Public Disclosure Authorized

Public Disclosure Authorized

Document of

The World Bank

FILE COPY

FOR OFFICIAL USE ONLY

Report No. 3393-MOR

STAFF APPRAISAL REPORT

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

February 26, 1982

Industrial Projects Department

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

CURRENCY EQUIVALENTS

Current Unit	=	Dirhams (DH)
US$1.00	=	DH 5.2
DH 1.00	=	US$0.19

WEIGHTS AND MEASURES

1 meter (m)	=	3.281 feet (ft)
1 kilometer (km)	=	0.622 miles
1 kilogram (kg)	=	2.205 pounds
1 metric ton (t)	=	1.1 short ton (st)
1 metric ton per year (tpy)	=	1.1 short ton per year (stpy)

PRINCIPAL ABBREVIATIONS AND ACRONYMS

BNDE	=	Banque Nationale pour le Developpement Economique
BMCE	=	Banque Marocaine du Commerce Exterieur
BRPM	=	Bureau de Recherches et de Participations Minieres
CADETAF	=	Centrale d'Achat et de Developpement de la Region Miniere du Tafilalet et de Figuig
CIF	=	Cost, Insurance and Freight
CPEs	=	Centrally Planned Economies
DOM	=	Directorate of Mines
ENIM	=	Ecole Nationale de l'Industrie Minerale
EPP	=	European Producer Price
GDP	=	Gross Domestic Product
LDC	=	Less Developed Countries
LME	=	London Metal Exchange
MEM	=	Ministry of Energy and Mines
MOF	=	Ministry of Finance
OCP	=	Office Cherifien des Phosphates
ONT	=	Office National des Transports
PZ	=	Plomb de Zellidja
USBM	=	United States Bureau of Mines

CADETAF FISCAL YEAR

January 1 - December 31

MOROCCO

STAFF APPRAISAL REPORT

PILOT PROJECT FOR SMALL-SCALE MINING

TABLE OF CONTENTS

This report was prepared by Messrs. J.O. Franz, J.E. Strongman, C.N. Ahmad and Ms. J. Wright of the Industrial Projects Department.

This document has a restricted distribution and may be used by recipients only in the performance of their official duties. Its contents may not otherwise be disclosed without World Bank authorization.

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

ANNEXES

MAP

TABLE OF CONTENTS (Cont'd)

SELECTED DOCUMENTS AND DATA AVAILABLE IN THE PROJECT FILE

I. INTRODUCTION

1.01 The Government of Morocco has requested a US$9.5 million Bank loan to finance a pilot project (the Project) for small scale mining in the Tafilalet and Figuig region in southeastern Morocco. The region lacks basic infrastructure and, outside the oases, has little agricultural or other economic potential, except for mining. There are an estimated 15,000 artisanal miners who derive their income principally from mining lead and zinc ore in about 1,600 mines with small and irregular--but very rich--ore deposits. A proportion of the mine workers live nomadic lives, working in a succession of mines and living in tents close to active mining sites. Productivity is low due to the rudimentary mining methods used and the average per capita income of miners in 1981 was US$250, more than 50% below the agricultural minimum wage.

1.02 The proposed Bank loan of US$9.5 million will finance two mobile concentrators, a mobile crushing and grinding unit, basic mining equipment packages for some 40 selected mines (including compressors, jackhammers, hoists, pumps, mine cars and rails), as well as geological studies, training and equipment for workshops and laboratories. The Bank loan would be made to the Government of Morocco and would be on-lent to the Centrale d'Achat et de Developpement de la Region Miniere du Tafilalet et de Figuig (CADETAF). CADETAF is a mining extension service entity responsible for providing various forms of assistance to the miners. It also has a purchasing and marketing monopoly for the artisanal production. The total project cost is estimated at US$15.2 million. Incremental project production of lead concentrate is estimated at about 14,500 tpy, and of zinc concentrate at about 7,500 tpy, about one and-a-half times the present production rate.

1.03 The Project has been designed on a pilot scale that will test the miners' reactions to its various components and operating procedures to determine the most appropriate form of assistance. The miners make independent decisions regarding their mine production according to ore prices and intermittent agricultural as well as other non-mining activities. The success of the Project depends to a large degree on whether or not sufficient ore will be produced to maintain a consistently high level of utilization of the concentrators and mechanized mining equipment. Being only a first step, the Project should, if successful, lead to a subsequent, larger development of the mining sector and associated activities in the region.

1.04 The Project was appraised in December 1980 by a mission consisting of Messrs. J. Franz (Chief) and N. Ahmad of the Industrial Projects Department, and A. Khilkoff-Choubersky (Consultant). A short follow-up mission took place in end-March 1981. A glossary of mining terms is given in Annex 1.

II. THE MINING SECTOR

A. Structure of the Moroccan Mining Sector

2.01 Morocco has a long mining tradition, possessing the world's largest reserves of phosphate rock, as well as modest reserves of iron, lead, zinc, manganese, cobalt and copper. While the mining sector's contribution to GDP has decreased from a peak of 13.0% in 1974 to 4.8% in 1979, mostly due to a decline in phosphate prices, its importance for the balance of payments is very significant. Mining exports in 1979 accounted for about 35% of foreign exchange earnings. Phosphate rock is by far the most important mineral, accounting for about 90% of export tonnage and 74% of the sector's foreign exchange earnings in 1979. Mining employment consists of about 40,000 workers in industrial mines, plus some 15,000 artisanal miners, representing a little over 1% of the country's total labor force.

Morocco--Mineral Sector Contribution
(% of)

	1974	1975	1976	1977	1978	1979
Gross Domestic Product (GDP)	12.8	9.1	5.5	5.3	4.7	4.8
Foreign Exchange Earnings	61.0	59.5	45.0	43.5	39.5	35.0
of which Phosphates	90.3	93.0	88.2	83.8	83.0	73.9

Source: Morocco--Basic Economic Report, 1980, IBRD 3289-MOR.

2.02 Lead is the most important of the non-phosphate minerals, accounting for 32% of the non-phosphate export value, followed by manganese (12%), cobalt (9%), iron ore (8%), and zinc (4%). The non-phosphate production is mostly exported in concentrate form, the major exception being lead. Since 1975, the domestic lead smelter Plomb de Zellidja (PZ) in Oued el Heimr (Map) has processed an increasing portion of Morocco's lead ore production (1978:28%). This share will increase further as PZ's smelting capacity was expanded in 1980 from 35,000 tpy of metal to 50,000 tpy.

Morocco--Mineral Production and Exports
Annual Average 1974-78

	Production		Exports		Export Value	
	('000 tpy)	(%)	('000 tpy)	(%)	(US$ million)	(%)
Phosphate Rock	17,264	96.1	15,882	96.2	692.0	90.9
Iron Ore	378	2.1	329	2.0	7.5	1.0
Lead Concentrate	134	0.7	107	0.6	31.2	4.1
Manganese (Chemical Grade)	130	0.7	128	0.8	11.8	1.5
Zinc Concentrate	25	0.2	26	0.2	3.6	0.5
Cobalt Concentrate	10	0.1	10	0.1	8.6	1.1
Copper Concentrate	15	0.1	16	0.1	7.0	0.9
Total	17,956	100.0	16,498	100.0	761.7	100.0

Source: Morocco--Basic Economic Report, 1980, IBRD 3289-MOR.

2.03 The phosphate subsector is managed by the Office Cherifien des Phosphates (OCP), a state-owned enterprise which has full responsibility for mining, exporting and--through its subsidiaries--processing rock phosphate into intermediate and finished fertilizer. The other, non-phosphate, mining activities are under the administrative aegis of the Ministry of Energy and Mines (MEM), which provides general guidance and supervision through the Directorate of Mines (DOM). The Bureau de Recherches et de Participation Minieres (BRPM) is the state-owned enterprise responsible for government participation in mining activities other than phosphate and was also responsible for oil and gas exploration and production until 1981. BRPM and its (over 30) subsidiaries undertake mine exploration, development, and operations. These companies, in which BRPM's participation, valued at US$90 million, ranges from 22% to 100%, produce a number of mineral products including iron ore, manganese ore, copper, lead, cobalt and zinc concentrates, silver, salt and barites. BRPM is also responsible for marketing these products as well as CADETAF's concentrates. BRPM employs 1,550 people on its permanent staff, including 191 engineers, while companies in which BRPM holds an interest, have some 13,100 employees.

B. The Artisanal Mining Sector

2.04 Artisanal production of lead and zinc concentrates from small and irregular--but very rich--ore deposits (up to 85% ore grade) takes place in the Tafilalet and Figuig region (Map). The term "artisanal mining" is the mining sector equivalent of "cottage industry" used in industry. Specifically it refers to mining undertaken by independent individuals or by small, informal groups, using only hand tools, with very low production rates--generally no more than a few hundred tons per year by any particular work group. Until 1938, mineral development was forbidden on the disputed southern Atlas mountains for security reasons. Early efforts at mineral exploitation under the French protectorate were stopped by World War II. Reserves in the Tafilalet region were opened to industrial mining companies in 1952 and exploited by the Societe Miniere de l'Atlas Marocain and the Societe Miniere de l'Adrar. Both private firms closed down operations in 1958 as a result of high energy and ore transport costs, difficulties in recruiting technicians to work in the remote regions and gradual depletion of deposits. Local miners, many of whom had worked for these two companies, rapidly initiated unauthorized artisanal activities. The ore thus mined was sold (illegally) to middlemen operating out of Erfoud. To protect the miners from exploitation and to encourage mining of the numerous known lead and zinc outcrops, legislation was introduced in 1960 leading to the creation of CADETAF and an artisanal mining concession comprising a contiguous area of about 48,000 km^2 in the Errachidia, Figuig and Ouarzazate provinces.

2.05 The deposits usually occur as fracture filling or veins in carbonate rock. They are narrow, often short and unpredictable and at times they continue below the water table. In most cases, they could not support an industrial operation. Therefore, artisanal mining is not only appropriate, but the only feasible method of exploiting these deposits.

2.06 In total, some 500 occurrences of lead and some 80 occurrences of zinc are known. With few exceptions, these have never been explored systematically. For 217 lead outcrops and veins known with sufficient certainty from stopes, downward development and past production, CADETAF has made a conservative theoretical reserve estimate, given below:

Lead Ore Reserves--CADETAF Estimate of 217 Occurrences

	Ore Reserves ('000 tons)	Average Grade (%)	Lead Reserves ('000 tons metal content)
Proven	653	10.98	72
Probable	662	7.92	52
Total	1,315	9.45	124

The lead reserves thus estimated are equivalent to about 15 times CADETAF's expected annual production including the Project and, thus, are large enough to support the Project; however, actual lead reserves are certainly much larger. New outcroppings continue to be discovered, while extensions of existing mines have led to the discovery of further veins.

2.07 No attempt has been made to systematically estimate the evidently large zinc reserves. Most zinc deposits are irregular cavity-fillings, requiring systematic exploration by drilling to determine shape, size and content before meaningful estimates can be established. Exploration of some zinc deposits will be carried out under the Project (para 5.25).

2.08 The level of artisanal production is presently limited by the lack of ore concentration facilities that can process low-grade ore into a marketable concentrate. In order to be marketable without further processing, the lead and zinc ores mined by the artisans must have a metal content of at least 30% and 35% respectively. By comparison, ore grades of 2% to 9% are viable for development in other mines worldwide. Furthermore, the lack of ore beneficiation facilities results in undesirable exploitation practices, since the miners tend to mine merely the richest parts of a vein, thus despoiling --often irreparably--the deposit.

