in favour of local items. There are also the more purely financial questions such as the proportion of equity capital to debt (normally in the region of 40:60), the proportions of the total finance to be provided from national and international sources, the rates of interest, periods of grace, repayment periods, and the extent of the national government's involvement by subscriptions or guarantees.

45. All the particulars of such terms and conditions form the essential substance of the negotiations for any scheme of financing. They are often complex and difficult to resolve, and are usually treated by the partners as confidential. However it is known that during the last ten years credit terms available for the development of iron and steel plants have become more difficult for all countries. At the end of the sixties there were possibilities if obtaining 10-years credit at a rate of interest 5, 6 or 7.5 per cent. In 1976 and 1977 a number of large-scale projects were financed by national banks and international consortia with rates of interest between 7.5 and 8.5% reflecting a general hardening of interest rates in the market economy countries, and affecting industry generally. The interest rates were increased by an amount of the order of 1 3/4% when guarantees for the repayment and interest on loans were given by organisations such as the EXIM bank of USA or by national financial

institutions in the receiving country. This type of guarantee is of particular importance for the first projects in a newly-created steel industry since the internally-generated cash flow from such plants will take some time to appear.

46. Among more general conditions included were the requirements that interest and debt repayment should be made free of local taxes, that there should be substantial contents of local manufacture in the total equipment installed, that cash flow deficits and cost overruns arising before a new scheme began to earn revenue should be financed by additional locally-raised equity. The main subscription to the equity for a steel project still normally comes from banking or private sources in the host country, although there was recently an interesting move towards the provision of some equity by the overseas suppliers of plant, giving them an additional incentive for ensuring that the plant was satisfactorily installed and worked up to capacity as quickly as possible.

47. A statement of the facts relating to terms, conditions and guarantees is one thing. An assessment of their suitability is another. Although no evidence has yet come to light, in the investigation, discussions undertaken by the Secretariat or in the replies to the questionnaire on Plans and Problems, that the terms and conditions themselves have been the main cause of a failure to conclude adequate financing arrangements for steel industry development, the e is still scope for a discussion of the ways and means of easing the conditions to ensure an adequate flow of funds for developing countries' projects.

48. However even if the terms, conditions and guarantees are judged equitable and there are ample funds from a vast number of institutions for steel industry development in developing countries, some difficulties are likely to remain. Projects in developing countries, particularly in the countries entering the steel industry for the first time, may need a longer period than elsewhere for construction because of the lack of local infrastructure. Equally the plant once built may need longer to run up to full capacity because of the need to train many operators in unfamiliar

work. These factors may have the result of increasing the investment needed in capital and running costs in a steel plant in a developing country above the similar sum needed in a developed country and thus may create a permanent handicap in relation to the total cost of the products.

49. These important matters lead to the selection of financing as a priority issue for discussion at the Consultation Meeting, with consideration of the activities which UNIDO should undertake to facilitate the appropriate international action. In particular:

- the Consultation Meeting will be asked to discuss and comment on the terms and conditions which have been attached to recent financing agreements for steel industry development, and suggest possible future changes.

THE CHANGING PATTERN OF WORLD STEEL PRODUCTION AND DEVELOPMENT

50. World steel production in 1977 at 674 million tons was slightly below the 676 million tons reached in 1976, and 5% below the peak production of 708 million tons in 1974. The USSR produced during 1977 146 million tons (+1.5% over the previous year) and thereby ranked first amongst the steel producing countries of the world for the fourth consecutive year, followed by USA, 115 million tons (-2.7% from the previous year), Japan 102 million tons (-4.6%), and FRG, 39 million tons (-8.1%). China is estimated to be fifth in order of size with a production of 23.5 million tons (+11%).

51. Steel output in the developing countries as a whole rose to 76 million tons in 1977 registering an increase of 15% over the previous year. Brazil and South Korea are estimated each to have increased their steel production by over 20% in the year. The developing countries total represented 11% of the world output in 1977 compared with 10% in the previous year. In contrast the production of steel in the developed countries of Western Europe fell by 4% in 1977, while the developed countries of the CMEA Group occupied an intermediate position with a rise of 2%.

52. The changing pattern of the world steel production in 1977 demonstrated by these figures is a continuation of a trend which has been apparent since 1974, as Table 1 on p. 19 shows. The reasons for the changes are complex and their full analysis would be a difficult task but whatever the reasons the resulting effect on the pattern of steel development in the world over the next few years is already profound.

53. It was widely predicted a few years ago that although industrialized European countries and other advanced countries would not pursue new steel capacity in their own countries for a variety of reasons including the very high cost of environmental control measures they would favour the creation of semis plants in countries overseas including the countries with rich ore deposits such as Australia, Brazil, South Africa and Venezuela. This concept has now been largely put aside. The sponsors of semis projects have been forced to suspend or cancel them because of lack of funds and the poor prospects in the international market for steel at least in the near future. The projects include that in Western Australia, put forward by the Mount Newman partners and based on Pilbara iron ore, the Itaqui project in Brazil based on the Carajas iron ore project which itself is subject to delay, and the ISCOR-Vöest steel project at Saldanha Bay in South Africa based on the Sishen mine. Other casualties are Sweden's Steelworks 80 Project, Italy's Giaio Tauro, US Steel's Conneaut and Canada's east and west coast schemes. In addition, major expansion plans have been shelved or postponed at existing steel plants in France (FOS), Belgium (Sidmar), the USA (Inland and National), the Netherlands (Hoogovens), and Spain (AHM).

54. On the other hand, in spite of some postponements for reasons similar to those affecting the developed countries, steel industry projects in developing countries in many parts of the world are being pursued steadily. The following Table 2 compiled from published data illustrates the general trends of planned increases in steel capacities in some of the developing countries; this list is illustrative but not complete for all the developing countries in the world. A recent independent survey of published information indicated that between 1978 and 1985 developing countries were intending to instal 90 million tons of steelmaking capacity of which 66% was accounted for by the six largest contributions from Brazil, Iran, Venezuela, Argentina, India and South Korea. Plans in preparation in China seem likely to add a further 30 million tons to this figure.

