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Follow-up Action on First  
Consultation Meeting on the  
Iron and Steel Industry

WORKING PAPER\*

FOR

THE WORKING GROUP MEETING

ON

IRON ORE

Vienna, 3 - 5 April 1978

prepared

by

The Secretariat of UNIDO

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Introduction

1. The Report of the first Consultation Meeting held in Vienna from 7 to 11 February 1977 recommended in paragraph 23 that the UNIDO Secretariat should examine the following topics so that it could make specific proposals to the next Consultation Meeting concerning ways of promoting international co-operation to ensure the availability of the raw materials and fuel needed for the expansion of the iron and steel industry:

- "(a) An assessment of the world iron ore resources, quantitatively and qualitatively;  
.....
- (c) A review of the plans and progress made in developed and developing countries to increase the production of those raw materials and consideration of whether appropriate measures were being taken to ensure an adequate supply of them;
- (d) A survey of the investment costs of existing iron ore mines and beneficiation and pelletizing installations and the infrastructure needed so that the magnitude of the investment problem could be evaluated to satisfy the requirements of the Lima Declaration, with a view to examining the return on investment that would be required to make the investment viable."

2. In carrying out these recommendations, the Secretariat commissioned surveys from consultants, reviewed published information, and considered written contributions from a number of ore developing companies relating to their experience of recent examples of ore-field development.

3. This working paper summarizes the results, and presents items for discussion by the Working Group in order to formulate proposals for action for consideration at the second Consultation Meeting.

Agenda item A: Iron ore resources, and prospects for demand and supply

4. The first Consultation Meeting recognized that reserves of iron ore in the world were sufficient and that iron ore was not a scarce resource. The world reserves are estimated at 250 thousand million tons and at the 1974 peak rate of production of 900 million tons would last for over 250 years. Some 20% of the total proven reserves are located in developing countries.

Detailed descriptions of the chemical and geological characteristics of the deposits are available in published form.<sup>(a)</sup>

5. The future demand for iron ore is directly related to the expected levels of steel production. For the year 2000, the first Consultation Meeting considered that the order of magnitude of steel production in the world was likely to be 1750 million tons. For the year 1985 a UNIDO estimate prepared in 1976 suggested a production of nearly 1070 million tons. However the current depression in steel demand in many countries may affect these estimates adversely.

6. On the assumption that the technical factors relating to the composition and use of ore and the proportion of iron used in steelmaking remain the same as at present, the above estimates of world steel production lead to estimates of world iron-ore requirements of a maximum of 1250 million tons in 1985 and an order of magnitude of 2000 million tons in 2000.

7. The total demand figures stem from the Fe content needed to match the expected steel production. Within the totals there may be problems relating to the changing proportions of lump ore, sinter and pellets required by the evolving techniques of blast furnace operation and the possible increase in direct reduction processes.

8. The supply of iron ore in the year 1985 will depend on the production from ore-fields now in operation, from those in process of development, and from those where development is planned and awaiting an early start. The peak production reached in 1974 analysed by region is given in Table I.

9. Since 1974 the total world production has fallen as a result of weakening demand, reaching 896 million tons in 1975 and 875 million tons in 1976. Some small workings have closed with the exhaustion of their resources or for other reasons, but new ore-fields have been made ready for operation and there is no doubt that when demand revives world production can respond rapidly to reach at least the earlier peak level of 900 million tons a year.

10. Countries with development schemes known to be in progress or in an advanced state of preparation are shown in Table II, indicating the potential to add 350 million tons a year of production by 1985. Some of the schemes are in suspense because of the current recession in world steel demand. The uncertainty of the course of world demand and the difficulties of securing finance for ore-field development must not be minimised but assuming that

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(a) e.g. UN Survey of World Iron Ore Resources 1970.