2.09 Low productivity, due to an almost complete absence of basic mechanized mining equipment, is another factor which limits production. Mining and concentrating methods used by the artisans are manual with only rudimentary equipment such as manual mining hammers, hand winches, wheelbarrows, manual jigs and sluice boxes. Over 50% of the time is now taken up for tramming and hoisting the ore. Also, the lack of mechanized implements makes the work in the mines physically demanding since mining reaches depths of 100 meters below surface. Miners generally work for four weeks, then rest for one week before continuing work in the mine.

2.10 In 1979, artisanal mining accounted for 11,260 tons of lead concentrate and 5,517 tons of zinc concentrate, equivalent to 11% of Morocco's lead concentrate exports and 21% of its zinc concentrate exports. Among the some 15,000 miners, an estimated 11,000, or 73%, are thought to be full-time

miners having negligible or no side activities. For an estimated 3,000, or 20%, mining is a seasonal activity, interrupted by harvest and other agricultural work, not only in the region, but also in other parts of the country. The remaining 1,000, or 7%, pursue mining as a temporary activity, for example when prices are high. About 50% of the miners work their mines on a family basis. Most of the other 50% have organized themselves along tribal lines in several hundred informal miners' associations, having between 5 and 60 members. In addition, there are three formal mining cooperatives with together 169 members (Skendis-50, Hawanit-32, Tamslamt-87). The miners being proudly independent, all groupings are based on partnerships and hired labor is non-existent in the mines. Production varies from 50 kg of concentrate per month for some of the miners who work on an individual basis to 40 tons per month for the largest associations and cooperatives.

2.11 While the Government has granted general mining rights to the local population, it does not administer individual mining rights. The latter is in the hands of the respective local "Djemaa," or Council of Artisans, which sanction individual mining rights along procedures that vary among different sub-regions. This system is not very formal, but has functioned well in the past and few disputes have occurred. In new mining areas within the mining region, which are not under the jurisdiction of the traditional authorities, CADETAF administers the granting of mining rights and issues permits to miners. This applies equally in cases where CADETAF itself has helped develop the mine. During the process, CADETAF cooperates closely with the local representative of DOM and the local authorities to ensure that there are no conflicting claims. The system is expected to work well under the project and does not require any change.

III. CADETAF

A. Background

3.01 CADETAF was created in 1960 as a non-profit public agency and placed under the authority of MEM whose Directorate of Mines (DOM) exercises the administrative control over CADETAF. Until 1978, CADETAF's head office was in Rabat and its management consisted of BRPM staff who combined their CADETAF responsibilities with other functions. In early 1979, CADETAF's head office was relocated to Errachidia which is in the center of the mining region with a small liaison office remaining at Rabat. At the same time, the management was replaced by a new team working for CADETAF on a full-time basis and being employed by CADETAF rather than BRPM. Both actions have been instrumental in revitalizing CADETAF and the artisanal mining sector and came at a time when metal prices were strengthening after a period of very low prices during 1975-78.

B. Objectives

3.02 CADETAF is a mining extension service, (similar to an agricultural extension service), which provides a broad package of support services for the mining operations and social needs of the miners. CADETAF's specific responsibilities include:

(a) purchase and marketing of ore;

(b) provision of mining inputs and technical assistance to miners; and

(c) provision of social services, such as medical facilities and medical and accident insurance.

3.03 The assistance to the miners, which may vary from place to place, presently can take one or more of the following forms: (i) provision of explosives; (ii) provision of hand tools, such as hammers, shovels, wheelbarrows, sacks and other artisanal mining implements; (iii) transportation of ore from the mine to the collection centers; (iv) pumping in areas where the mineralization extends below the water table; (v) provision of basic medical services; (vi) geological surveys, geometric bearings and other forms of technical assistance; (vii) upgrading of zinc ore in calcination ovens; and (viii) construction and maintenance of mining roads.

C. Organization, Staffing and Management

3.04 Operating out of Errachidia, CADETAF presently has seven ore collection centers (Map) which serve as concentrate purchase centers and as distribution centers for assistance and materials. The centers usually have an office building, a small warehouse for mining inputs, and scales to weigh ore purchases which are stocked in the open yard (surrounded by a wall). Three of the centers also have a shop for equipment repairs and a nurse for medical assistance. Geological services, carpentry and masonry work are provided by the center in Errachidia. CADETAF also operates self-constructed vertical calcination kilns at Tizi N'Firest and Beni Tadjit for beneficiation of zinc ores with a total capacity of about 20,000 tpy zinc concentrates. It has a branch office in Rabat and an ore storage facility at the mining port of Kenitra-Mehdiya, 30 km north of Rabat. An organization chart is shown on the following page.

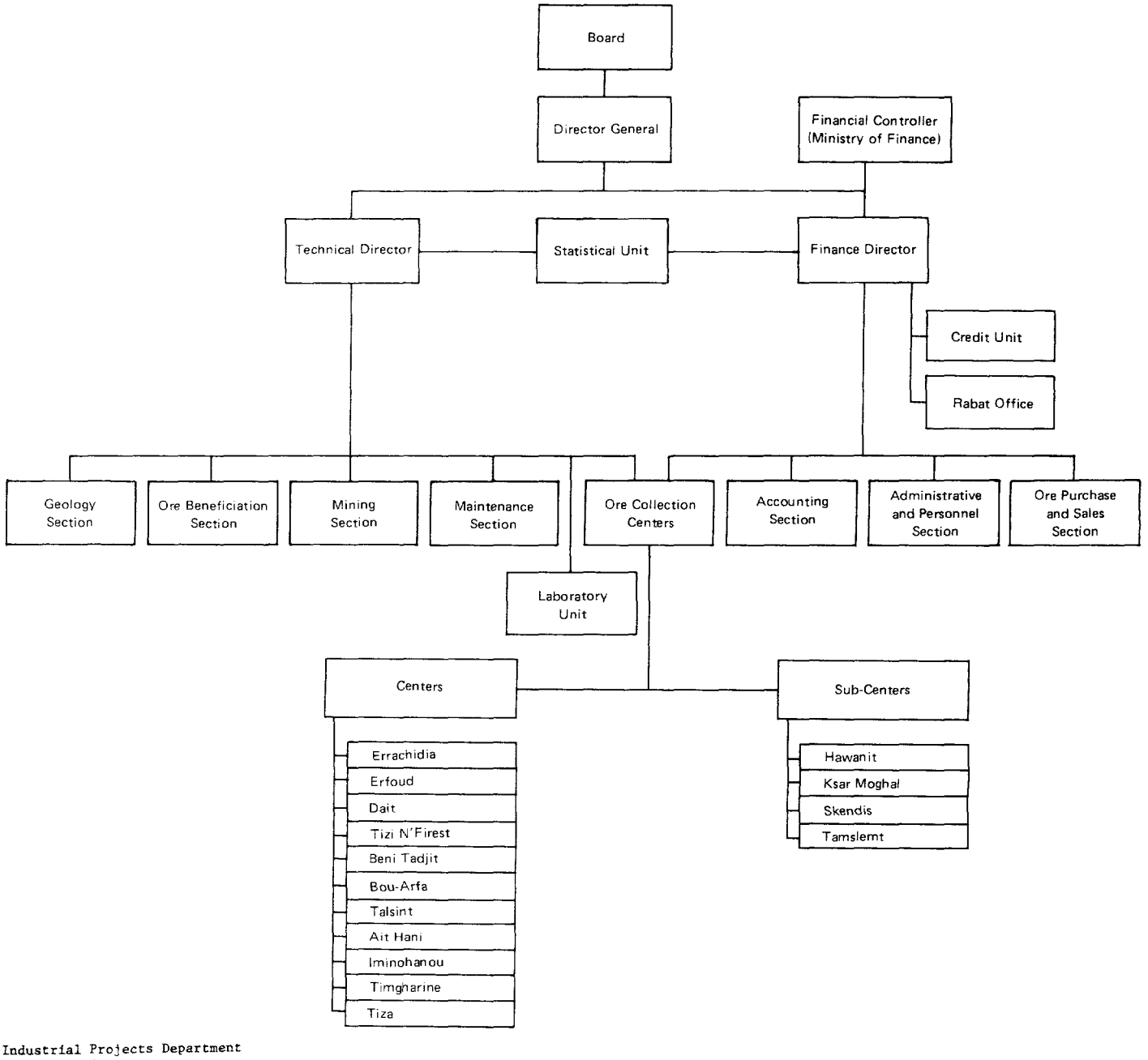
3.05 CADETAF's operations are supervised by a 19 member Administrative Board, chaired by a representative of MEM (1), and consisting of representatives of other concerned ministries (5) 1/; DOM (1); BRPM (1); the Governors of the Provinces of Errachidia, Ouarzazate and Figuig (3); and miners' representatives (8). The latter are selected by the Governors of each of the three provinces on a representative basis, and appointed for a period of three years. The Board is not involved in day-to-day management, but sets the guidelines for CADETAF's activities. In particular, the Board must consent to: (i) the annual investment and operating budget; (ii) the price of mining inputs sold to miners; (iii) conditions and terms of equipment loans to miners; (iv) employment and salary guidelines for CADETAF's staff; (v) all contracts with third parties; (vi) application for and acceptance of loans from banks, as well as advances and subsidies from Government; and (vii) CADETAF's financial statements.

3.06 CADETAF is headed by a Director General, responsible for overall management. Its key staff are an ore purchase officer, responsible also for providing mining inputs, one mining engineer and one geologist, jointly

---

1/ Namely Interior; Finance; Public Works; Labor; and Commerce.

MOROCCO
PILOT PROJECT FOR SMALL-SCALE MINING
FUTURE ORGANIZATIONAL STRUCTURE OF CADETAF



Industrial Projects Department
February 1982

World Bank-22563

responsible for all forms of technical assistance, one financial and administrative officer, and the heads of the ore collection centers. CADETAF's permanent staff totals 250 plus 25 occasional laborers; 40 staff work at the head office, 10 in Rabat and Kenitra, and 200 at the ore collection centers. Salaries for laborers and unskilled workers are paid according to local standards or minimum wage regulations. Salaries for medium and higher level staff, who have to be recruited from other parts of the country, contain bonuses of up to 50% over normal civil service salaries in order to attract qualified staff to Errachidia. Despite the remote location, CADETAF has been able to attract suitable staff, and recruitment of adequately qualified staff is not expected to be a problem in the future.

3.07 CADETAF's new management, appointed in 1979 after relocation to Errachidia, has succeeded in reviving assistance to the miners after the 1975-78 crisis, while at the same time reducing CADETAF's operating expenses. CADETAF's key personnel is competent and motivated, but needs to be strengthened both in number and available skills to implement the Project (para. 5.38). The distribution of functions between head office and collection centers is adequate; within the head office, some organizational changes are required to reflect the widened scope of future activities (paras. 5.38-5.41).

3.08 CADETAF's day-to-day financial management, including the preparation and presentation of its financial statements, is supervised by a local controller from the Ministry of Finance (MOF). His approval is required for all expenditures above US$50, except for ore purchases where there is no limit, and salaries, which are budgeted.

D. Past Operations, Performance and Operating Procedures

1. Ore Purchase

3.09 The artisanal production of lead and zinc ores is purchased by CADETAF at ore collection centers. The lead ores then are upgraded, through further manual crushing and sorting, into marketable concentrates with about 60% metal content. The zinc ores are processed in calcination ovens, which yield a concentrate of about 50% metal content. After upgrading, the Office National des Transports (ONT) transports the concentrate by trucks to Kenitra-Mehdiya (600 km), the ore port from where it is exported in 1,000 to 2,500-ton lots to Europe.

3.10 At present, the miners receive a fixed monthly price for their ore, which is calculated by DOM by deducting certain specified charges from the previous months's average London Metal Exchange (LME) price for lead, and the previous month's European Producer Price (EPP) for zinc. The deductions comprise land transportation, port handling, shipping and smelting costs; taxes (zinc: 0.5% on minehead price; lead: 5% on minehead price if the LME price is below or equal to US$870 per ton and 10% if above); transport losses (1.5% on minehead price); and CADETAF's service margin (25% on minehead price for all administrative costs, investments and technical assistance). Historically, the deductions have averaged 42% of the net metal value, leaving 58% for the miners.