55. The shift in the pressure for the development of the steel industry in the different parts of the world presents the developing countries with an exceptional opportunity. They are able to pursue their own development schemes, provided they are soundly organised and appropriately related to their own conditions and their local and regional markets, with technical assistance and delive ies of equipment more readily available from developed countries than at any time during the past ten years. The developing countries would thus be able to make rapid progress with their steel industries, reducing their dependence on imports, improving their balances of payments and creating a sound basis for their engineering industries and further industrialisation. If this opportunity is seized during the course of the next few years the industrial momentum created would facilitate the achievement of the Lima targets relating to the share of developing countries in world industrial output. That result would still be eminently practicable even if the measures now under consideration to stimulate economic revival in developed countries show benefits in the near future, because of the great stimulus to world trade generally which that would provide.

56. The changing pattern of steel production in the world, its causes, consequences and possible future evolution, has occupied the minds of steel producers and governments in many countries and has given rise to much public comment and discussion. The second Consultation Meeting provides an exceptional opportunity for raising the issue and considering questions such as:

- What has been the effect of the depression in retarding or cancelling development schemes and thus reducing the forecast growth in world steel production? What has been the effect on the expansion of the steel industry in developing countries? Is there a risk that in a few years' time a revival of demand for steel may create scarcities again? If so, what would be the effect on developing countries? What international action can be organised to ensure that development schemes in developing countries appropriately related to their own general industrialisation programme can be vigorously pushed ahead and not held back by a pessimistic view of the world market?

Table 1. World Crude Steel Production (million tons)

	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	77/67 annual growth rate %
Developing countries	37	39	41	45	49	55	60	64	67	66	76	7.6
Developed countries												
1. Western Europe	129	141	153	158	149	162	175	183	151	159	150	1.5
2. Japan	62	67	82	93	89	97	119	117	102	107	102	5.1
3. USA and Canada	124	129	137	130	120	133	150	146	119	129	127	0.2
4. Other market economy countries	10	10	11	12	12	12	14	14	15	15	15	3.9
Sub-Total lines 1-4	325	348	383	393	369	404	458	459	387	411	394	1.9
5. Eastern Europe	33	35	37	40	42	45	47	49	51	54	58	5.7
6. USSR	102	107	110	116	121	126	131	136	141	145	147	3.7
Sub-Total lines 5+6	135	141	147	156	163	170	178	185	193	199	204	4.2
Total developed countries	461	489	530	549	532	574	636	644	579	610	598	2.7
World Total	497	528	572	544	581	628	697	708	646	676	674	3.1

Table 2

Planned Steel Industry Development in developing countries

Country	Steel Output 1975 Million tons crude steel	Capacity in 1975 Million tons crude steel	Planned Capacity	
			1980/82 million tons crude steel	1985/88 million tons crude steel
Argentina	2.2	3	11	16
Brazil	8.3	10	22	32
Chile	.5	.9	1.4	2.4
India	8	11	19	25
Iran	.55	1	8	18
S. Korea	2.6	2.7	6.6	11
Mexico	5.2	7	12	18
Peru	.43	.6	2.2	4
Saudi Arabia	-	-	2.8	4.4
Venezuela	1.1	1.5	7.5	16

Commentary on the replies to the Questionnaire on Plans and Problems

The countries that replied to the questionnaire were the following:

Region[1/]	Countries
AFRICAN	Burundi, Ethiopia, Kenya, Lesotho, Mali, Somalia, Senegal, Zaire (8 countries)
ARAB	Egypt, Iraq, Kuwait, Libya, Morocco, Qatar, Saudi Arabia, Syrian Arab Republic (8 countries)
AMERICAN	Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, Honduras, Mexico, Peru, Uruguay, Venezuela (13 countries)
ASIAN	India, Iran, Republic of Korea, Pakistan, Papua New Guinea, Philippines, Singapore, Thailand (8 countries)
EUROPEAN	Cyprus, Malta, Turkey, Yugoslavia (4 countries)

A. DEVELOPMENT PROGRAMME

Question 1. Have you formulated a programme for the development of the iron and steel industry in your country a) for 5 years ahead, b) for ten years ahead, c) beyond ten years?

Replies

Table 3 Number of countries which have formulated a programme

Region	Time-scale of the programme			No programme	No reply
	beyond 10 years	up to 10 years	up to 5 years		
African	1	2	0	3	2
Arab	4	1	2	1	0
American	4	4	5	0	0
Asian	1	3	3	1	0
European	1	0	2	0	1
	11	10	12	5	3
Cumulative Total	11 (27%)	21 (51%)	33 (80%)	38 (93%)	41 (100%)

1/ In this analysis, developing countries are grouped for convenience into regions as indicated above. African signifies sub-Saharan countries.

Almost all the countries which replied to this question have a programme for at least five years ahead. More than 50% have a programme for ten years ahead.

Most countries which do not have a programme are those where it would not be justified to establish steel industries in present circumstances.

Question.2. Where will your iron and steel plants be located and what will their capacities be?

Replies All the countries which have a development programme listed one or more projects. The number of total projects (both greenfield sites and expansion) amounts to 76 of which only 7 have not yet been assigned a location.

Table 4 Capacity distribution of the steel industry development projects and existing works

Plant capacity (million tons)	No. of projects in each region						No. of existing plants in all replying countries
	African	Arab	American	Asian	European	Total projects	
0.1	3	-	3	1	1	8	data uncertain
0.1-0.49	1	4	11	1	-	17	about 40
0.5-0.99	-	3	4	1	-	8	12
1	-	3	3	4	3	13	9
2	-	1	4	1	2	8	8
3	-	-	3	2	-	5	1
4	-	-	6	-	-	6	-
5	-	-	1	2	1	4	-
6	-	-	1	-	2	3	-
7	-	1	-	-	-	1	-
8	-	-	-	2	-	2	-
9	-	-	-	-	-	-	-
10	-	-	-	1	1	1	-
	Total capacity: 144 million tons						Total capacity: 58 million tons

The capacity distribution of the projects shows a distinct trend to largesized projects compared to the existing steelworks' sizes.