Table I  
Iron ore production by region 1974  
(millions of tons)

North America	133	
of which USA		86
Canada		47
Latin America	131	
of which Brazil		80
Venezuela		26
Western Europe	123	
of which France		55
Sweden		36
Eastern Europe	240	
of which USSR		225
Africa	75	
of which Mauritania		11
Liberia		36
South Africa		12
Asia	98	
of which India		34
China		51
Oceania	99	
of which Australia		97
<u>Total</u>	<u>899</u>	

Table II  
Potential Extra Iron Ore Production by 1985  
Above the 1974 Potential  
(millions of tons)

Canada	35		
USA	30		
Brazil	115	-	
			Barão de Cocais 35
			Carajas 30
			Other CVRD 30
			Samarco 10
			Agua Claras 10
Other Latin America	10		
South Africa	15	-	
			Saldanha Bay
Other Africa	43	-	
			Gabon 10
			Guinea 15
			Ivory Coast 12
			Mauritania 6
India	25	-	
			Kudremukh 20
			Bailadila 5
Other Asia	5		
Australia	60		
Eastern Europe	12		
	<u>350</u>		

they can be resolved there is every likelihood that the potential will exist to raise world production to meet the maximum requirement of 1250 million tons in 1985.

11. In the longer perspective, up to the year 2000, additional supplies may come from new schemes yet to be worked out and indeed from ore deposits which may not yet have been fully surveyed and proved.

12. The time from the proving of workable reserves to the start of operations at a new orefield can be of the order of 10-15 years, so that during the period up to 1985 which is covered as far as production potential is concerned by development already planned there need to be substantial further proposals for surveys and development to meet the rising requirements up to the year 2000. The future course of demand and the solution of the financial problems will continue to be of vital importance.

13. The foregoing paragraphs refer to the world demand and supply balance. There are also interesting points which emerge from a consideration of the share of developing countries in the total production of iron ore. Table III sets out some relevant figures.

Table III  
Iron Ore Production (a)

		<u>1970</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>	<u>1975</u>	<u>1976</u>
<u>World total</u>	(M/tons)	774	780	851	899	896	875
<u>Developing countries</u>	(M/tons)	223	238	261	292	299	272
<u>total</u>	(%)	28.8	30.5	30.6	32.5	33.4	31.0
of which Brazil, China	(M/tons)	109	112	140	165	180	161
and India	(%)	14.1	14.3	16.4	18.4	20.1	18.4
of which other	(M/tons)	114	126	121	127	119	110
	(%)	14.7	16.2	14.2	14.1	13.3	12.6

14. The share of developing countries in the world total has varied little over the period 1970-1976, but the share of the three largest producers among them, Brazil, China and India, has shown a rising tendency while the share of the others has declined.

Questions:- Does the Working Group subscribe to the general prospects for demand and supply of ore described above?

(a) Calculated from data from the Statistisches Bundesamt, Düsseldorf.

- What special issues may arise in relation to the demand and supply of pellets?
- What courses of action should UNIDO undertake to keep in touch with orefield development throughout the world and assess its adequacy in relation to the evolution of demand?
- What is the scope for international co-operation between groups of developing countries which have surveyed and proved their ore deposits and those which are planning to do so, with the intention of sharing experience?

Agenda item B: Investment costs and the magnitude of the investment problem

15. The capital investment required for opening up a new orefield will depend on many factors including the geological and physical nature of the deposits, the engineering problems of stripping the overburden and excavating the ore, the length and difficulties of the railway or other transport from the deposits to the point of usage or shipment, the size of the beneficiating and pelletizing equipment required, and the social and other infrastructure to be provided.

16. The magnitude of single orefield development projects has been increasing in the attempt to secure economies of scale from the use of massive excavating and transport facilities. A survey of 26 potential development schemes throughout the world illustrates the size of the individual investments required.

Table IV

Capital investment cost of orefield project (million US\$)	Less than 100	100-500	More than 500
Number of projects	3	14	9

17. Detailed estimates for recently completed schemes have indicated capital costs varying from \$50 to \$100 per annual ton of pelletized product at 1977 prices, but figures given for schemes projected for the future tend to be at the top end of that range, more particularly if substantial concentrating and pelletizing equipment is included. Typical analyses of the costs at recent schemes are shown in Table V.