3.11 CADETAF's ore purchases are subject to considerable annual fluctuations associated with movements in international lead and zinc prices. The miners tend to increase production when prices are high and reduce if prices fall, as shown in the following table:

CADETAF--Annual Concentrate Purchases

Year	Lead		Zinc	
	Quantity (tons)	Price a/ (US$ per ton)	Quantity (tons)	Price a/ (US$ per ton)
1962	6,268	154	-	185
1963	5,795	174	-	212
1964	6,978	278	7,769	324
1965	6,870	318	5,698	311
1966	10,937	262	2,343	282
1967	13,816	229	1,730	273
1968	15,664	240	1,299	262
1969	18,409	289	2,010	287
1970	16,296	304	2,028	295
1971	26,878	254	3,709	309
1972	21,030	302	16,703	377
1973	22,353	430	12,451	851
1974	22,337	593	15,943	1,239
1975	13,260	417	12,250	743
1976	6,232	445	9,130	712
1977	11,443	617	5,627	591
1978	8,071	661	3,543	593
1979	11,260	1,203	5,517	742
1980	9,500	880	6,000	840
1981 b/	9,000	730	6,000	860

a/ LME settlement price, in current terms.
b/ Estimated.

3.12 According to CADETAF's management, the decline in ore purchases during price slumps is accentuated by a tendency of miners to hoard part of their production, hoping for prices to improve. Further, CADETAF's purchases are also shaved during periods of high prices when miners are tempted to sell (illegally) part of their production to other private mining concerns which are willing to pay higher prices than CADETAF. Since such other internal markets exist for high grade ores, the incentive to sell to these markets would be increased by any measures to stabilize prices. Thus a scheme to buffer prices would face severe problems, as it would be very difficult to keep control of the artisanal production which would be essential to the operation of a stabilization fund. Furthermore, the fact that artisanal mining is often not a full-time employment and that the work force is subject to considerable fluctuations argues against the possible effectiveness of such a scheme.

3.13 The ore pricing formula implies that CADETAF's revenues from the 25% withholding margin vary with changing metal prices and artisanal production levels. Further, CADETAF carries a price risk associated with the shipping period of four to six months for the ore to reach the port of destination. The smelter (abroad) pays CADETAF the price prevailing on the arrival date, whereas, as noted, the formula used to calculate CADETAF's payment to the miners is based on prices prevailing in the month prior to the ore purchase. Thus, if prices decline during the shipping period, CADETAF's margin is reduced, and if prices rise, it increases.

2. Services and Technical Assistance

3.14 CADETAF provides explosives and other supplies such as picks, shovels, wheelbarrows, manual drill bits, hammers and ore sacks, which are sold to the miners at cost on a cash and carry basis. CADETAF has first-aid posts at each collection center and three doctors are on contract. They make weekly rounds and are available to miners and their families. CADETAF insures miners for minor accidents with the state Caisse de Secours, paid for through CADETAF's service margin. For more serious job-related illness and accidents, miners are protected by an insurance policy with the private SIDARSA Insurance of Essarda and Casablanca. Apparently, so far this insurance has only had to be used once.

3.15 CADETAF provides technical assistance which has centered around: (i) construction of ore collection centers; (ii) construction and operation of two zinc calcination facilities at Tizi N'Firest and Beni Tadjit; (iii) geological surveys and drillings, mostly to locate the continuation of existing veins and fracture fillings already exploited, but also to identify new deposits; (iv) boring of shafts (vertical) and galleries (horizontal) for exploration and production; (v) de-watering about 60 small mines in the Erfoud sub-region, where underground water would otherwise make production impossible; and (vi) maintenance and repair work of mining roads.

3.16 The various forms of technical assistance are funded out of CADETAF's 25% withholding margin and thus provided free of charge. CADETAF had to reduce its technical assistance because of low revenues during the period of low metals prices from 1975-78. Geological drilling as well as shaft boring were discontinued in 1978 and were only recommenced in 1981, following the recovery of revenues in 1979 and 1980. Shown below are past revenues and technical assistance of CADETAF:

CADETAF--Annual Revenues and Technical Assistance Expenditures
(DH'000)

Year	CADETAF Revenues from Withholding Margin	Technical Assistance Expenditures
1973	2,948	1,522
1974	5,594	2,594
1975	2,829	3,034
1976	1,574	2,517
1977	2,212	1,846
1978	1,781	1,183
1979	4,269	2,003
1980	3,128	1,900
1981 a/	2,625	1,500

a/ Estimated.

3.17 Despite the limitations in scope due to equipment, manpower and financial constraints, CADETAF's technical assistance has been effective in supporting artisanal production. Furthermore, CADETAF has been able to allocate its assistance reasonably equitably among the sub-regions and among lead and zinc producers.

3. Financial Situation

3.18 The financial performance of CADETAF over the last 8-year period is summarized below and shown in detail in Annexes 3-1 to 3-3.

Summary of CADETAF's Financial Performance 1974-81
(DH '000)

	1974	1975	1976	1977	1978	1979	1980	1981 a/
Concentrate Sales (tons)	35,388	31,140	19,504	18,094	13,527	15,777	15,500	15,000
Average Price (DH/ton)	915	616	650	831	949	1,853	1,533	1,390
Concentrate Sales	32,389	19,198	12,678	15,041	12,848	29,241	23,776	20,850
Ore Purchases	22,377	11,317	6,292	8,851	7,127	17,075	12,513	10,500
CADETAF Operating Cost b/	5,237	6,374	4,980	5,495	3,711	4,730	5,257	4,715
Fixed Assets	1,178	1,534	1,380	1,159	672	318	383	363
Current Liabilities	4,356	8,581	9,768	13,726	12,674	12,588	9,226	10,338
Long-Term Debt (Government Advance)	200	200	200	-	2,000	2,000	2,000	2,000
Operating Surplus/(Deficit)	6,396	(2,801)	(2,409)	(13,236)	(3,484)	4,291	(1,062)	2,270
Cumulative Reserves/ (Deficit)	14,904	12,208	9,879	(3,262)	(6,841)	(1,815)	(2,822)	(749)
CADETAF Operating Cost in % of Ore Purchases	23.4	56.3	79.1	62.1	52.1	27.7	42.0	44.9

a/ Estimated.
b/ Includes technical assistance to miners.

3.19 CADETAF's capital consists of an interest-free advance from the Government of DH 2 million (US$0.385 million) which, as confirmed by Government, will not be repayable until the completion of the Project or at the latest until December 31, 1986. As stated (para. 3.10) CADETAF derives its revenues from the 25% withholding margin on the minehead price of the ore. The ore-pricing formula stipulates that 60% of the witholding margin is to cover CADETAF's administrative and investment costs and 40% is to finance assistance to the miners. In practice, the two categories cannot be kept entirely separate because personnel and material are often employed for both categories at the same time. CADETAF, therefore, in its financial statements, accounts for the totality of its operating expenses. However, part of the technical assistance is shown under self-constructed assets, which are fully depreciated in the same year. Since CADETAF's revenues from its fixed withholding margin fluctuate with metal prices and artisanal production, its operating expenses in percentage of ore purchases have varied between 23.4% and 79.1% between 1974 and 1981. If total expenditures are above 25% of ore purchases, CADETAF usually suffers a loss (except when prices rise between ore purchase and sale--para. 3.13), which it must finance either by drawing on reserves or by increasing its current liabilities.

3.20 Up to 1974, CADETAF benefited from favorable prices and increasing artisanal production, enabling it to reimburse the initial US$0.19 million Government advance and accumulate reserves of about US$2.87 million at the end of 1974. In 1975, a sharp decrease in metal prices depressed artisanal production and subsequently CADETAF's revenues. By 1979, the prolonged duration of unfavorable metal prices had developed to crisis proportions. Other factors aggravated the situation: the distance of CADETAF's management (then in Rabat) from the operational area; inadequacies in the technical control system which permitted the over-valuation of ore purchases; and a management decision to hold on to over-valued ore stocks in the hope of obtaining better prices. The combination of these factors led to large operating losses and negative cash flows, which severely strained CADETAF's liquidity position and resulted in delays in payment to miners for ore.

3.21 To deal with this crisis, an inter-ministerial commission was appointed in July 1978. It recommended separating management from BRPM and making it exclusively responsible for CADETAF; a reform of the accounting system and practices and relocation of the head office from Rabat to Errachidia. These measures were implemented in March 1979, supported by an interest-free Government advance of US$0.385 million (para. 3.19). Sharply higher metal prices in 1979 have also greatly contributed to a recovery of ore production and a strengthening of CADETAF's financial position. Another step was to reduce CADETAF's inflated field staff: personnel costs, in current terms, were 10% lower in 1979 than in 1977. For the first time since 1974, CADETAF, in 1979, had an operating surplus of US$1.23 million. CADETAF's operating result in 1980 was slightly negative at minus US$0.2 million. For 1981, an operating surplus of US$0.44 million is estimated.

3.22 CADETAF's accounts are kept by a qualified bookkeeping staff who prepare annual income statements and balance sheets as well as an operating and investment budget. The accounting system is subject to the financial control of the MOF in lieu of an external audit. Presently lacking are a cost

accounting system and a budgeting system permitting the setting of objectives for individual operating units and to measure performance against objectives. Equally lacking is a system for long-term financial planning which, given CADETAF's environment, would be particularly beneficial. Both areas are addressed under the proposed Project (para. 5.35).

IV. MARKET ASPECTS FOR LEAD AND ZINC

A. Market Conditions and Outlook for Lead

1. Lead Production and Reserves

4.01 World reserves of contained lead are estimated at 115 million tons, of which 82 million tons (71%) are found in the USA, Canada and Australia. In addition, 125 million tons of lead resources are known and the prospect for discovery of additional reserves is highly favorable.

4.02 The supply of lead comes from two sources--mine production (60-70%) and scrap (or secondary) recovery (30-40%). Five countries--USA, Australia, Canada, Mexico and Peru--supplied 62% of world mine production of 2.6 million tons in 1980. Sixty-three percent of production was exported, mainly to Europe and Japan. Morocco accounted for 126,000 tons or 4.6% of world production, of which 90% was exported to Europe and the remainder consumed domestically. Seventy percent of lead mine output is from co-product or by-product production, mainly in combination with zinc but also with silver and copper. Primary lead production is therefore affected to a degree by the market situation for these other metals. During the 1960s, primary lead production increased by 3.8% annually, but stagnated in the 1970s, when it actually declined in the industrialized countries, as follows:

Lead--World Production and Consumption 1960-81 a/
('000 tons)

							Average Annual % Growth Rates	
Mine Production	1960	1965	1970	1975	1980	1981 c/	1960-70	1970-80
Industrialized Countries	961	1,171	1,674	1,604	1,537	1,344	5.7	(0.9)
Developing Countries	826	873	909	908	999	1,013	0.9	1.0
Total	1,787	2,044	2,583	2,512	2,536	2,357	3.8	(0.2)
Consumption b/								
Industrialized Countries	2,008	2,330	2,772	2,504	3,074	2,973	3.3	1.0
Developing Countries	217	368	458	689	855	869	7.8	6.4
Total	2,225	2,698	3,230	3,193	3,929	3,842	3.8	2.0

Source: 1965-75--EPD; 1980-81--Int'l Lead and Zinc Study Group.

a/ Excludes Centrally Planned Economies (CPEs).
b/ Includes consumption of secondary sources.
c/ Estimated.