Question 3. How much primary iron (pig iron or directly reduced iron) and crude steel (from integrated plants with blast furnaces or direct reduction units, and scrap based mini-plants) do you aim to produce annually -
a) Five years ahead?, b) Ten years ahead?, c) Beyond ten years?

Replies The data given were analysed and are presented in Figures 1 and 2. In interpreting the data the following points should be considered:

(i) most countries indicated the production capacities rather than production figures. When a reply apparently gave production figures they were converted into capacities assuming 80% operation.

(ii) when a reply gave a figure for 5 years ahead only, it was assumed that the figures would remain the same in 10 years time. The figure of 1987 is thus probably under-estimated.

(iii) because of the nature of the projects BF route projects are well known in advance, but scrap based projects are not. The ratios of capacities by the different routes are thus no more than a rough indication.

In spite of these limitations the following points seem worth mentioning:

(i) for ASIA and AMERICA, the past trends of production match quite well with the capacity increase programmes; for EUROPE and the ARAB Region, particularly the latter, a very rapid increase in capacity is planned compared to the past production growth;

(ii) capacity utilization ratios (production versus rated capacity) of developing countries are generally low and estimated to be of order of 70 to 75% in 1977, although there are a few exceptional countries;

(iii) the expected annual growth rate of steel production capacity as a whole is about 12% over the decade 1977 to 1987;

(iv) the production capacity of the DR-EF based steelworks will be substantial in future. By 1981, it may reach about 20% of the total steelmaking capacity in developing countries;

(v) in the ARAB, AMERICAN and ASIAN regions, the DR-EF based route may reach 56%, 20% and 19% of steel production capacity respectively by 1982.

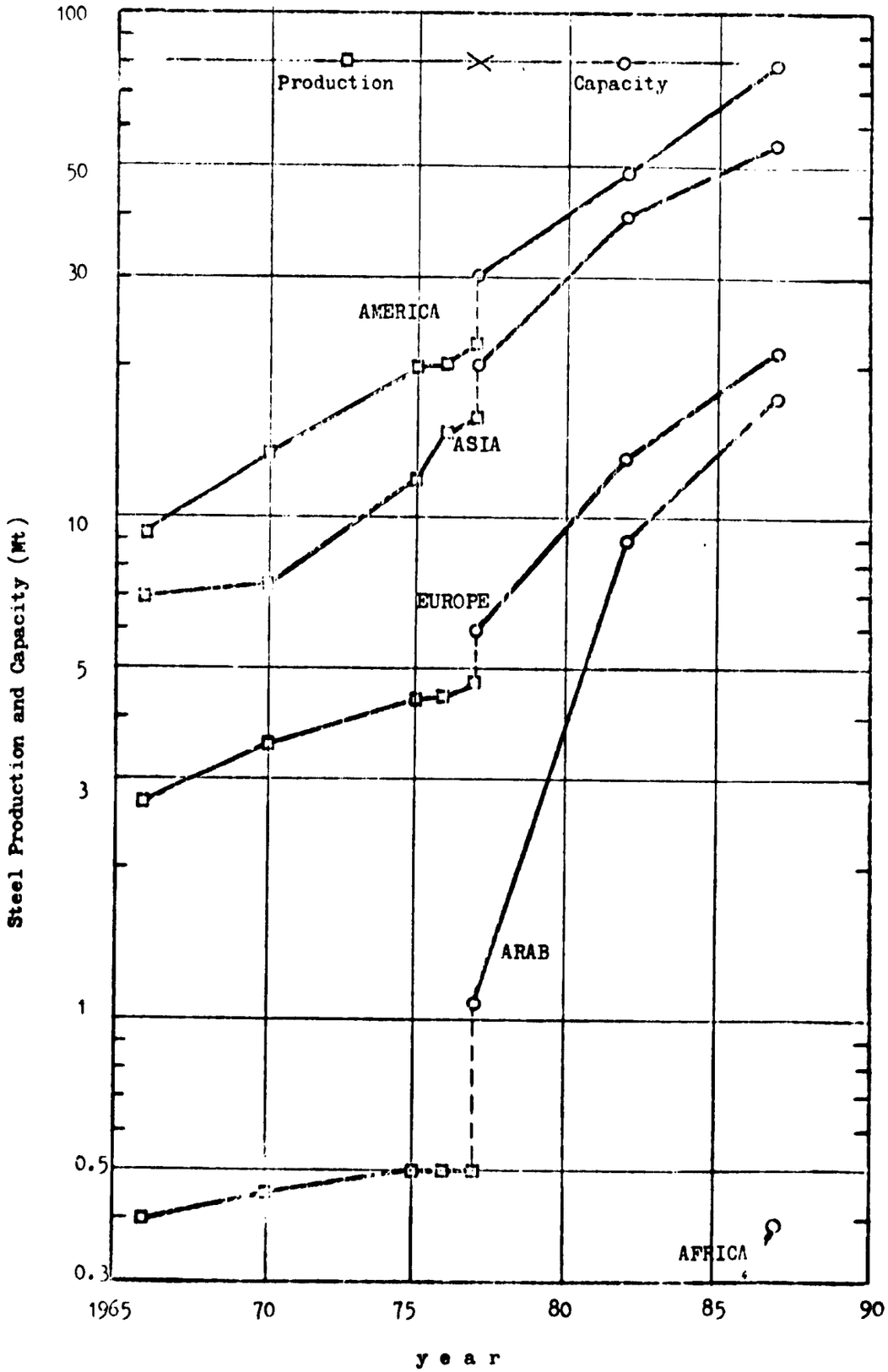


Figure 1 Steel production capacity expansion plans by region together with production records in the recent past