18. The figures in Table V are averaged over the total output from a complete scheme. At other locations where additional plant has been installed to supplement existing facilities the cost of a concentrator with associated engineering

Table V  
Investment costs in iron ore mining,  
\$ per annual ton of pelletized product  
(1977 prices - Consultants' tabulation)

	<u>Example 1</u> 10 million tons of pellets/year, conveyor transport (Dg.C)	<u>Example 2</u> 2.5 million tons of pellets/year, pipeline transport (Dd.C)	<u>Example 3</u> 6 million tons of pellets/year, pipeline transport (Dg.C)
Mine, including equipment	1.7	2.2	5.6
Processing	7.9	37.8	13.5
Pelletizing	9.9	18.7	15.6
Services	5.2	11.1	6.2
Transport	10.5	18.9	8.9
Engineering	4.1	4.4	8.8
Other	5.2	10.2	7.3
<b>TOTAL</b>	<u>44.5</u>	<u>103.3</u>	<u>65.9</u>

has been as high as \$50 per annual ton of high-grade product, and pelletizing plants have cost up to \$40 per annual ton of pellets.

19. Taking the round figure of \$100 per annual ton of product from a complete scheme, the total requirements for finance to add the 350 million tons of extra production of iron ore needed to meet the maximum requirement by 1985 would amount to \$35 billion, or a rate of \$4 billion a year. The provision of such sums is part of the financial tasks relating to the expansion of the steel industry generally in both developing and developed countries. It is intended to consider the financing problems for steel industry development as a whole at a separate Working Group in the Autumn of 1978.

20. A capital cost of \$100 a ton would imply that the price of the pelletized product would need to include between \$12 and \$15 a ton to cover depreciation and profit. The average operating costs at recent projects are in the range of \$12 - \$14 a ton of pellet output so that the selling price of pellets from a new scheme must be between \$24 and \$29 a ton delivered f.o.b. at 1977 prices to make the scheme financially attractive.

Questions:- The interests of developing countries as ore producers lie in organizing their orefield development to be as efficient as possible, thus keeping the capital investment to a minimum and yielding as large a margin as possible compared with future market prices. Given that the actual process of financing including the terms and conditions are to be dealt with elsewhere,



what forms of international co-operation can developing countries evolve to minimize the capital investment required in their ore-field schemes?

- Is there scope for neighbouring countries with the same or similar geological fields to combine their exploration and working, sharing the high costs of the equipment and installations needed?
- If developing countries seek to add value to the crude ore from their deposits by concentrating, pelletizing, or other forms of processing, what points should they consider and what assessments should they make before coming to a decision?

Agenda item C: Market structure and access to markets

21. Until about 25 years ago, the iron ore market was characterized by annual negotiations between buyers and sellers, both sides being numerous and well informed so that a reasonable equilibrium market price emerged dependent on the world steel demand position at the time and on the characteristics, particularly the Fe content, of the ore on each contract.

22. The situation has now changed. The technical growth in the size of blast furnaces, exemplified by the developments in Japan, has meant that a comparatively small group of buyers needs very much greater annual tonnages than before. The opening up of new orefields in remote locations has required heavy investment in transport and infrastructure facilities, and the associated use of large-scale excavating machinery and shipping, all designed to minimize operating costs, have made it necessary to raise large sums of money on the international market, well beyond the accumulated resources of existing mining concerns. In these circumstances, there has been a move towards the conclusion of long-term contracts for iron ore giving both buyers and sellers some assurance of continuity of supplies and production, and providing some security for financial advances.

23. Recent examples of the new arrangements have been those between suppliers such as Australia and Brazil on the one hand and Japan and the European Community countries on the other. Developing countries including those in the Middle East where the oil interests have created world-wide commercial contracts have also adapted to the new conditions with ease. However, with much of the world ore trade now covered by long-term arrangements, some difficulties may be encountered by small-scale buyers, particularly those in developing countries which are beginning to establish their steel industries