2. Lead Consumption

4.03 The principal use of lead is for storage batteries which account for nearly 50% of world lead consumption. Gasoline additive, cable sheathing, chemicals and soldering are other important uses. Consumption grew steadily in the 1960s, but growth rates fell off in the 1970s, as shown above, especially in industrialized countries as a result of the slump in automobile manufacturing and the shift to smaller cars with lighter batteries following the oil crisis in 1973-74. However, growth of consumption was also reduced by other factors, including a decline in the use of lead as a gasoline additive and substitution by plastics in a variety of uses, including building construction, electrical cable covering and in cans and containers. Net imports by CPEs averaged 30,000-50,000 tpy in the early 1970s and increased to over 100,000 tpy in 1978 and 1979.

3. Lead Supply/Demand Balance and Price Prospects

4.04 Concern over future lead prices resulted in investment decisions in new mines being delayed by a "wait and see" attitude during the early and mid-1970s. However, investment strengthened in the late 1970s and latest estimates indicate an additional 200,000-300,000 tons (metal content) of new primary capacity under construction or on stream by 1985, including the Aggeneys mine in Namibia starting production in 1981 with an eventual capacity of 90,000 tpy metal content. In addition, there are many known ore bodies in the main producing countries with good lead grades suitable for development.

4.05 The future demand for lead depends largely on the battery sector since the use of lead as a gasoline additive is expected to decline further and no growth is foreseen in other uses such as cable covering or chemicals. Consumption of lead in the traditional battery market is expected to increase steadily in the 1980s. Lead will also likely be required for batteries for electric vehicles in the late 1980s. Recent assessments by various industry and other groups including the forecast prepared by the Economic and Analysis Projections Department and issued in IBRD Report 814/80 indicate a growth rate in the 1980s of between 1.4% and 3.3% annually, as shown below:

Comparison of Different Long-Term World Lead Market Growth Rate Estimates

Date	Source	Period	Average Annual % Growth Rate
1976	USBM (United States)	1973-2000	2.6
1978	AME Pty. Ltd. (Australia)	1978-1990	1.4
1979	Rayner Harwill (England)	1980-2000	2.0-2.5
1980	IBRD Report 814/80	1980-1990	3.3
1980	St. Joe Minerals (United States)	1980-1990	1.8
1980	Chase Econometrics (United States)	1979-1990	2.8

4.06 This report estimates future consumption growth at 2.0% per year based on the following assumptions: (i) 2.0% per year growth in lead requirements for conventional batteries in industrialized countries; (ii) 400,000 tpy lead requirements for electric vehicle batteries in industrialized countries in 1990; (iii) zero growth in lead use by other sectors in industrialized countries; and (iv) 3.75% per year consumption growth from 1980-90 in developing countries. Bringing together the production and demand trends, the outlook for lead supply and demand is that production will exceed demand in the early 1980s, but supply and demand will be in balance in the mid-1980s as shown below:

Lead--World Supply/Demand Balance 1980-90 a/
('000 tons)

	1980 (actual)	1981 (est.)	1985	1990	Average Annual % Growth Rate 1980-90
Mine Production	2,556	2,540	2,760	3,120	2.0
Refined Production	4,257	3,979	4,450	5,070	1.8
Refined Consumption	4,114	3,775	4,410	5,030	2.0
Refined Exports to CPEs	144	63	40	40	(12.0)
Total Refined Demand	4,258	3,838	4,450	5,070	1.8
Surplus/(Deficit)	(1)	141	-	-	-

a/ Excludes CPEs except for refined exports to CPEs from LDCs and industrialized countries.

4.07 Virtually all the world's lead outside North America is traded at the LME price, or prices based on the LME price. The LME price is set on a twice daily basis and is extremely sensitive to changes in supply and demand, with an average change of plus/minus 15% annually from 1955-78. During the late 1970s, a strong price boom occurred when consumption consistently exceeded supplies due to a combination of factors, including: (i) a loss of lead production capacity resulting from lead-zinc mine closures due to depressed zinc prices; and (ii) unexpectedly high battery demand for three years in a row following severe winters in 1977, 1978 and 1979. In 1979 prices averaged US$1,203 per ton but in 1980 a surplus occurred and prices averaged US$906 per ton. 1/

1/ LME lead price has fallen to US$660 per ton in March 1981 as a result of lower than expected consumption during the mild winter of 1980.

Past Lead Prices and Projections a/
(US$ per ton)

	Current Prices	Constant Prices (1980 terms)
1960-64	200	749
1965-69	267	979
1970-74	379	970
1975	417	699
1976	445	732
1977	617	939
1978	661	853
1979	1,203	1,355
1980	906	906
1981	730	700
1982	825	733
1985	1,230	880
1990	1,650	880

a/ LME settlement price, good, soft, pig lead; 1960-81 actual; 1982-90 projected.

4.08 Lead prices are projected to recover from their 1981 low to US$880 per ton in 1980 terms by 1985 and to continue at that level until the end of the decade, as shown above. This is based on estimates of total production costs for refined lead of US$770-880 per ton in 1980 terms for new production units and US$425-850 per ton (in 1980 terms) for existing operations. This is more conservative than the most recent (December 1981) IBRD forecast of US$980 per ton in 1990 (in 1980 terms) and is used in view of the sensitivity of the financial projections to the price assumption. This forecast is a long-term trend price that assumes no major imbalance occurs between supply and demand and that lead producers adjust production to keep supplies broadly in line with demand.

B. Market Conditions and Outlook for Zinc

1. Zinc Production and Reserves

4.09 World reserves of zinc are estimated at 138 million tons (contained metal), of which 73 million tons (52%) are located in Australia, Canada and the USA. The remaining reserves are widely distributed in many countries. In addition, 121 million tons of resources are known. If all other reported zinc deposits, including presently sub-economic resources, were included, the world total would be 5.6 billion tons, including 800 million tons of ocean nodules.

4.10 Australia, Canada and the USA accounted for 47% of the world mine production of zinc of 4.6 million tons in 1980; 63% of the production of these three countries was exported, largely from Canada and Australia to Europe. Morocco accounted for 20,000 tons or 0.3% of world production, all of which was exported to Europe. In addition to world primary production, there are small amounts of zinc scrap recycled, mainly in the USA.

4.11 World zinc production grew strongly in the 1960s, but stagnated in the 1970s due to low demand as follows:

Zinc--World Production and Consumption 1960-81 a/
('000 tons)

							Average Annual % Growth Rates	
Mine Production	1960	1965	1970	1975	1980	1981 c/	1960-70	1970-80
Industrialized Countries	1,666	2,404	3,056	3,023	2,699	2,795	6.3	(1.2)
Developing Countries	963	1,058	1,273	1,526	1,830	1,593	2.8	3.7
Total	2,629	3,462	4,329	4,549	4,529	4,388	5.1	0.5
Consumption b/								
Industrialized Countries	2,191	3,524	3,307	2,779	3,381	3,378	4.2	0.2
Developing Countries	264	373	595	773	1,110	1,125	8.5	6.4
Total	2,455	3,897	3,902	3,552	4,491	4,503	4.7	1.4

a/ Excludes CPEs.
b/ Includes consumption of secondary sources.
c/ Estimated.

4.12 In the mid-1970s, additional new production came on stream, including two large mines at Tara, Ireland, and Rubilas, Spain, resulting in a worldwide capacity utilization of only 80-85% in the late 1970s. Despite the closure of several small mines and older smelters, considerable surplus capacity presently exists, especially in European smelting capacity and in mine capacity of developing countries.

2. Zinc Consumption

4.13 The major uses of zinc are as a protective coating for steel and in die-casting production for automobile components. Construction and transportation account for over 50% of zinc consumption. These two industries are extremely sensitive to business cycles, making zinc consumption very volatile on a year-to-year basis. Other markets include the direct use of zinc as an alloy in brass and bronze castings and the use of zinc oxides for ceramics, paints, chemicals and rubber manufacture. But zinc is prone to substitution because it is relatively heavy and has a low strength-to-weight ratio, and has lost its market share in various uses to other materials such as aluminum and plastics, especially in recent years.

4.14 Zinc consumption grew strongly in the 1960s, but growth rates declined in the 1970s, especially in the industrialized countries where the amount of zinc per automobile declined from 80 lbs in 1968 to 28 lbs in 1979. Over 90% of the industrialized countries' consumption is imported, compared with 22% for developing countries. In the 1960s and early 1970s, CPEs were net importers of zinc concentrates but exporters of zinc metal. However, metal exports declined in the 1970s and in the late 1970s CPEs were net importers of metal as well as concentrates.

3. Zinc Supply/Demand Balance and Price Prospects

4.15 Despite the present excess capacity in the zinc industry, many new projects are planned or under construction, especially in areas with low operating costs such as Australia and Latin America where many producers have costs in the US$660-770 per ton range compared with US$880-1,100 per ton for many older European producers. Industry estimates indicate a growth of as much as 500,000 tons in annual zinc production capacity from 1980-85 mainly in the regions with low production costs.

4.16 Prospects for future zinc consumption growth are limited. Growth possibilities exist in the areas of coatings for steel corrosion protection, in builders' hardware and in foundry uses. However, these markets are likely to provide only modest increases in zinc usage. Also, the development of new uses for zinc through thin-wall and one-sided die-casting only requires limited quantities of zinc. Estimates of future long-term growth rates for zinc consumption vary from 1.5-2.9% per year, except for IBRD Report 814/80, which estimates 5.1% per year, as shown below:

Comparison of Different Long-Term World Zinc Market Growth Rates

Date	Source	Period	Average Annual % Growth Rate
1976	USBM (United States)	1973-2000	2.2
1978	Malenbaum (United States)	1975-2000	2.9
1979	IBRD Report 814/80	1980-1990	5.1
1980	CRU Ltd. (England)	1980-1990	1.5
1980	Chase Econometrics (United States)	1979-1990	3.1

4.17 This report estimates the future growth rate in zinc demand at 2.6% per year from 1980-90. This forecast is based on estimates of annual demand growth for different regions as follows: (i) 1.7% per year in US and Europe; (ii) 3.5% per year in Japan; and (iii) 4.5% per year in developing countries. Based on this estimate of demand and on the preceding assessment of supply the outlook for zinc is that excess production capacity will persist and that capacity utilization will be below 90% in the early-mid 1980s, if inventory build-ups are to be avoided.

Zinc--World Supply/Demand Balance 1980-90 a/
('000 tons)

	1980 (actual)	1981 (est.)	1985	1990	Average Annual % Growth Rate 1980/90
Mine Production	4,642	4,530	5,260	6,090	2.8
Refined Production	4,701	4,454	5,260	6,090	2.6
Refined Consumption	4,636	4,424	5,230	6,060	2.7
Net Exports to CPEs	77	66	30	30	(9.0)
Total Refined Demand	4,713	4,490	5,260	6,090	2.6
Surplus/(Deficit)	(12)	(36)	-	-	-

a/ Excludes CPEs.

4.18 Most zinc is traded in Europe either at the producer price set by European producers or at the LME price. The two prices are closely linked. Like lead, zinc prices are very volatile with an average annual change of plus/minus 18%. Zinc prices went through a peak during the demand boom in 1973-74 and subsequently declined steadily in the face of surplus capacity and high inventories during the mid-1970s. However, production cutbacks by producers resulted in consumption exceeding production in the late-1970s, and prices increased from US$593 per ton in 1978 to US$900 per ton in 1981.

Past Zinc Prices and Projections a/
(US$ per ton)

	Current Prices	Constant Prices (1980 terms)
1960-64	240	899
1965-69	280	1,040
1970-74	611	1,620
1975	743	1,250
1976	712	1,179
1977	591	899
1978	593	760
1979	742	829
1980	783	783
1981	900	859
1982	945	800
1985	1,230	880
1990	1,720	920

a/ LME Settlement Price; 1960-81 actual; 1982-90 projected.

