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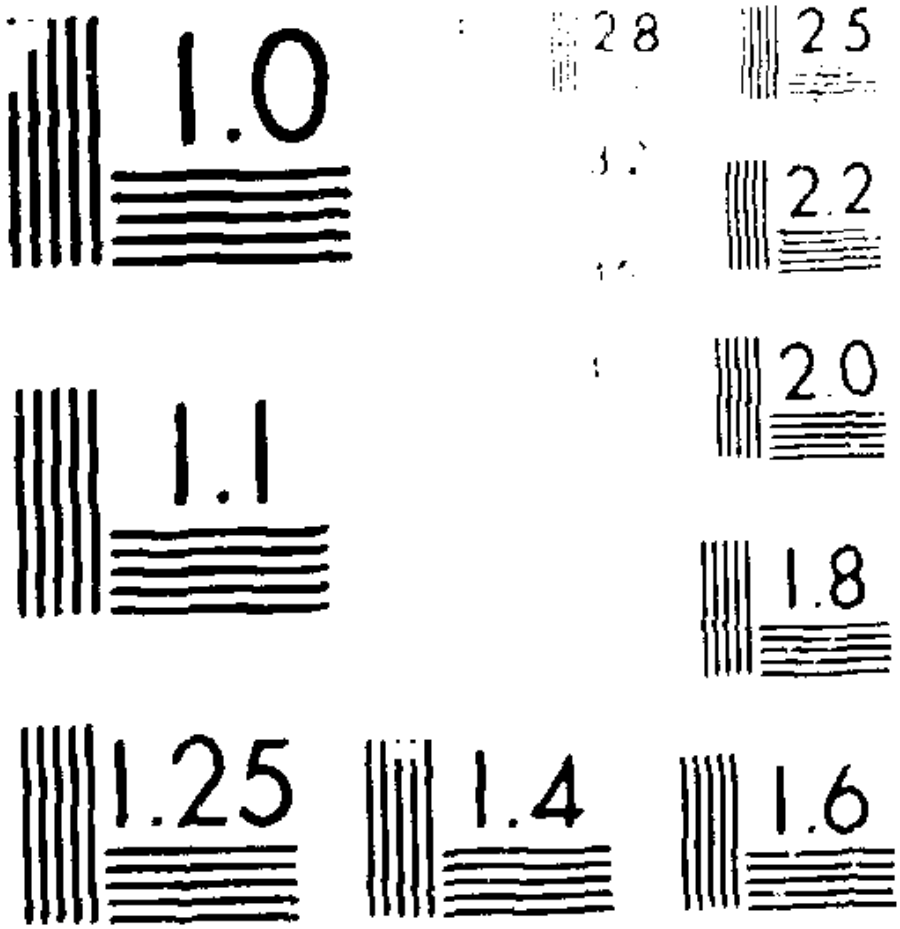
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Distr.
LIMITED

UNIDO/IS.202
26 June 1981

ENGLISH

UNITED NATIONS INDUSTRIAL
DEVELOPMENT ORGANIZATION

NATIONAL MINING CORPORATION AND METAL PRODUCTS CORPORATION*

Prepared By

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V.81-27158

NATIONAL MINING CORPORATION AND METAL PRODUCTS CORPORATION[a]

In the Spring of 1979, negotiations were about to start between the National Mining Corporation (NMC) of Africana[1/] and the Metal Products Corporation (MPC) based in the EEC, for the supply by MPC to NMC of a newly discovered process that decreased the air pollution resulting from copper refining while increasing the yield of the process.

1. METAL PRODUCTS CORPORATION (MPC)

MPC was a large European corporation based in one of the countries of the European Economic Community.

It had rather diversified manufacturing and commercial activities in the whole of Europe as well as in the USA, Latin America, Asia and Africa.