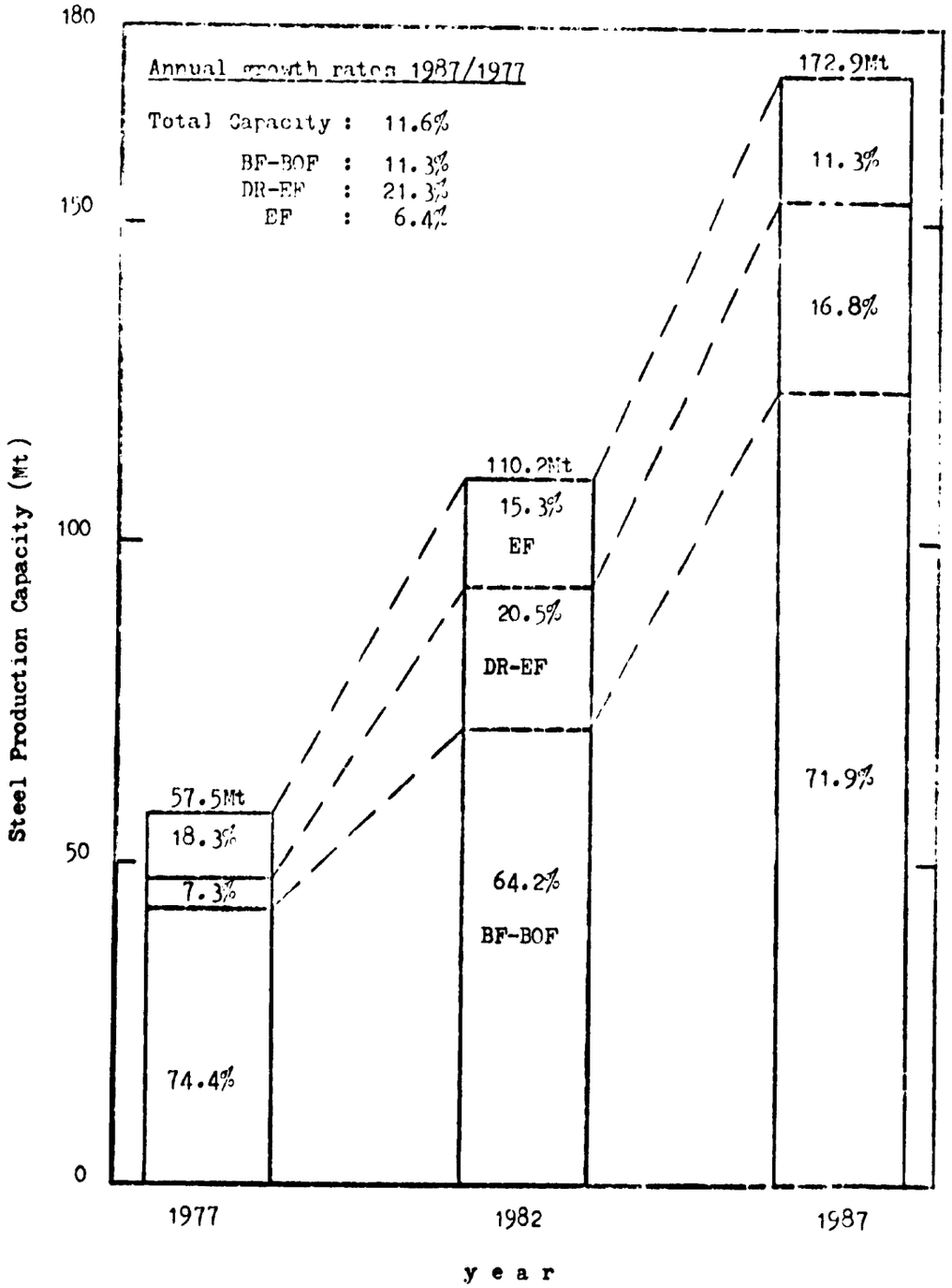


Figure 2 Steel production capacity increase by process routes 1977-1987

Question 4. What steel product-mix is planned?

(a) Structurals, beams or heavy sections
(b) Flats (sheets, plates)
(c) Merchant bars and light sections

Replies The ratios of flat products to total steel products were calculated and shown in Figure 3. It will be seen that:

(i) at a steel production level below 1 Mt most of the countries aim to produce non-flats only;

(ii) the flat products ratio for most countries which produce more than 1 Mt products falls between 40 to 60% which seems a reasonable range compared to the past records of developing countries.

(iii) few specific data on structurals were given since many countries combined their replies to a) and c).

(iv) There was considerable scatter in data, possibly caused by differences in classification.