4.19 Production costs for new capacity are estimated at US$800-900 per ton in 1980 terms. In view of the excess capacity, it is expected that zinc prices will remain around the lower level of this range in 1982. However, as capacity utilization rates increase during the 1980s, it is expected that prices will rise, reaching around US$900 per ton in 1985 and US$960 per ton in 1990 (both in 1981 terms), by which time capacity and consumption should be approximately in balance. This is lower than the most recent IBRD forecast of US$1,090 per ton in 1990 (in 1981 terms), which is viewed as an optimistic forecast since it is based on an assessment of increased demand bringing production capacity and consumption back into balance by 1985. The present report represents a more conservative view. As with lead, the forecast is a long-term trend price and prices in any particular year may be US$50-100 per ton above or below the trend depending on the prevailing supply/demand balance.

C. Market and Marketing of CADETAF's Concentrates

4.20 CADETAF's lead and zinc concentrates are marketed by the sales division of BRPM, which, on behalf of CADETAF, concludes annual contracts with 3-4 lead smelters and 1-2 zinc smelters in Western Europe. The contracts, in which the smelter purchases the concentrate--as compared to custom smelting--have terms and conditions that are in line with the industry's practice 1/ and do not contain any unusual clauses. Even with the proposed production increases, CADETAF's production will be very small by market standards. The structure of the European lead and zinc industry is such that even in difficult market conditions, CADETAF can be assured of being able to have its concentrates processed and sold, either to established customers or through traders on the LME. This is true whether the concentrates are shipped to the domestic smelter PZ or to European smelters. Further, CADETAF's concentrates are well accepted because, from a metallurgical point of view, they are simple ores and comparatively easy to smelt.

4.21 The ore is shipped from the port of Kenitra-Mehdiya, about 30 km north of Rabat. Individual shipments for each of the three main ore types, i.e., zinc-calamine, lead-galena both with about 60% metal content, and lead-galena with 40-50% metal content, must average 1,500-2,000 tons, because of vessel availability and customer specifications. The average time required to accumulate the tonnage for a shipment is 3-4 months. Payment for the ore is based on the average LME price (lead) or European Producer Price (EPP) (zinc) of the calendar month following arrival at the port of destination.

1/ Lead: Delivery is CIF European port. The smelter pays 95% of the lead content and 98% of the silver content above 30g/t, and deducts: (i) a lead smelting charge that varies slightly with the lead price; (ii) a fixed refining charge for silver; and (iii) a fixed crushing fee.

Zinc: Delivery is CIF European port. The smelter pays 85% of metal content and deducts: (i) a smelting charge that varies slightly with the zinc price; and (ii) a fixed crushing fee.

Upon presentation of the provisional invoice and freight papers for a particular shipment, CADETAF receives an installment of between 75% and 90%, depending on the customer (smelter). The balance is paid after the invoice is finalized, usually 2-3 months later.

4.22 In 1980, agreement in principle was reached between DOM, CADETAF and the Moroccan lead smelter PZ, that in the future CADETAF will deliver lead concentrates to PZ, which has recently expanded its smelting capacity from 35,000 tpy to 50,000 tpy. Located at Oued el Heimr near Oujda in northeastern Morocco, PZ is owned by several state enterprises (51%) and Zellidja, S.A., a mining company of the Penarroya Group (49%). Delivery to PZ has two important advantages for CADETAF. First, ore shipments can be smaller and more frequent, thus reducing working capital requirements and financial charges. Second, the time lag between ore purchase from miners and payment by the smelter will be reduced from presently 5-6 months to 1-2 months, thus decreasing CADETAF's exposure to metal price fluctuations. Terms and conditions of the 1981 contract between CADETAF and PZ, which has been reviewed by the Bank, are very similar to the existing contracts. However, delivery of lead concentrates to PZ will not limit CADETAF's marketing options. PZ's annual contract offer will compete with those of other customers and CADETAF will select the most advantageous one.

4.23 Recently a technical marketing problem has surfaced which, for the time being, concerns only the zinc concentrate. Due to the lack of mechanical crushing and grinding facilities, CADETAF's concentrates--both lead and zinc--are coarse and of irregular grain size, i.e., 20-100 mm. The remaining crushing and grinding required to feed the ore to a smelter is done by CADETAF's customers for a fee of US$1.00-1.50 per ton. In September 1980, CADETAF's only zinc ore customer closed down and the zinc ore had to be stockpiled for about 6 months until it could be custom-crushed by several mines in the vicinity of CADETAF, since all other prospective zinc customers required that the ore be delivered in grains below 5 mm in size. In order to make CADETAF independent from crushing facilities at the smelter and to facilitate sale of the zinc ore, financing of a crushing and grinding unit is proposed under the Project (para. 5.15).

V. THE PROJECT

A. Project Objectives and Scope

5.01 The proposed pilot Project is designed to: (i) permit the mining and beneficiation of low-grade ores, leading to more rational mining and ending the waste of deposits; (ii) increase production and productivity of the artisanal miners; (iii) establish a sound geological basis for future artisanal mining; and (iv) improve and extend CADETAF's services to the miners. The Project will have to achieve these objectives in an environment where the decision to produce is made by thousands of independent individuals. The Project, therefore, is also designed to test the miners' reaction to various components and

operating procedures, in particular their production behavior, to determine if and how future assistance should be provided. Benefits from the Project will not be limited to those miners with high average incomes. Practically all miners will benefit from CADETAF's enhanced capacity to provide assistance. In addition, about 50% of all miners, or 7,500 are expected to utilize the beneficiation facilities, and another 10% or 1,500 will, in addition, take advantage of mechanized mining equipment. As a result of the Project, the production of lead concentrate is expected to increase from presently 8,000 tpy to about 20,000 tpy and the production of zinc concentrate from presently 6,000 tpy to about 13,000 tpy.

B. Project Description

5.02 The Project, which will be implemented over a four-year period, contains the following components:

(a) a mobile lead concentrator with a capacity to treat about 36,000 tpy of low-grade lead ore during 10 operating months;

(b) a mobile zinc concentrator with a capacity to treat about 29,000 tpy of low-grade zinc ore during 10 operating months;

(c) a crushing and grinding unit at Tizi N'Firest to process coarse, hand-sorted concentrates into a material with a grain size below 5 mm;

(d) mechanized equipment and mine works for 3 cooperatives, 6 miners' associations in the Taouz sub-region and some 30 other miners' associations;

(e) establishment of a training mine as training center for the application of new mining equipment and techniques;

(f) geological studies and works including a metallogenic study, a geochemical survey and drilling and tunnelling to investigate ore reserves;

(g) construction of four additional ore collection centers and four additional sub-centers in areas where miners at present do not benefit from CADETAF's services;

(h) additional workshop equipment for the existing and new ore collection centers, including two mobile workshop units to carry out maintenance and repairs;

(i) equipment for two ore assaying laboratories;

(j) a socio-economic study of the artisanal mining sector; and

(k) technical assistance (financial/management) to CADETAF.

Detailed technical data on the project components are presented in Project File A. The following paragraphs describe the main project activities and their expected results.

C. Detailed Features

1. Mobile Lead Concentrator

5.03 The lead concentrator is a combination of the two main processes for beneficiation of lead ore: gravimetric separation, based on the difference in specific gravity between the mineral to be recovered and the waste; and flotation which effects separation through application of chemical reagents. The ore will first be treated by gravimetric separation, which will recover the more coarsely-grained portion of the galena ore, and then by flotation which will recover the galena fines and lead ore, occurring as cerussite. A mobile plant has been chosen, because artisanal production in the immediate vicinity of any given location is insufficient to ensure continuous full capacity utilization, and road transport of untreated ore over distances of up to several hundred kilometers to a central, fixed plant is commercially infeasible.

5.04 The main components of the concentrator are: a crushing and grinding section, including screening; a gravimetric section; a flotation section; a section to thicken and discharge the waste, as well as to recycle process water; and a power generating section. Each section will be mounted on mobile bases with wheels for haulage by tractor, which will be rented from ONT. The sections will be interconnected by conveyor belts and hopper bins. Auxiliary equipment includes a laboratory for assaying of the ore, a 1.2 m^3 front-end loader and a 12-ton truck for ore transport. A detailed equipment list is given in Annex 5. Regarding infrastructure, watertight tailings ponds will be prepared to receive the flotation effluents.

5.05 Both flotation and gravimetric separation require process water of up to 5 m^3 per ton of low-grade ore, two thirds of which can be recycled. Water availability in all prospective concentrator locations has been verified and confirmed by CADETAF.

5.06 The concentrator will operate on three shifts requiring 39 staff, including one technician and 3 foremen, one for each shift. The technician will be trained for two months at the supplier's plant, while foremen and workers will receive on-site training by the supplier for five months.

5.07 Based on 36,000 tpy of low-grade ore feed at 10% Pb and a conservative metal recovery factor of 85%, the plant will produce 4,570 tpy of lead concentrate at 67% Pb during 10 operating months per year. During its expected lifespan of 15 years, the concentrator will consume an estimated 540,000 tons of low-grade ore. At least 480,000 tons will come from proven reserves in artisanally mined deposits, although it is likely that the reserves and thus production will be higher. The remaining 60,000 tons will, to the extent

needed, come from about 300,000 tons of tailings and rejects presently stockpiled in the region. About 200,000 tons of these come from former industrial gravity separation plants. The other 100,000 tons are rejects from hand-sorting or from low-grade ore unavoidably mined and then discarded at the minehead.

5.08 The mobile concentrator will rotate among eight locations, i.e. El Hawanit, Ksar Moghal, Beni Tadjit, Talsint, Tizi N'Firest, Tiza, Iminohanou and Taouz, as shown on the Map. In each location the concentrator will remain for a period of 5.5 months, of which 0.5 months are assumed for relocation activities (start-up, shut-down, transport) and five months for production. After two locations, or eleven months, major maintenance and repair work will be carried out during the twelfth month. The 4-year cycle has been chosen in view of expected artisanal production and in order to distribute the concentrator benefits equitably. To move the concentrator, CADETAF will rent tractors from ONT. The road connections between the locations are mostly dirt roads, passable for trucks. Where required, CADETAF will carry out road repairs necessary to move to the next location. Staff, housed in tents, will relocate together with the concentrator, which CADETAF has assured will be no problem.

5.09 To feed the concentrator, CADETAF will purchase low-grade ore from the artisans at the rate of 375 tons per month and location, or 36,000 tpy. To ensure full capacity utilization of the concentrator, each location must have 15,750 tons of stock on the date the concentrator arrives. This implies the build-up of stocks in each location over a 42-month period. The resulting stocks to be maintained at any given moment are thus 63,000 tons. Until the artisanal production accumulated in each location is sufficient to feed the concentrator, CADETAF will utilize old mine tailings left over by foreign mining companies in the 1950s (para. 5.07). The tailings will also serve as back-up feed later if artisanal production were to fall below the expected levels. Available in each of the eight locations, they total, as already noted (para. 5.07), 200,000 tons, equal to about six years of feed, at 4-5% Pb. Due to their low metal content, the tailings had no value previously and were abandoned after being originally mined. Since these ore dumps will take on a commercial value as a result of the Project, the question had arisen as to whether they are owned by CADETAF, the Government or by the miners who have the mining rights in the region. Recently Government has decided, that the old mine tailings belong to the Government but CADETAF will be allowed to use them as necessary and free of charge. The utilization of tailings and artisanal production, as well as the build-up of ore stocks that CADETAF will have to maintain, are shown below:

Lead Concentrator--Artisanal Production, Feed, Low-Grade Ore Stocks
(tons)

	1984	1985	1986	1987	1988	1989	1990
Artisanal production	12,000	32,000	36,000	36,000	36,000	36,000	36,000
Concentrator feed							
- of which tailings	10,500	24,000	18,250	9,250	1,750	250	-
- of which artisanal production	1,500	9,000	17,750	26,750	34,250	35,750	36,000
Low-grade ore stocks from artisanal production	10,500	33,500	51,750	61,000	62,750	63,000	63,000

It must be emphasized that the production model above represents merely the best estimate available and that actual artisanal production could be very different. If it is lower, CADETAF will have to use more tailings. Should miners, on the other hand, achieve and maintain much higher production rates, then CADETAF will not be able to purchase all production for lack of capacity.