Its main line of business consisted of various mineral processing operations like copper, aluminium, zinc, tin, molybdenium and other non-ferrous materials. The company owned several non-ferrous mines both in Europe as well as in other parts of the world. It had also certain - although not large - iron ore mining and processing activities in its home country, as well as in one Latin American country. (See Exhibit 1 for financial data on Metal Products Corporation in 1977 and 1978).

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[a] This case was prepared by the Secretariat of UNIDO, with the assistance of the Centre for Applied Studies in International Negotiation (Geneva, Switzerland) and the Institut pour l'Etude des Méthodes de Direction de l'Entreprise - IMEDE (Lausanne, Switzerland) as basis for discussion rather than to illustrate either effective or ineffective handling of an administrative situation.

1/ Names and figures are disguised. Parts of the case are based on materials provided by LES Australia.

The policy of the Corporation, founded back in the second half of the 19th century had always been to devote a considerable part of its resources to research and development in its field of operations, both in processing and in mining of non-ferrous minerals. As a result of this policy, MPC experienced during the 10's and 70's a rapid increase of its business both in the EEC and on other markets.

Its R+D efforts led MPC to develop a number of new and increasingly sophisticated technological processes for more profitable and efficient mineral processing. The Company also accumulated considerable experience and know-how in the prospection and exploitation of non-ferrous minerals both in open-pit and deep-mining, including management know-how in the combined mining and processing operations.

In late 1979, MPC was operating a medium-size mining and processing facility (45,000 T. smelter) in a Latin American country. In a few instances in the 70's, it had also provided its technical and management expertise in areas of mining and processing in Chile, Ecuador, Zambia, Zaire and Malaysia.

Although it operated directly in several countries outside Europe, MPC had managed to retain a rather European outlook, For example, it always used expatriates to hold the key management positions in its foreign operations where its policy, so far, had been to hold a controling interest. The reason for this, the company executives claimed, was that it wanted to protect the integrity of its sophisticated technologies and of its managerial standards.

Several persons occupying top management positions in MPC had had some work experience, at some point in their careers, in dealing with foreign assignments. Although this experience was not considered to be essential in a manager's career, it was certainly considered a definite plus. This was because it was quite clear to top management that, even though they felt a preference for operating in western industrialized countries with the necessary technological base, they

did not believe that the company could survive if it limited its activities to these countries. Participation in the development of the industrial infrastructure of LDC's with mineral resources was considered to be important. Initially this move towards selling the metal processing technology rather than the refined metal itself had in fact been criticized within the company on the ground that it was helping new competitors. However, top management had become convinced that if MPC did not enter the field of technology supply, other companies would do so and in the end it would not sell its finished refined products either.

In support of this strategic move, the company had established in 1974 a division in charge of technology supply. Staffed mostly with engineers specialized in facilities and process design, this division was responsible for supplying technology and processes both inside the company itself, and outside. When it supplied its technology to outsiders, its preference had been to provide licenses as well as processing equipment and personnel training. This approach was preferred to direct investment because it did not require any of the corporate financial resources that could then be directed to areas considered to be more stable than some of the prospective buyers of technology. At that time, in particular, the company was pursuing a policy of acquisitions in the U. S., in Canada, in Brazil, and in Australia. However, top management also knew that, at some point, direct investment might be needed in order to serve certain promising markets for its equipment and technology.

From the industrial relations point of view, MPC had a good reputation in its country of origin, although, like most other European operators it had also experienced its share of strikes. Many of these, however, were part of national demonstrations generated by the recession and the threat of unemployment, even though MPC had managed to decrease its workforce entirely through natural attrition.

On the other hand, MPC's operations in western countries had sometimes

been target of environmentalist pressure groups. They were concerned both by the alterations made to the landscape as a result of mining operations, and by the air pollution resulting from metal ore processing. Although they had initially represented a surprise for the company, it was clear to top management that, unfortunately, more and more of what they viewed as "emotional attacks" would have to be dealt with. Being strong believers in the free-enterprise system, MPC's executives were somewhat distressed by the growing move of non-market forces that ousiness had to deal with.