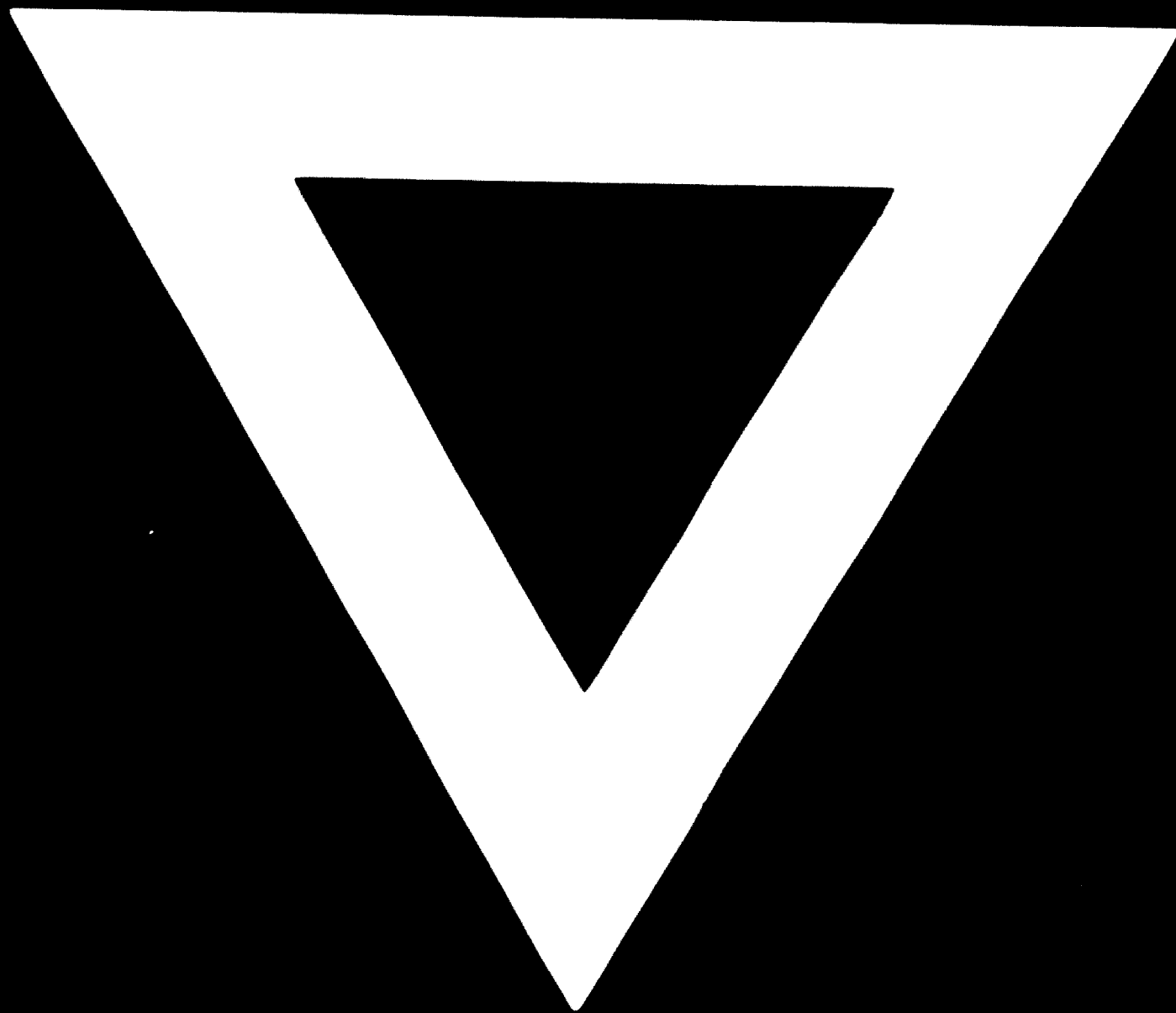
and are thus coming into the ore market for the first time, in making the right contacts to secure their modest requirements.

Questions:- The interests of developing countries as buyers of ore lie in securing and maintaining access to supplies for their needs which may at first be on a small scale. What forms of international co-operation should developing countries adopt to this end?

- Should such countries combine their buying programmes to build up total tonnages which are more interesting to large-scale producers?
- Is it practicable for a small-scale buyer to arrange to include his requirements with those of a large-scale buyer; and if geography and technical considerations are convenient, to share in the transport?
- If a developing country is starting to establish a steel industry including possibly working its own iron ore deposits, what criteria should it apply in deciding whether to exploit the deposits or to buy ore in the international market?



**B-37**



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