2. Mobile Zinc Concentrator

5.10 The zinc concentrator will preconcentrate low-grade calamine ore by gravimetric separation to a metal content of 35%. After preconcentration, the zinc ore will be further upgraded in CADETAF's existing calcination facilities (para. 3.04) to a marketable concentrate of 46% metal content. A mobile plant has been chosen for the same reasons as the mobile lead concentrator (para. 5.03). The main plant components, as well as auxiliary equipment, are the same as for the lead plant (para. 5.04), except for the flotation section, which the zinc plant does not have. A detailed equipment list is given in Annex 5. Also, watertight tailings ponds are not required because the process water is not polluted but merely dirty. CADETAF has equally verified and confirmed the availability of process water at each prospective location.

5.11 The plant will have a three-shift operation requiring 16 staff, including one technician and three foremen, one for each shift. The technician will be trained for two months at the supplier's plant, while foremen and workers will receive on-site training by the supplier for five months.

5.12 Based on 29,000 tpy of low-grade ore feed at 15% Zn and a conservative metal recovery factor of 80%, the plant will produce 9,940 tpy of zinc concentrate at 35% Zn, representing, after calcination, 7,560 tpy of zinc concentrate at 46% Zn. During its lifespan of 15 years, the concentrator will consume about 435,000 tons of low-grade ore. Present production is sufficient for the concentrator (para. 5.14), and reserves--while no systematic assessment is available--are large. In addition, CADETAF has 87,000 tons of its own all-grade zinc stocks at 7-30% Zn, which are rejects from former purchases from the miners due to low grade.

5.13 The mobile zinc concentrator will rotate initially among two locations, i.e., Tizi N'Firest and Beni Tadjit (Map), adjacent to the existing calcination facilities. Once CADETAF has constructed calcination ovens at El

Hawanit, that location will be added. Three locations are sufficient for the zinc concentrator because the occurrence of zinc ore is limited to these three areas. The sequence of relocation is the same as for the lead concentrator (para. 5.08).

5.14 To feed the concentrator, CADETAF will purchase all-grade ore from the artisans at the rate of about 1,200 tons per month in each of the two initial locations, or about 29,000 tpy. Present production rates are comparable, i.e., 2,350 tons per month, assuming that for each ton of ore now purchased by CADETAF of 35% Zn or above, an additional 2.4 tons were mined out, but had to be rejected because of their low grade. To ensure full capacity utilization of the concentrator, each location must have 8,350 tons of stock on the date the concentrator arrives, and CADETAF must therefore maintain a stock of 8,350 tons at any given time. During the first six months--and as back-up reserve--CADETAF will utilize its own stocks of all-grade zinc, equal to three years of feed (para. 5.12).

3. Crushing and Grinding Unit

5.15 The unit will consist of a jaw crusher of 10-15 tons per hour (t/h) capacity, the necessary vibrating screens and conveyors and two 50-ton storage bins, one for lead and one for zinc. It will produce ore of small and even grain size at 5 mm or below. A detailed equipment list is given in Annex 5.

5.16 The unit will treat all artisanal production of high-grade, hand-sorted and hand-washed ore that is immediately marketable and thus bypasses the concentrators. The unit will be located at Tizi N'Firest where 100% of all zinc ore and 60% of all lead ore pass through directly. The rest of the lead ore passes within 10 km of Tizi N'Firest.

4. Equipment and Works for Pilot Mines

5.17 Mining, tramming, hoisting and pumping equipment will be provided to selected pilot mines. In some of the mines, CADETAF will in addition construct collector drifts for underground transport of ore. The proposed equipment is small, simple to operate and well within the present capabilities of the miners. It also does not require large back-up maintenance facilities. The main types of equipment and mine works are:

(a) hoists of swing-boom type with a 2-ton capacity and 130 m hoisting depth, either mechanical or driven by compressed air;

(b) compressors varying from 2.5 m^3/min to 12.6 m^3/min, but predominantly with 3.0 m^3/min. The larger compressors will be installed in mines which require pumping and/or hoisting;

(c) jackhammers, weighing 11 kg and chosen to be easily handled and held in position by one man, without mechanical support;

(d) mine cars of 500-liter capacity, running on 60-cm gauge track of 9 kg/m rail. A turntable will be provided for each 100 m of drift;

(e) pumps of the type already in use;

(f) light downhill aerial tramming equipment for miners on high slopes or on top of mountains. This will cut down on mule transport and on long truck hauls to the valley; and

(g) driving of 100 m foot wall collector drifts with cross cuts and shafts for tramming and hoisting in each of six mines at Taouz. These works will be carried out by CADETAF.

5.18 Equipment and mine works above are designated exclusively for lead mines where the optimal mining method, as well as the appropriate equipment, is readily determined due to the vein-type deposits being mined. The zinc deposits, which often are cavity fillings, require more systematic exploration by drilling to determine shape, size and content before the best mining method and equipment can be identified. The geological work on the zinc deposits (para. 5.25) will lay the groundwork for future assistance to zinc miners.

5.19 The recipients of equipment and mine works will be the three existing mining cooperatives, i.e., Hawanit, Skendis and Tamslamt, six miners' associations at Taouz and some 30 other mines operated by miners' associations or on a family basis. The cooperatives and the Taouz mines have been selected by CADETAF based on the quality of deposits being exploited, the level and continuity of production, and the technical experience of the miners. The some 30 other mines will be selected according to appraisal guidelines agreed with the Bank. The 39 pilot mines will be distributed throughout the mining region and are estimated to provide the livelihood for some 1,500 miners and their families. During the project implementation period, assistance will be limited to these some 39 mines because of the pilot nature of the Project and CADETAF's implementation capacity. Starting in 1986, assistance will be provided to additional mines from repayments by the pilot mines (para. 6.11).

5.20 Equipment and mine works will be made available in six different packages, tailored to technical requirements and production levels of individual or groups of mines; one for each cooperative, one for the 6 mines at Taouz, one for 20 of the other mines and one for the remaining 10 mines. The equipment for each mine category is given in Annex 5. The investment involved has been estimated (in average 1983-85 current terms) at US$166,000 per Taouz mine, US$92,000 per cooperative, and US$30,000 per other mine.

5.21 Drilling is, and will be, done dry by hand-held drills in dry ground and will produce dust. The introduction of wet drilling, which requires a supply of water under pressure at the mine face, is beyond CADETAF's power to impose on the miners. The ground is calceous, so that the risk of silicosis is small. However, CADETAF will consult a mine doctor regarding whether lead or zinc sulfide dust can be absorbed through the lungs. If so, dust masks must be provided and the miners be persuaded to wear them when drilling.

5. Training Mine

5.22 To familiarize miners with new equipment and mining techniques, CADETAF will open up a training mine. The site selected is on the Ain Dermchane vein in the Keba area, 10 km from Errachidia and close to the main road. The mine will be equipped with 2 compressors, 2 jackhammers, a hoist, 200 m of track, 6 mine cars and timber for underground support. A detailed equipment list is given in Annex 5. Underground supervision will be in the hands of a foreman, two miners and two drillers, assisted by two laborers. CADETAF's professional staff will give formal instructions where required. Miners will be lodged in two big tents at the mine site. Board will be provided by CADETAF.

5.23 Courses will focus on practical demonstration with the necessary minimum of formal instruction. Each course will have about 10 participants and last about 1-2 months to limit the miners' absence from their own mines. Under supervision of CADETAF staff, the trainees will actually develop the mine and, at the same time, produce lead concentrate, the revenues of which will help cover the operating cost of the mine and can be used to compensate the participating miners for the income foregone from their own mines.

5.24 The areas in which miners will receive basic training include: (i) operation, performance and maintenance of simple mining equipment; (ii) execution of underground mine works; (iii) mining techniques; (iv) blasting methods; (v) mine safety; and (vi) basic mine management. Not every course can touch on all subjects, because the course content will be adapted to the actual development work required at a given time. This will apply in particular to mine works. In such cases, CADETAF will reschedule the participants for a second course at a later time. CADETAF has agreed to prepare its detailed training program in cooperation with the training section of MEM and the Ecole Nationale de l'Industrie Minerale (ENIM). CADETAF will (i) prepare the program, including the selection criteria for trainees, and submit it to the Bank not later than September 30, 1982, for comments, and (ii) promptly thereafter, implement said program, taking into account the Bank's comments thereon.

6. Geological Studies and Works

5.25 The geological program consists of 3 components:

(a) a metallogenic inventory of lead and zinc occurrences throughout the mining region;

(b) a geochemical survey of several sub-regions predetermined by CADETAF; and

(c) a detailed estimate of lead and zinc reserves in 3 deposits at Taouz, 1 at Iminohanou, 1 at Hawanit, 1 at Ksar Moghal, 1 at Dait, including about 600 m of tunnelling, 400 m of vertical driving and 20,000 m of drilling.

A detailed equipment list as well as consultancy man-months is given in Annex 5.

5.26 The metallogenic survey, which will cover the whole region, will start from areas already being mined where data can be obtained most readily, and then spread to the lesser-known areas. It will include surveying and geological mapping to scales of 1:2,000 to 1:5,000 of geological units and individual deposits, trenching and sampling, and possibly some pitting and drilling. The survey will be carried out by consultants over a period of three years. CADETAF will provide support staff, transportation, small equipment and housing. CADETAF will present by March 31, 1983, terms of reference including a specific time schedule, for comments by the Bank, and consultants are scheduled to be hired by December 31, 1983.

5.27 The geochemical survey, which is the best method available to locate blind orebodies of lead and zinc, will consist of the taking and testing of about 2,200 samples on 92 pre-selected alignments. The samples will be sent to ENIM or BRPM in Rabat for analyses by X-ray fluorescence. Follow-up underground exploration is not foreseen during the project period. If a noteworthy anomaly were to be found, meriting immediate investigation, this could be done with the light diamond core drill included under the Project (Annex 5). Survey personnel includes 2 geochemists and 1 surveyor, assisted by 2 samplers (CADETAF). For the geochemical work CADETAF will employ consultants whose selection, qualifications and terms and conditions of employment will be acceptable to the Bank. Terms of reference prepared by CADETAF are scheduled to be submitted to the Bank by June 30, 1983, and the consultants will be hired by December 31, 1983.

5.28 Exploration work will be undertaken to improve the knowledge of the lead and zinc reserves contained within individual deposits already being mined. This work will involve surface geological mapping of individual outcrops or groups of outcrops to scales between 1:250 and 1:500, accompanied by systematic trenching, sampling and testing. Underground, the selected mines will be topographically surveyed and mineralogically mapped to the same scale as for the surface. Exploration along the outcrop length beyond the present mining or below known levels will be done by drilling. A CADETAF team, consisting of 1 geologist, 2 surveyors and 2 assistant surveyors will carry out the program over a period of 2 years.

5.29 In the course of this program, CADETAF will acquire sufficient knowledge to be able to predict the probable behavior of the ore ahead of the faces with a reasonable degree of certainty. It can then agree with the miners on annual production quotas from each face, which can be followed up through the monthly deliveries made to the collection centers. This will provide CADETAF with a tool to exert influence on artisanal production rates.