Early in 1979, the marketing manager of the technology supply division. a newly created position, had been traveling in Africana to explore the possibilities resulting from the copper-ore resources of this country. Back in 1972-74, MPC had already supplied Africana with copper-ore processing equipment supplemented by a two-year technical and management assistance contract. MPC had no financial interest in Africana and, at that time, did not intend to invest directly in this country, However, it had been informed by the Commercial Attaché of its home country of Africana's development plans regarding its copper-ore processing capabilities. The initial discussions during this first trip seemd to indicate that Africana would welcome a proposal from MPC concerning the supply of its newly developed copper-ore technology. In the spring of 1979, the head of the technology supply division and his marketing manager were thus reviewing the various possible proposals they could submit to Africana.

2. NATIONAL MINING CORPORATION (NMC) AND AFRICANA

Africana was a medium-size developing country with vast mineral resources such as copper-ore, bauxite, and other non-ferrous minerals (gold, silver, molybdum, etc.).

Its TNP per capita was US$850 in 1977 and US$975 in 1978, thus placing Africana in the top league among developing countries. (See Exhibit 2 for Basic Economic Indicators.). On the other hand, Africana

was fully dependent on oil imports, particularly for its production of electricity since it had no energy sources in its soil. Politically stable over the previous 20 years, and with a presidential system, it had been drawing its successive Governments from either of the two (2) main political parties.

Partsof its economy were in private hands, local or foreign, while others also included state participation up to 100% in a number of State corporations.

Where it existed, State participation was achieved through the National Development Bank and the National Financial and Development Agency (NFDA). State participation could co-exist with national participation and/or foreign participation. Such situations of mixed economy could be found in all industrial sectors, although state participation tended to be relatively limited to the service sector.

The Government had adopted a rather liberal approach with regards to foreign ownership. In principle, various levels of foreign ownership were possible, from minority participations to full ownership. However, in the economic sectors, considered to be most crucial for the national economy, foreign participation was limited to 49%.

Repatriation of profits free of taxes was in principle unlimited, even though for the last two or three years the Government had attempted to encourage the reinvestment of profits locally.

Profits were taxed at a rate of 22.5% while the tax rate for royalty payments was 11%. New joint ventures normally enjoyed a three-year tax holiday.

Africana had been eager to secure the technologies needed to ensure its development. It was estimated that in the previous three years at least US$50 million to US$75 million had been spent anually to acquire technology hardware and software. Considerable efforts were

also under way to develop the technological base of the country. Technical schools producing skilled workers, universities, and R+D centres had been set up. Even though these programmes had represented a considerable effort, it was recognized by the local authorities themselves that they had not yet produced the base sufficient to master locally more sophisticated technologies.

Similar efforts had also been started to develop an industrial infrastructure, particularly regarding transportation networks. However, the results were still far under the desired level and modernization and expansion were considered to be urgent. For example, the copper mines located in the centre of the country were connected with the port facilities, some 300 Km. away, through only one railway line with limited capacity. Major expansion work had been started in 1977 to double this capacity. It was expected that by 1982 it would then be sufficient to meet the needs of the projected increase in the mining output.

Because of the stabilization of world copper prices and following the unexpected rise in gold, silver, and platinum prices, new openings of copper mines were in effect being projected. Such expansion plans had already been developed earlier but had had to be temporarily shelved back in 1973-74 due to the recession. The present mines had been built in the late 40's and it was estimated that they would remain profitable until 1985 [illegible]. New mines would have to be opened then if production were to remain at the current level. In particular, the Government had planned for doubling the copper production by 1990, thus also calling for the construction of additional smelter capacity starting in 1982-83.

Parallel to the high investrents projected, the likeliness of a fast increase in the local production costs of copper, coupled by a slow increase in the world market prices, would call for more attention to productivity over the next few years.