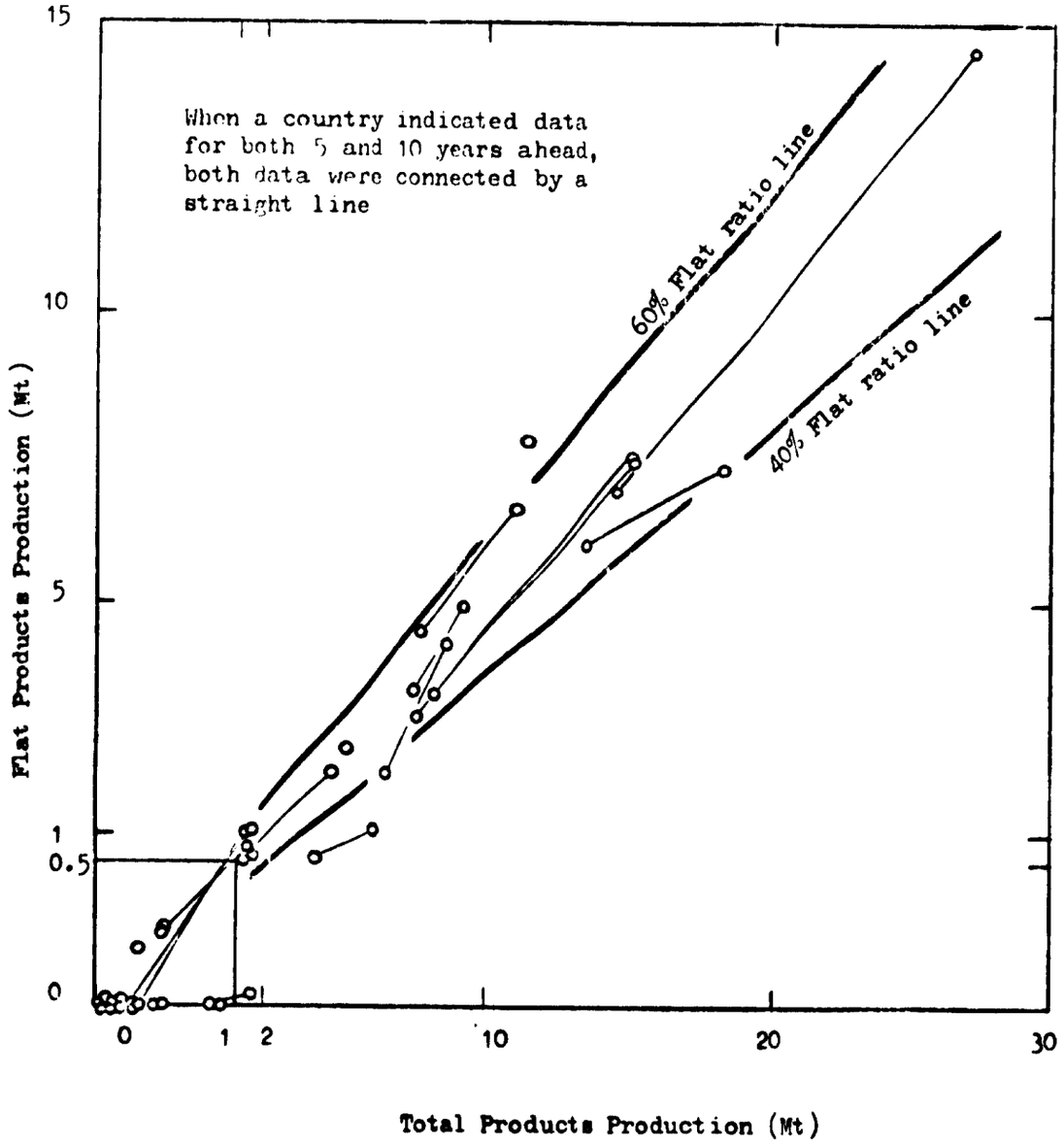


Figure 3 Flat products ratio envisaged in 5 and/or 10 years ahead

Question 5. Please indicate present availability of raw materials for the iron and steel industry:

(a) Iron ore

(b) Coal

(c) Natural gas

Replies

(a) Iron ore

Table 5 Numbers of countries classified by present status of reserves and mining operations

Region	Iron ore reserves				Ore mining industry			Ore processing plant		
	More than 100 Mt	Less than 100 Mt	Nil or unknown	No reply	Existing	Not existing	No reply	Existing	Not existing	No reply
African	0	2	5	1	0	7	1	0	7	1
Arab	3	2	3	0	3	5	0	2	6	0
American	8	3	1	1	7	4	2	6	5	2
Asian	5	1	2	0	5	3	0	4	4	0
European	1	0	1	2	2	1	1	2	1	1
Total	17	7	12	4	17	20	4	14	23	4

Out of 36 countries, 24 countries (67%) possess iron ore reserves, 17 countries with reserves over 100 Mt. 17 of the 24 countries already have a mining industry and most of them have iron ore processing facilities.

(b) Coal

Table 6 Numbers of countries classified by present status of reserves and mining operations

Region	Reserves				Coal mining industry		Coal processing plant		No reply*
	Coking coal		Other coal						
	Existing	Nil or unknown	Existing	Nil or unknown	Existing	Not existing	Existing	Not existing	
African	0	4	1	3	0	4	0	4	4
Arab	0	7	1	6	0	7	0	7	1
American	5	5	7	3	6	4	4	6	3
Asian	4	4	5	3	4	4	4	4	0
European	1	2	2	1	2	1	2	1	1
Total	10	22	16	15	12	20	10	22	9

* Most of these countries seem to be without coal reserves.

Only 10 countries out of a total of 32 possess coking coal reserves, mainly blending grades. Of the 16 countries which have reserves of other coal 12 already have coal mining industries. Reserves and production of coal in the African and Arab regions are very low.

(c) Natural gas

Table 7 Number of countries classified by availability of natural gas

Region	Supply available for steel industry		Quantities enough for steel industry		No reply
	Yes	No	Yes	No	
African	2	4	2*	4	2
Arab	5	3	5	3	0
American	6	7	6	7	0
Asian	3	5	3	5	0
European	1	2	0	3	1
Total	17	21	16	22	3

* Some doubt about adequacy of supplies.

45% of countries replying have natural gas resources (some of them yet to be developed) which will meet the quantity requirements of the expected steel expansion programme. The Arab and American countries are generally well endowed with this resource.

Question 6. Have you formulated a programme for expanding the production of raw materials for the iron and steel industry?

Replies

Table 8 Number of countries which have (Yes) or have not (No) formulated raw materials development programmes

Region	Iron ore		Coal or Gas		Electricity		Fluxes		Refractories		Water	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
African	1	5	1	5	4	2	1	5	1	5	4	2
Arab	3	5	5	3	7	1	7	2	6	1	6	2
American	9	3	8	4	12	0	10	2	8	4	8	1
Asian	5	3	3	5	6	2	5	3	6	2	6	2
European	2	1	2	1	2	1	1	2	2	1	2	1
Total	20	17	19	18	31	6	24	14	23	13	26	8

"No replies" to this question range from 4 to 9 depending on the material concerned.

About half of the countries have formulated iron ore and coal (or gas) development plans. Taking into account the number of countries which do not have steel expansion programmes or reserves, it can be said that most of the countries with steel plans will be developing their own raw materials.

Most of the countries have programmes for electricity and water supply.

Fluxes and refractories are mostly to be developed locally.

Question 7. Apart from your own national resources, where do you expect to obtain a) iron ore, b) coking coal, c) other fuels and power d) water?