7. Ore Collection Centers

5.30 CADETAF will construct four new ore collection centers at Iminohanou, Tiza, Timgharine and Ait Hani (Map), i.e. in locations too distant to be easily serviced at present from elsewhere. The centers will be equipped with a warehouse for equipment and supplies, an ore receiving and sampling yard, an office, a first-aid post, including anti-tetanus and anti-snake serum, housing

for the manager, two-way radio, a 2-ton platform weigh scale and a four-wheel drive vehicle (for every two centers). A detailed equipment list is given in Annex 5. In four areas, which support a large or developing artisanal population and thus merit special attention, CADETAF will construct sub-centers. They will be erected at Tamslamt, Skendis, Ksar Moghal and Hawanit and will be smaller than the collection centers, but will have the same equipment (Annex 5). The centers and sub-centers will be constructed by CADETAF personnel at the rate of 2 per year. Having constructed the other collection centers in the past, CADETAF is well qualified to do the work.

8. Equipment for CADETAF's Technical Services

5.31 Laboratory Equipment. CADETAF's existing two laboratories at Errachidia and Erfoud have a combined capacity of 10,000 assays per year, which is insufficient to process the some 20,000 assays per year that will result from the Project. This figure excludes assaying for geochemistry and metallogenics, which will be carried out under contract. To make up the shortfall (10,000 assays per year), the collection centers at Tizi N'Firest and Tadjit which already have facilities, but no equipment, will each be equipped to handle 5,000 assays per year. A detailed equipment list is given in Annex 5.

5.32 Workshop Equipment. The mining equipment foreseen under the Project, while of similar type to that presently in use, will more than double the quantity to be maintained by CADETAF. It will also be spread more widely geographically. The Project therefore provides for (i) equipment for each of the three workshops in Errachidia, Beni Tadjit and Erfoud, and (ii) two mobile maintenance vans, including equipment. Each maintenance van will have a crew of 2 mechanics, 2 electricians and 1 driver. A detailed equipment list is given in Annex 5.

5.33 Surveying Equipment. CADETAF's surveying and drawing section will be reinforced by 3 additional staff (para. 5.38) for whom 3 theodolites and 3 levels will be provided (Annex 5).

9. Socio-Economic Study of Artisanal Mining Sector

5.34 To improve the data base for planning future assistance to artisanal miners, the Project includes 6 man-months for a socio-economic study which will include a survey of the main characteristics of the mines and miners and provide an assessment of the impact of artisanal mining on the regional and national economy. In addition, the study will assess CADETAF's impact on the artisanal mining operations and make recommendations for future activities. To carry out the study, CADETAF will hire a qualified local consultant. CADETAF will prepare terms of reference to be submitted to the Bank for comments by June 30, 1983, with contract signature scheduled for December 31, 1983.

10. Technical Assistance for CADETAF

5.35 The Project includes 36 man-months of consulting services for CADETAF to design (12 man-months) and implement (24-man-months):

(a) systems and procedures for management information, financial accounting, cost accounting, budgeting, credit to pilot mines (para. 6.10) and long-term financial planning; and

(b) analysis of CADETAF's financial organizational set-up, staffing and identification of possible training needs.

The proposed services will help CADETAF to (i) determine possible additional staffing and training needs in the financial area; as well as (ii) adjust its accounting and planning procedures in light of the widened scope and complexity of the activities under the Project. The program will be carried out over a period of 18 months, with recommendations to be presented after 9 months, followed by 9 months of systems implementation. Before implementation, the consultants' recommendations will be reviewed by CADETAF, in consultation with the Bank, in particular with regard to staffing levels and training needs in the financial area. To carry out the program, CADETAF will employ consultants, whose selection, qualifications and terms and conditions of employment will be acceptable to the Bank, and who will be hired by September 30, 1982. The review mentioned above is scheduled for mid-1983.

11. Ecology

5.36 The single source of pollution under the Project is the effluents from the flotation section of the lead concentrator, which contain chemical reagents used in the process. The effluents will be held in watertight tailings ponds until evaporated to prevent their entering the aquifer.

12. Mine Safety and Medical Care

5.37 CADETAF's technicians conduct periodic mine inspections and advise on mine safety. Hard hats are required for the miners' safety in the shafts and tunnels, albeit not unfailingly worn. CADETAF also distributes masks to be worn as protection against dust, particularly from blasting. As mentioned in para. 5.21, a mine doctor will be consulted regarding the health effects of drilling dust from lead and zinc sulfides and the necessity of strictly enforcing mask wearing. Although mine safety is haphazard by industrial standards, few accidents seem to occur. Six accidents were reported in 1978, 25 in 1979, of which 1 was fatal, and 4 during the first half of 1980. The comparatively low accident rate is probably due to good rock conditions. Underreporting is unlikely in view of the insurance benefits that miners may expect (para. 3.14).

D. Project Implementation

1. Project Management and Organization

5.38 Project management will be undertaken by CADETAF with technical assistance from BRPM (para. 2.03). On the senior level, CADETAF has reinforced its staff with a technical director, seconded from BRPM, who will remain throughout the project implementation period and train one CADETAF staff (the present head of the geological section) to take over his position after project completion. CADETAF has also hired a mechanical engineer to head the maintenance section. In the financial area, the present chief accountant will act as financial director, assisted by the consultants mentioned in para. 5.35. In addition, CADETAF will hire and maintain in position at least until the completion of the Project, (i) not later than December 31, 1982: one geologist, two geologist technicians, a foreman instructor for the training mine, two geologist technicians, two surveyor technicians, an assayer and an assayer technician, two credit agents, and a chief statistician, and (ii) not later than June 30, 1983: a beneficiation engineer and two beneficiation technicians. Should the financial consultants' recommendations on staffing levels and their review (para. 5.35) so indicate, CADETAF will also hire additional staff for its financial department.

5.39 BRPM will provide assistance mainly in metallurgical testing and flow-sheet design, engineering, procurement, installation, training of personnel, and start-up for the concentrators and the crushing unit. BRPM will also assist CADETAF in procurement of equipment for the other components of the Project, and training for the instructor of the training mine will be undertaken in BRPM's existing mines. A respective contract with BRPM, on terms and conditions satisfactory to the Bank, is a condition of effectiveness.

5.40 Under the Project, CADETAF will contract for about 126 consultancy man-months to carry out (i) the metallogenic survey (para. 5.26)--36 man-months; (ii) the geochemical survey (para. 5.27)--42 man-months; (iii) the socio-economic study of the artisanal mining sector (para. 5.34)--12 man-months; and (iv) technical assistance to CADETAF (para. 5.35)--36 man-months. Approximately 50% of these are expected to be contracted from expatriate consultants.

5.41 To handle credit in kind in the form of mining equipment and works 1/ to be supplied to artisanal mines (para. 6.10), CADETAF will establish a credit unit, staffed with two qualified credit agents reporting directly to the financial director, by January 1, 1983. In addition to administering the credit, the unit will also monitor the performance of the pilot mines. A separate file will be kept for each of the some 39 mines indicating, on a monthly basis, production tonnage and grade, consumption of explosives, fuel

---

1/ Sinking of shafts and driving of haul tunnels by CADETAF.

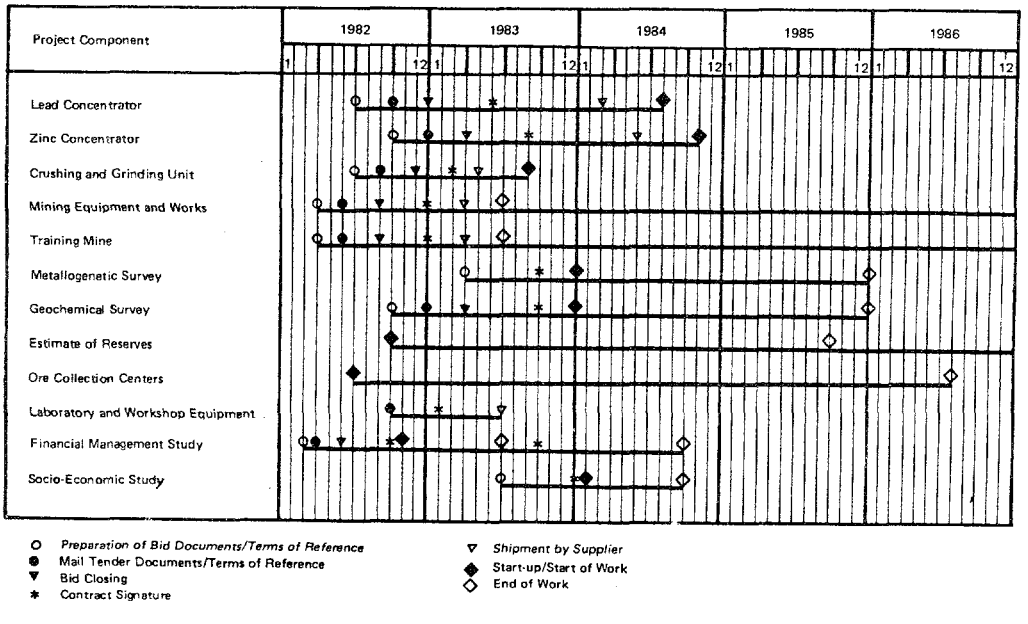
and spare parts, safety record, work interruptions caused by equipment failures and other causes, and revenues from ore sales. Once established, this work is expected to be routine and two agents should be sufficient to meet the workload. The file of mines will provide a data base for a review of credit terms and conditions scheduled for June 30, 1985 (para. 6.12). Over the medium term, it will also provide information for the introduction of mine-specific production targets that would be jointly agreed upon by CADETAF and the miners (para. 5.29).

5.42 To provide its management with regular and standardized information on all important aspects of its activities, CADETAF will establish a statistical unit, also by January 1, 1983, staffed with a chief statistician and an assistant. The unit will base its work on the management information system that the consultants will develop (para. 5.35).

2. Implementation Schedule

5.43 The Project will be implemented over a period of four years. The implementation schedule, which is shown below, is based on CADETAF's physical and institutional capacity to execute the various components or to contract for them, and on suppliers' information regarding delivery time of equipment. Accordingly, the concentrators have been phased, with start-up of the lead concentrator on August 1, 1984, and start-up of the zinc concentrator on November 1, 1984. The crushing and grinding unit has a high priority (para. 4.23) and will be purchased as quickly as possible; start-up is foreseen on August 1, 1983. After initial contracting for all mining equipment, CADETAF will install the equipment and carry out the mine works for the pilot mines in annual tranches as follows: Cooperative Hawanit, two Taouz mines, 10 other mines from July 1983 to June 1984; Cooperatives Skendis and Tamslamt, two Taouz mines, 20 other mines from July 1984 to June 1985; and two Taouz mines from July 1985 to June 1986. Equally, CADETAF will construct the eight centers and sub-centers in four equal tranches of two per year.

MOROCCO
PILOT PROJECT FOR SMALL-SCALE MINING
PROJECT IMPLEMENTATION SCHEDULE



Industrial Projects Department
February 1982

World Bank-22562

VI. CAPITAL COST, FINANCING PLAN, EQUIPMENT CREDIT FACILITY AND PROCUREMENT

A. Capital Cost

6.01 Total financing required for the Project is estimated at US$15.21 million, of which US$9.50 million or 62%, is in foreign exchange, as summarized below (Annex 6-1):

Capital Cost Estimates

	DH Million a/			US$ Million			% Base
	Local	Foreign	Total	Local	Foreign	Total	Cost
Equipment							
- Concentrator/Crusher	0.39	13.43	13.82	0.08	2.58	2.66	32.4
- Mine	0.89	7.58	8.47	0.17	1.46	1.63	19.8
- Other	0.51	3.08	3.59	0.10	0.59	0.69	8.4
Civil Works	2.03	-	2.03	0.39	-	0.39	4.8
Consultant Services							
- BRPM	1.28	-	1.28	0.25	-	0.25	3.0
- Other	2.14	4.48	6.62	0.41	0.86	1.27	15.5
Geological Survey	2.07	-	2.07	0.40	-	0.40	4.9
Tax b/	4.80	-	4.80	0.92	-	0.92	11.2
Base Cost Estimate	14.11	28.57	42.68	2.72	5.49	8.21	100.0
Physical Contingencies	1.46	2.43	3.89	0.28	0.47	0.75	
Price Contingencies	3.87	6.25	10.12	0.74	1.20	1.94	
Installed Cost	19.44	37.25	56.69	3.74	7.16	10.90	
Incr. Working Capital c/	10.22	-	10.22	1.97	-	1.97	
Project Cost	29.65	37.25	66.91	5.71	7.16	12.87	
Interest during Constr.	-	12.17	12.17	-	2.34	2.34	
Total Financing Required	29.66	49.42	79.08	5.71	9.50	15.21	

a/ The exchange rate used is DH 5.20=US$1.00 (December 1981).
b/ 16.5% on imported equipment and 12% on both foreign and local services.
c/ Up to and including 1986.