In addition, the pollution generated by the mining and processing industries had led the Government, in cooperation with UNEP (United Nations Environmental Programme) and with the assistance of the U. S. Government to take a number of anti-pollution measures. A primary target for these measures was the emission of sulphur dioxide resulting from copper processing. Large quantities of sulphur dioxide were released directly in the atmosphere and affected agricultural production, an important source of foreign exchange, over vast parts of the country.

According to the recently issued National Environmental Decree, the quantity of sulphur dioxide emitted in copper processing had to correspond to less than 10% of the sulfur contained in copper ore.

The National Mining Corporation (NMC) had been established in 1963 to undertake mining and processing operations of local non-ferrous minerals, mostly copper. At the time of its incorporation, its ownership was:

49% - foreign
31% - State
20% - local private

In 1975, through a stock increase and the purchase of a portion of the shares held by a Swedish mining and processing company, the State increased its share to 51%, thus leaving 25% to foreign stockholders and 24% to local private stockholders.

In 1979, NMC employed 3,000 persons. It operated one open-pit mine and two deep-mines in the centre of the country, as well as processing facilities and port equipment on the coast. It also owned and operated the railroad between the mines and the coast (see Exhibit 3 for 1977 and 1978 financial data).

NMC produced copper through the traditional smelting process. It operated two smelters, one built in 1966 with a capacity of 50,000

T/year and a more recent one built in 1972 with a capacity of 80,000 T/year. The two plants currently produced at the rate of 120,000 T/year, 40,000 T. from the 1966 one and 80,000T. from the 1972 one. Both smelters had been supplied by Metal Products Corporation together with the necessary technical assistance. The second one, however, had involved a management agreeme t through which MPC had also operated the plant and distributed its output, including the by-products, from 1972 to 1974. In 1975, NMC took over the operations and the distribution of copper while MPC continued to distribute the by-products. In 1979, however, it was found that the pollution control equipment used on these smelters could not comply with the 10% emission limit on sulphur dioxide.

NMC's top managers were rather eager to equip the plants with modern machinery. They believed that the increased yields of copper and related by-products would justify the investment costs and would permit a better use of the country's resources. All of the five executives with responsibility positions within NMC were in their early 40's and had studied in European or in U. S. universities from which they held engineering degrees. They were quite at ease with the copper refining technology and with mining processes. They had all been working with NMC for several years. Only the managing director had had experience with an American firm operating in an African country. The four other executives had joined NMC immediately after their graduation.

Below the executive level, however, technical competence was less available and was lacking the versatility needed to proceed rapidly with process improvement opportunities when possible.

3. CONVENTIONAL COPPER-ORE PROCESSING

Over 90% of the world's supply of copper ores occur as sulphide minerals that are recovered under the form of concentrates containing 20%-30% of sulphur. Conventionally, the concentrate is melted and most if not all of the sulphur is emitted into the atmosphere as sulphur

dioxide. The air pollution danger such emissions represent has led the U. S., Canada and European countries, as well as in increasing number of developing countries, to issue regulations requiring that no more than 10% of the sulphur contained in the ore concentrate be emitted as sulphur dioxide. Anti-air pollution processes existed, however, that recuperated and liquified sulphur dioxide. For a 100,000 tons plant, the estimated investment represented some US$3 million. Operating costs to process the sulphur dioxide would amount to US$2 per ton of capacity used. On the other hand, liquified sulphur dioxide could be sold at US$150 per ton. It was also estimated that about 2,000 tons of liquified sulphur dioxide could be obtained through this method from a 100,000 tons plant. Such conventional equipment, however, could not allow to go much below the 10% emission percentage of sulphur content in copper ore.

Copper ore processing is done in two steps. First, the extracted copper ore is concentrated, and second the concentrate is refined or smeltered to obtain pure copper in quantities ranging from 10% to 15% of the weight copper concentrate.