Replies

Table 9. Number of countries classified by sources of raw material (countries aiming at BF-BOF routes)

Region	Iron Ore			Coking coal (or charcoal)		
	Mostly imported	Partly imported	Domestic only	Mostly imported	Partly imported	Domestic only
African	0	0	0	0	0	0
Arab	0	2	1	3	0	0
American	2	1	7	4	3	3
Asian	2	1	2	3	1	1
European	0	2	0	1	1	0
Total	4	6	10	11	5	4

Table 10. Number of countries classified by sources of raw materials (countries aiming at DR-EF routes)

Region	Iron Ore			Gas	
	Mostly imported	Partly imported	Domestic only	Imported	Domestic
African	1	0	0	0	1
Arab	4	1	0	0	5
American	2	2	4	0	8
Asian	2	0	0	0	2
European	0	0	0	0	0
Total	9	3	4	0	16

Countries aiming at the BF-BOF route intend to produce steel largely from domestic ores using imported coals; countries aiming at the DR-EF route will import the iron ore but plan to use gas locally available.

Although most of the replying countries expect to use locally available natural gas and electricity, six countries noted that they expect to share gas or electricity with neighbouring countries.

As for the sources of imports of iron ore and coking coal the names of countries are given below:

Table 11. Names of countries expected to be the sources of raw materials imports

Importing region	Expected sources of imports	
	Iron ore	Coking coal
African	Zaire, Swaziland (2) S. Africa	S. Africa, Botswana, Europe
Arab	Brazil (3), Mauritania (2), Guinea, Liberia, Sweden, Australia, India	East Europe, West Europe USA
American	Brazil (4), Venezuela (3), Chile (2), Peru (2)	USA (7), Colombia (6), Austria (4), Poland (3), Canada (3), Mexico
Asian	Australia (4), Brazil (3), India (3), Peru, Liberia, S. America	Australia (4), USA (3), Canada (3), India
European	Brazil	Poland (2), USA, Australia

Numbers after countries indicate the number of times they were named by importing countries.

Question 8. What organization (or organizations) is responsible for planning and implementing the growth of the iron and steel industry and of raw-materials production?

Replies All the countries which have a steel industry development programme named one or more organizations, mostly governmental organizations.

Question 9. Did you base your programme for the steel industry's growth on a general survey of economic development and industrial infrastructure in your country or subregion?

Replies All the countries which have a steel industry development programme answered "yes".

Question 10. Did you prepare studies of the demand (current and future) for steel in your home or regional markets and in potential export markets?

Did you engage a consultant to undertake the above studies?

Replies

Table 12 Number of countries replying Yes or No to Question 10 and their consultants

Region	Number of countries			Number of countries with foreign consultants	Number of countries with studies made locally
	Yes	No	No reply		
African	5	1	2	4	1
Arab	8	0	0	7	1
American	12	0	1	6	6
Asian	7	0	1	3	4
European	2	1	1	1	
Total	34	2	5	21	13

Almost all the countries made studies of steel demand. Two-thirds of the countries (21 out of 34) appointed foreign consultants for the studies and the rest carried out the studies themselves of by domestic consulting firms. Most of the foreign consultants belonged to developed countries.

Question 11. Have you undertaken studies on:

(a) The requirements for and supplies of iron ore?
(b) The requirements for and supplies of coking coal?
(c) The requirements for and supplies of other fuels?
(d) The requirements for and supplies of fluxes?
(e) Appropriate process routes?
(f) The requirements for trained manpower?
(g) Facilities for training?
(h) The economic factors to be considered in the provision of the necessary financing?

Question 12. Did you engage a consultant to undertake the above studies?

Replies

Table 13 Number of countries replying Yes or No to Question 11

Region	Ore		Coal or Gas		Flux		Process routes		Manpower requirem.		Training		Economic factors		No reply
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	
African	3	3	3	3	3	3	2	4	2	4	2	4	2	4	2
Arab	5	3	6	2	6	2	6	2	6	2	7	1	6	2	0
American	13	0	11	1	10	2	12	1	13	0	11	2	12	0	1*
Asian	5	3	5	3	5	3	6	2	5	3	4	4	5	3	0
European	3	0	3	0	2	1	3	0	1	2	1	2	1	2	1
Total	29	9	28	9	26	11	29	9	27	11	25	13	26	11	4

* Partial reply.

Table 14 Number of countries engaging consultants to undertake the above studies, and classification of consultants

Region	Number of countries with consultants	Mainly domestic consultants	Mainly foreign consultants from				No reply
			Dd.C	Dg.C	UNIDO	Not specified	
African	3	0	1	1	1	0	5
Arab	6	0	4	1	0	1	2
American	13	5	6	0	2	0	0
Asian	6	2	3	0	1	0	2
European	3	1	1	0	0	1	1
Total	31	8	15	2	4	2	10

The majority of replying countries have made or are making studies on the subjects indicated, but some have not yet done so although they have steel expansion plans or targets.

Many countries appointed foreign consulting firms for the studies, mostly from developed countries; the contribution of developing countries and UNIDO remains modest.

Question 13. What have you decided about choice of technology and process routes for iron and steel production?

Replies

Table 15 Number of countries as classified by the choice of technology and process routes

Region	BF-BOF	DR-EF	BF-BOF and DR-EF	Scrap based EF	Re-rolling	No reply
African	0	1	0	3*	0	4
Arab	1	3	2	1	1	0
American	5**	2	6	0	0	0
Asian	4	1	1	0	1	1
European	2	0	0	1	0	1
Total	12	7	9	5	2	6

* includes one country which selected foundry as first step

** includes two countries which selected charcoal BF-BOF route and one country examining ESF-EF route

The BF-BOF route is likely to remain the main process route, although the DR-EF route is also important. In total 16 countries out of 35 are expecting to depend on the DR-EF route completely or partly.

Question 14. Please describe briefly government and private plans for applied research and pilot-plant development in:

(a) Raw-materials processing

(b) Adaptation of process technology

Replies Since most of the countries gave only the names of the research and development institutions which exist or are being established the replies were summarised as numbers of countries which have or have not such institutions.