An analysis published by the Financial Times (October 15, 1979) indicated that the longer term outlook for copper was good. With an expected total consumption in the western world of 9.1 million tons (compared to 7 million tons estimated for 1979), the price was expected to reach US$1.5 per pound by the mid 1980's. Variations in copper prices were explained by the abrupt production changes in Zaire and Zambia, the dramatic decline in world stocks, and the uncertainty surrounding a possible recession in the U. S..

4. THE NEW PROCESS

In 1973 a research from MPC conducted laboratory experiments applying a known chemical reaction to the reduction of the sulphur dioxide emitted in the smeltering of copper ore. In yhis process, a pelletized mixture of copper ore concentrate and lime was being roasted and then leached

with sulphuric acid to form a copper sulphate solution from which copper would be recovered by conventional chemical processes. The yield of pure copper was expected to be comparable to the one obtained from conventional smelters.

This process was thought to offer several advantages. Firstly, by controling the mix of lime and copper concentrate it was possible to control the temperature of the reaction so as to obtain a more stable output of by-products. Secondly, the lime acted as a natural binder making it possible to have a thicker roasting bed and thus probably increase plant capacity by about 25%. Thirdly, the reaction would produce all the sulphuric acid needed to leach the roast mixture, plus a certain quantity as a by-product. Fourthly, the gold and silver recovery from further processing of by-products was expected to remain equivalent to what it was in the conventional smeltering process. And fifthly, it was found that the output of calcium sulphate as a by-product could be improved, compared with the conventional process. This might turn out to be useful since the calcium sulphate could be used to produce gypsum boards, a fast developing supply for the construction industry.

Patent applications for this new process were filed in Australia, Canada, the U. S. A., E. E. C. countries, and several copper producing countries in the Third World, including Africana. MPC evaluated that the basic research and laboratory work involved in developing the new process represented an investment of US$500,000. In addition, tests in a small size pilot plant had represented an additional development cost of US$1,300,000.

In mid-1978, MPC introduced the new process in a commercial-scale plant of 60,000 tons/year. During the first six months of operation, the following results were obtained:

- Increase in plant capacity: 20%
- Proportion of sulphur let out in the atmosphere: 6%

- Sulphuric acid; an additional 2,000 tons to 3,000 tons a year, selling at US$52 per ton in 1978
- Calcium sulphate; an additional 2,000 tons to 3,000 tons a year, selling at US$18 per ton
- Gold and silver; equivalent to the conventional process
- Increased electricity consumption: 10% (an 80,000 tons conventional smelter used Kwh 15 million a year at 10 cents per Kwh)
- 10% extra marginal profit on extra production.

Some uncertainties remained with the price of some of these inputs and outputs. For example, it was known that giant Russian sulphuric acid plants would reach full capacity by 1981; at that time prices for sulphuric acid would probably go down to about US$40 and stabilize at that level. Also, it was expected that the cost of electricity would generally follow future increases in the price of oil.

At the end of 1978, the head of the Technology Supply Division of MPC was eager to sell this newly developed technology in the various copper producing countries. His preference was toward licensing agreements, although he also knew that joint ventures would probably also have to be considered.

MPC having been involved in setting up the Africana copper processing plants back in the early 1970's, he saw the NMC as a potential client and developed some estimates of the costs that would be involved in equipping their 80,000 tons smelter installed back in 1972:

- Cost of engineering and adaptation of the equipment	US$2,000,000		
- Modification of the existing processing equipment above the engineering	950,000		
- Technical assistance: per year (including personnel training)	50,000	to	
	100,000		
- Downtime needed to proceed with the plant modifications (smelters operate 350 days/year, on average)	10	days	

For information, the cost of building of a new 80,000 T. smelter is estimated (beginning 1980) at US$20,000,000.

The average life of the smelter is between 7 and 9 years.