Table 16 Number of countries which have or have not R. and D. institutions for:

Region	Iron ore processing		Coal processing		I.S. making and Rolling		Standardization		No reply
	Yes	No	Yes	No	Yes	No	Yes	No	
African	0	6	0	6	1	5	2	4	2
Arab	1	7	1	7	2	6	3	5	0
American	7	6	4	9	5	8	4	9	0
Asian	3	5	3	5	3	5	3	5	0
European	2	1	2	1	2	1	1	2	1
Total	13	25	10	28	13	25	13	25	3

Research and development is at less advanced stage than the steel industry expansion programmes. One-third of the countries have research and development institutions but many countries are not yet in a position to devote resources to these activities.

Question 15. How did you arange foreign-exchange financing for whatever steel industry is already operating?

Replies

Table 17 Number of countries with established sources of credit

Region	Domestic resources	Foreign credits	Foreign investment	No iron and steel industry at present	No reply
African	2	0	1	3	2
Arab	3	2	0	1	2
American	0	7	0	3	3
Asian	2	3	0	2	1
European	0	2	1	1	0
Total	7	14	2	10	8

The principal sources of financing were given as domestic resources - both public and private - together with foreign credits from state-owned and private banks.

Direct foreign investment played only a small part.

Few details concerning terms and conditions were given. One exceptionally detailed answer indicated periods of repayment of 5 to 15 years and rates of interest of 6 to 8.5 per cent.

Question 16. What arrangements have you made or are you planning for future financing?

(a) Internal national sources

(b) External bilateral arrangements with countries or companies

(c) International agencies.

Replies

Table 18 Number of countries with expected future sources of credit

Region	Arrangements involving (a), (b) and (c)	Arrangements involving (a) and (b)	Arrangements involving only (a) or (b) or (c)			No arrangements	No reply
African*	2	3	0	0	0	0	2
Arab	2	1	0	0	0	3	2
American	7	2	0	0	0	1	3
Asian	2	3	1	1	0	0	1
European	2	1	0	0	0	1	0
Total	15	10	1	1	0	5	8

* Plus one case involving only (b) and (c).

Most of the countries have made suitable arrangements involving two or three sources of future financing. Among those which have not some are known to be in a favourable financial position (e.g. oil exporting countries).

The credit suppliers mentioned directly in replies (b): USA, Japan, Western Europe, USSR. International institutions mentioned directly - (3 times) - World Bank.

Question 17. What arrangement have you made for:

(a) Training local management?

(b) Training local technical staff?

(c) Training other local manpower?

(d) Securing managerial and technical staff from abroad?

Replies

Table 19 Number of countries with training arrangements

Region	Number of countries having arrangements for (a), (b), (c)		Number of countries planning arrangements for (a), (b), (c)	Number of countries arranging (d)	No plans	No reply
	at home	abroad				
African	(a) 1	0	3	0	1	3
	(b) 2	0	0	0	0	0
	(c) 2	0	0	0	0	0
Arab	(a) 1	5	1	3	0	0
	(b) 3	2	0	0	0	0
	(c) 1	2	0	0	0	0
American	(a) 7	2	4	0	0	1
	(b) 6	2	0	0	0	0
	(c) 6	0	0	0	0	0
Asian	(a) 5	1	1	1	1	1
	(b) 5	2	0	0	0	0
	(c) 5	1	0	0	0	0
European	(a) 2	0	0	0	0	0
	(b) 2	0	0	0	0	0
	(c) 2	0	0	0	0	0
Total	(a) 16	8	9	4	2	5
	(b) 18	5	0	0	0	0
	(c) 16	3	0	0	0	0

Nine countries are currently working on their plans for training schemes. For them the help which UNIDO can give is particularly timely.

The developing countries which are to establish their iron and steel industries from the very beginning rely heavily upon training abroad, although a substantial majority of the replying countries have already established a full range of training requirements for themselves.

Developing countries insist upon having their own managerial and technical staff. The staff from abroad is invited only exceptionally and is entrusted with tasks requiring technical expertise. E.g., one of the responding countries emphasized that it is securing managerial and technical staff from abroad only during the comissioning of new foreign-made equipment.

Question 18. During the past three years, has any iron and steel project negotiated between your country and a developed country been cancelled?

Question 19. If the answer to the question 18 is yes, please:

(a) Briefly describe the project

(b) Give the reasons for cancellation.

Replies

Table 20 Number of cancellations of projects and reasons

Region	Number of cancellations	Type of project	Reasons
African	0	-	-
Arab	1	Direct reduction plant	The lack of natural gas
American	1	Semis plant	International marketing and financial
Asian	1	Not given	Not given
European	0	-	-
Total	3	-	-

The answers given indicate that cancellations have not been a major factor interfering with the realization of iron and steel industry projects in developing countries since 1974.

B. PROBLEMS

Question 20. Please describe

(a) The specific problems your steel industry has encountered so far

(b) Your experience with co-operation with developed and developing countries.

Replies

(a) The problems encountered by the industries in the developing countries could be roughly classified into 6 groups:

1. economic problems such as price fluctuation, high production costs, restricted market, tight credit, etc.
2. social-economic problems - e.g. the turnover of manpower
3. technical problems e.g. difficulties in mastering some technologies
4. inadequate material infrastructure
5. " training
6. " financing

And the number of countries quoting these groups are as follows:

Table 21 Number of countries reporting problems

Region	Problem			Group			No reply
	1	2	3	4	5	6	
Afrioan	1	0	0	2	3	1	3
Arab	0	1	1	1	3	1	3
American	3	0	1	2	4	4	1
Asian	3	0	1	0	2	0	0
European	1	0	1	0	1	1	1
Total	8	1	4	5	13	7	8

The answers are not always easily comparable because of their heterogeneous character (some general, some very specific).

A number of answers identified problems but also pointed out the arrangements made to solve them.

Some of the countries outlined more individual problems. One of the Arab countries referred to the delay in completion of plant and a negative attitude on the part of contractors towards the training of indigenous personnel. An Asian country emphasized the high costs of the transfer of technology.

It seems desirable to consider the specific technical problems raised (e.g. application of heavy oil in the DR-process, the elimination of aluminium from iron ore, prevention of scaffold formation in blast furnaces) within the framework of the cooperation between iron and steel research institutes, as referred to in the main part of this Working Document.