EXHIBIT I

METAL PRODUCTS CORPORATION

Key Financial Data

(US$000)	1978	1977
Sales	752,000	711,000
Profit after Taxes	91,100	85,700
Cash Flow	100,200	84,000
Capital Expenditures	60,000	25,000
Dividends	19,500	17,000

EXHIBIT II

BASIC ECONOMIC INDICATORS-
AFRICANA

A. Balance of payment situation (1974-1978)
(in million US$) Balance +

1974	1975	1976	1977	1978
-110	+350	-420	-280	-750

B. Balance of trade (1974-1978 in million US$

1974		1975		1976		1977		1978	
Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp	Exp	Imp
210	280	360	500	510	390	600	900	680	1200

C. Export Structure (1974-1978) in %

PRODUCTS	1974	1975	1976	1977	1978
Agricultur-al products	70	68	67	62	61
Minerals (non processed)	14	14	14	15	15
Processed mi-nerals and components	8	8	10	11	12
Manufactured goods	6	7	7	8	9
Others	3	3	2	2	3
T o t a l s	100	100	100	100	100

D. Average domestic inflation rates (1974-1978) in %

	1974	1975	1976	1977	1978
Inflation rate	8	13	18	15	12

E. External debt situation (1975-1978) in million US$

	1975	1976	1977	1978
Amount of debt outstanding	420	650	540	890

The sources of international credit:

The country received an IMF loan in 1976 totalling to US$350 million on normal terms to partially offset worsening balance of payment situation.

Bilateral loans account for most of the credits currently taken.

Private credits from banks both in W. Europe and U. S. A. account for ca 20% of all credits.

Small amounts result also from publicly issued bonds in 1975 and 1976.

Debt Service (million of US$)

1975	1976	1977	1978
45	70	65	100

Terms

	1975	1976	1977	1978
Average insterests %	7.0	8.2	7.5	8.0
Average maturity years	14.0	12.0	15.0	14.0

EXHIBIT III

NATIONAL MINING CORPORATION

Key Financial Data

(US$000)	1978	1977
Sales	206,000	190,000
Profit after Taxes	8,000	4,500
Cash Flow	6,200	4,400
Capital Expenditures	9,600	8,100

EXHIBIT IV

A. World Copper Production (thousand metric tons)

	Mine Production*	Smelter Production**	Refined Production***
1974	7,669.0	7,888.0	8,902.1
1975	7,348.1	7,534.1	8,386.9
1976	7,872.8	7,965.8	8,824.4
1977	7,976.7	8,125.8	9,093.0
1978	7,794.4	7,967.4	9,113.9
1979****	7,374.0	7,675.2	8,930.4

*These figures show the recoverable copper content of ores and concentrates produced.

**The basis of these figures is metal produced in the form of blister and anodes from ores, concentrates, other primary materials and secondary blister produced from scrap. The figures are in terms of recoverable copper content wherever possible.

***These figures indicate total production of refined copper, whether electrolytic or fire refined. They include production from blister, anodes and other primary materials, together with secondary production from scrap and other similar materials. They do not include copper recovered from secondary materials by simple smelting.

****These figures are based on the (lower than average) data for the first quarter.

Source: World Metal Statistics, World Bureau of Metal Statistics, July 1979, pp. 37-39.

B. Copper wirebar average annual prices at the London Metal Exchange (USc/lb)

		USc/lb	Average Exchange Rate for £1.00 in US$
1961		28.81	
1965		58.79	
1970		63.83	
1971		49.31	2.446
1972		48.55	2.502
1973		80.86	2.452
1974		93.13	2.34
1975		56.08	2.22
1976		63.92	1.805
1977		59.46	1.745
1978		61.90	1.922
1979		85.50 (Until October 15)	
	January	75	2.0037
	February	85	2.0036
	March	92	2.0038
	April		2.0072
	May	88.7	2.0579
	June	83.5	2.1142
	July	81.0	2.2598
	August	87.6	2.2450 (August 15)
	September	92.8	2.18 (September 15)
	October	93.0	2.1575 (October 15)
1980			
	March	98.0	
	April	99.0	

Sources: CIPEC, Quarterly Review, January-March 1979, p. 8 and Financial Times, October 18, 1979 p. 36, May 28, 1980, p. 35.