(b) **Few countries gave much detail of their experience with co-operation with other countries in steel industry matters, but only one reported in a specifically unfavourable way.**

Table 22 Classification of replies on experience with co-operation with other countries

Region	Positive experience	Negative experience	Non-classified experience	No experience	No reply
African	0	0	3	2	3
Arab	1	1	4	0	2
American	2	0	4	2	5
Asia	2	0	2	1	3
Europe	2	0	0	1	1
Total	7	1	13	6	14

One country stressed its difficulties in co-operation with developing countries but not details were given.

Countries mentioned as partners in helpful co-operation were Japan (3), USSR (3), Egypt (2), US (2), Argentina, Brazil, FRG, Iran, Mexico, Turkey, UK.

Question 21. Having set out in part A the programme for the development of the iron and steel industry in your country, what major difficulties do you foresee in connection with the following areas:

(a) Raw materials
(b) Coking coals and other fuels
(c) Production technology
(d) Research and development
(e) Training and management
(f) Financing

In your comments, please indicate which problems could be solved by bilateral and multilateral co-operation with other countries (developed and developing) and which would require wider involvement, with or without the assistance of UNIDO.

Replies In some cases the areas in question were indicated without further elaboration. As a first step toward a summarized answer the following table illustrates the frequency of the mention of each possible area of difficulty. There was a fairly even spread of mentions of each area with financing quoted least frequently (9 times) compared with technology the most (14 times) including an interest in the development of the gasification of coal.

Table 23 Number of countries quoting the respective difficulties:

	Areas of potential difficulties						
Region	(a)	(b)	(c)	(d)	(e)	(f)	No reply
African	0	1	1	2	3	1	4
Arab	1	1	2	3	4	2	2
American	6	6	8	4	2	4	4
Asian	3	3	2	2	2	1	1
European	1	2	1	1	1	1	0
Total	11	13	14	12	12	9	11

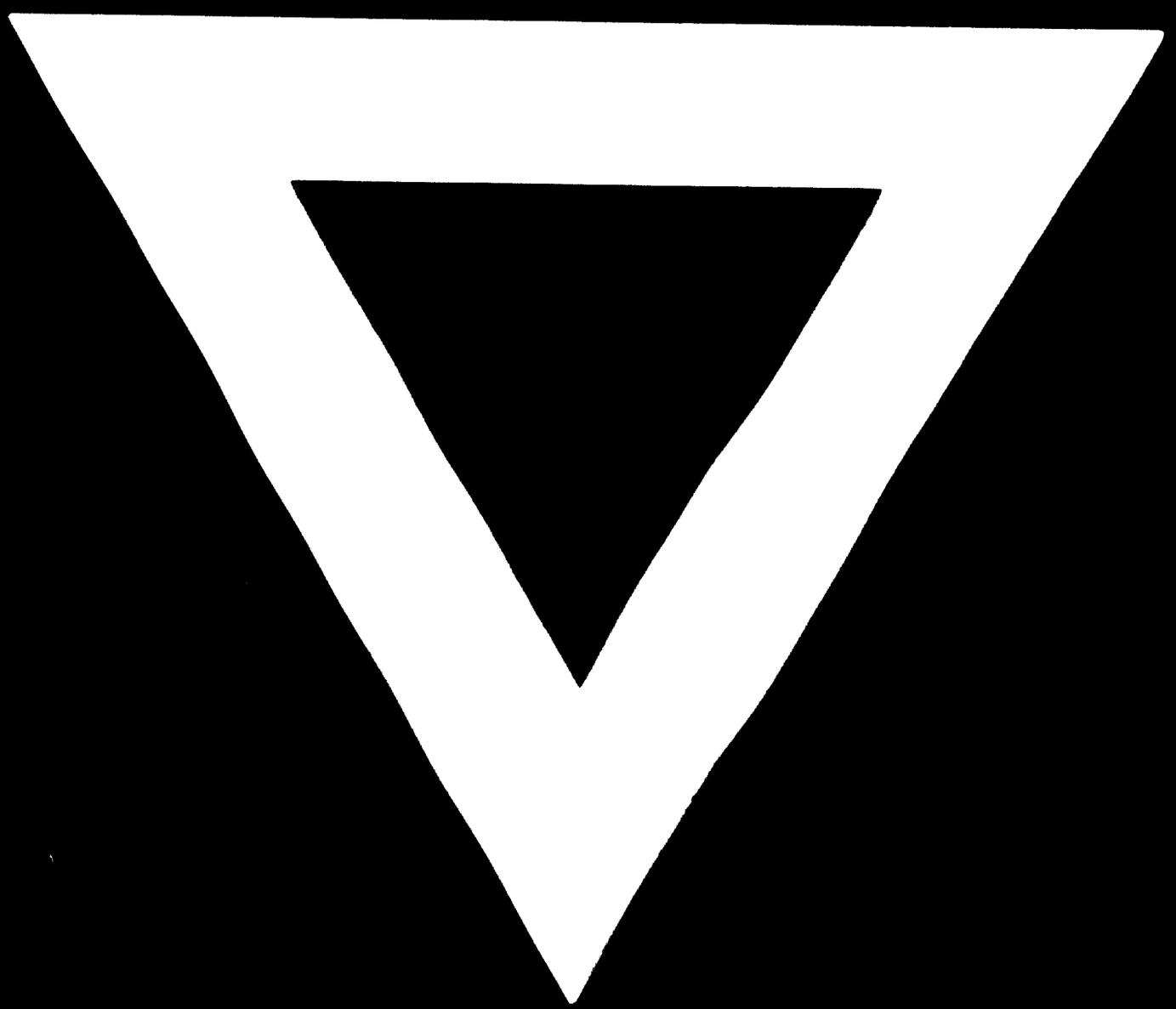
Two countries, one Arab and one Asian, referred in general terms to the problem of price fluctuations in the markets for steel and raw materials.

Referring to the problems of raw materials and fuels some answers stressed the need for stability in the supply of iron ore, coking coal and scrap.

Some countries indicated their capacities to help other developing countries with training.

There was a view in some answers that UNIDO should advise on plant purchase, orefield development and financing.

C-10



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