6.02 The equipment cost estimates are based on delivered prices quoted by suppliers in December 1981. Expenditures for civil works and the geological surveys have been estimated by CADETAF, based on its own past and ongoing construction as well as exploration activities. Consultants' costs include a total of 60 man-months for foreign consultants to carry out the geochemical survey (para. 5.27) and part of the technical assistance to CADETAF (para. 5.35) at an average total cost of US$13,500 per man-month. Estimates for local consultants to carry out the metallogenic survey (para. 5.26), the socio-economic study (para. 5.34) and part of the technical assistance to CADETAF are based on an average total cost of US$5,000 per man-month.

6.03 Physical contingencies for equipment are estimated at 15% of the base cost, except where number and type of equipment to be purchased has been clearly identified and changes are neither expected nor warranted. This includes equipment for the pilot mines, the training mine, the geological program, the collection centers and CADETAF's technical services. Physical contingencies for the geological surveys, the socio-economic study and technical assistance for CADETAF are estimated at 10%. Price escalation for all foreign components is calculated on the basis of annual international price increases in US$ of 8.5%, 7.5%, and 6% for 1982, 1983-85, and 1986, respectively. Domestic costs have been escalated at 12%, 10%, 8%, 7.5%, and 6% for 1982, 1983, 1984, 1985, and 1986, respectively.

6.04 Incremental working capital requirements have been estimated for the low-grade ore and concentrate stocks of the concentrators as well as for the hand-sorted concentrate stocks of CADETAF itself (Annex 6-2). Fifteen percent of the working capital is for stocks of hand-sorted concentrate, 5% for the zinc concentrator and 80% for the lead concentrator. The high amount of working capital for the lead concentrator (US$1.6 million) is a result of the continuous purchases of low-grade ore in all eight concentrator locations necessary to build up and maintain low-grade ore stocks of 63,000 tons. The stocks are required to ensure that an adequate supply of low-grade ore from artisanal production is built up prior to the arrival of the lead concentractor in a given location. This must be equally ensured for the zinc concentrator, but the required stocks, and thus the required working capital, is much lower. Estimates are based on the projected ore purchase prices for the different ore types and the relocation schedule of the mobile concentrators (paras. 5.09 and 5.14). Working capital estimates for the concentrators are also based on paying for low-grade ore with an 80% down payment at the time of purchase and a final payment of 20% twelve months later (para. 7.22).

6.05 Interest during construction has been calculated at 11.6% on the Bank loan which will be both lent to the Government and on-lent to CADETAF for 17 years, including 4 years of grace (para. 6.07). During the grace period, interest charges and commitment fee will be capitalized.

B. Financing Plan

6.06 The financing plan for the Project during 1982-86 is the following:

Financing Plan

Equity	US$ Million	%
Government Contribution	5.1	34
CADETAF Internal Cash Generation	0.6	4
Total Equity	5.7	38
Debt		
Bank Loan	9.5	62
Total Financing	15.2	100

6.07 The financing plan is structured on the basis that CADETAF will finance from its own cash generation part of the 1986 tranche of working capital (US$0.6 million). The amount of working capital to be financed by CADETAF in 1986 is about 65% the depreciation in that year. In addition, a net income of US$0.50 million is projected for CADETAF in 1986 (para. 7.25). Therefore the internal generation of funds to finance the last tranche of working capital should present no problem for CADETAF. The financing plan further stipulates that the Government's contribution will include the financing of all remaining local costs. Government disbursements will be made according to local project costs incurred by CADETAF, up to a total of DH 26.5 million. Under the current Five-Year Plan of Morocco, tranches of DH 10, 10 and 6.5 million are foreseen for 1982, 1983, and 1984 respectively, but these will be adjusted to project requirements, projected at DH 0.3, 5.3, 11.5, 7.6, and 1.8 million in 1982, 1983, 1984, 1985 and 1986 respectively. It is proposed that the guarantee fee normally charged by IBRD for its industrial projects be waived since the loan proceeds go to an organization which operates as an extension service rather than a commercial enterprise. The extension service activities for which project funds are designated include ore collection centers, training mine, workshop equipment, etc. For the same reason, the Government will carry the foreign exchange risk of the Bank loan.

6.08 Government will finance the local cost share of the Project and do so in the form of budgetary contributions to CADETAF.

6.09 Regarding overrun financing, Government has agreed to ensure the prompt availability of funds (foreign and local) and in a form acceptable to the Bank to complete the Project, independent of whether the need for such funds arises out of an increase in project cost or a shortfall in CADETAF's internal cash generation. Project completion is defined as (i) the operation of the lead and zinc concentrators and of the crushing and grinding unit at a rate equivalent to 80% of their feed capacity for a period of three months, and (ii) the delivery in full of mining equipment and works to the first 35 pilot mines.

C. Equipment Credit Facility

6.10 CADETAF will provide credit in kind in the form of mining equipment and mine works such as driving of 100-meter haul tunnels to the value of US$2.18

million to some 39 pilot mines which have been and will be selected according to criteria acceptable to the Bank (para. 5.19). CADETAF will procure the equipment and also carry out the mine works. Credit will be provided to (i) individual mines; (ii) miners' associations, registered as such with CADETAF, with each member carrying joint responsibility; and (iii) mining cooperatives, with the latter as formal debtor. The recipient mines will enter into a lease/purchase arrangement for the equipment, with CADETAF holding the ownership title until payment of the last installment. The credits will have a maturity of five years, including one year of grace on the principal, and carry an interest rate of 12%. The credits will be recovered in quarterly installments through deductions from payments for ore deliveries from the pilot mines or will be payable in cash. Since CADETAF controls the primary marketing of the artisanal production, the credit risk is considered acceptable. Moreover, the small number of recipient mines allows for effective supervision by CADETAF and, since CADETAF will hold the title, the equipment can be physically recovered in case of defaults. CADETAF has prepared a sample credit contract which was reviewed and found acceptable by the Bank.

6.11 The credits will be made with funds from a Credit Facility, whose resources will be (i) a portion of the Bank loan of about DH 8.71 million (US$1.67 million); and (ii) Government contributions of about DH 2.66 million (US$0.51 million). The Credit Facility will be set up separately from CADETAF's other finances, and its resources will be non-transferable. It will be operational by January 1, 1983, and operate in accordance with policies and procedures satisfactory to the Bank as described in detail in Annex 6-3. Within the maturity of the Bank loan (17 years) it will provide a revolving source of funds to finance new mining equipment and works credits (5 years maturity). Debt service from the mines will be allocated to service the loan portion of the Facility's funding and for relending to new beneficiaries (para. 7.29) CADETAF will administer the Credit Facility and bear its operating costs. CADETAF will also appraise and supervise the credit recipients according to guidelines agreed with the Bank. It is recognized that these guidelines may have to be adjusted in the light of subsequent experience. Therefore, it was agreed that CADETAF, not later than June 30, 1985, will exchange views with the Bank regarding financing terms, appraisal and supervision guidelines, thereafter making modificatins as may be needed. This date has been set to allow for adequate feedback from the experience with the first two tranches of pilot mines.

D. Procurement

6.12 Procurement of local equipment, material and services not financed by the Bank will be done through local competitive bidding, which is required by Moroccan regulations if the contract value is above DH30,000 (approx. US$5,800). CADETAF has previous experience in such contracting procedures.

6.13 The main Bank-financed equipment items will be procured through international competitive bidding, representing approximately 70% of total procurement value (of the Bank-financed equipment). The remaining Bank-financed equipment will be procured through limited international tendering, with the exception of some small equipment, mainly workshop and laboratory items up to a total of US$0.25 million, which will be procured through prudent local shopping. For limited international tendering, quotations will be invited from at least three suppliers from different member countries of the Bank and Switzerland. 1/ For the local

1/ For this purpose, Taiwan is also included.

shopping, CADETAF will invite quotations from three suppliers where possible and will keep procurement records of these purchases for inspection by Bank supervision missions. For procurement of Bank financed equipment, local suppliers will enjoy a 15% preference margin. A detailed list of the equipment packages is given in Annex 6-4.

E. Allocation and Disbursement of the Bank Loan

6.14 The proposed Bank loan would be allocated as follows:

Allocation of the Bank Loan

Category	Amount of the Loan Allocated (US$ million)	% of Expenses to be financed
1. Equipment	5.3	100% of foreign expenditures and 75% of local expenditures.
2. Consultants' services for the geochemical survey and technical assistance to CADETAF	1.1	100% of foreign expenditures and 85% of local expenditures.
3. Interest and other charges during implementation	2.3	Amounts due.
4. Unallocated	0.8	
Total	9.5	

The estimated disbursement schedule for the Bank loan, which is expected to be fully disbursed by December 1986 is shown in Annex 6-5.

VII. FINANCIAL ANALYSIS

A. Introduction

7.01 This chapter first discusses the incremental production resulting from the Project. It then examines the future financial position of the pilot mines, incremental income for miners and the future financial position of CADETAF, followed by the financial covenants. Subsequently, the Equipment Credit Facility, reporting requirements, financial rate of return and major risks are presented.

B. Incremental Production of Lead and Zinc Concentrate

7.02 Additional production resulting from the Project has been estimated as summarized below (Annex 7-1). The assumptions underlying the estimate are discussed in paras. 7.03-7.06.

Projected Production of Lead and Zinc Concentrates

		Annual Production a/ (tons)	Productive Period b/
A.	Without Project		
	1. Lead Concentrate	8,000	from 1982 on
	2. Zinc Concentrate	6,000	from 1982 on
	Total	14,000	
B.	Incremental Production of Project		
	1. Lead Concentrate		
	a. Concentrator	4,550	1984-98
	b. Pilot Mines	4,045	1983-91
	c. Non-Pilot Mines	1,500	1986-94
	d. Ore Collection Centers	1,550	from 1983 on
	e. Concentrator-Induced Production of Hand-sorted Concentrate	1,000	1984-98
	f. Erfoud Mines (reinstalled pumping equipment from Taouz Mines)	2,000	1983-88
	Sub-total	14,645	
	2. Zinc Concentrate (Concentrator)	7,560	1984-99
	Total	22,205	
C.	Total Artisanal Production	36,205	

a/ At full capacity.
b/ Including start-up and phasing out.

While projected production appears high for the artisanal sector as a whole if compared with present production, artisanal production was 37,700 tons in 1972, 34,800 tons in 1973 and 35,200 tons in 1974, indicating that the production potential for the Project targets exists. Production figures from 1972-74 also indicate that CADETAF can mobilize the infrastructure to handle the projected ore volumes.

7.03 Concentrators. Estimates for the operations are based on artisanal low-grade ore inputs of 10% Pb and 15% Zn (paras. 5.07 and 5.12) to produce lead concentrate of 67% Pb and zinc concentrate of 46% Zn. Both concentrators

are assumed to produce at 60% of available capacity during the first year (55% for the first six months and 67% for the second six months), 75% during the second year, 95% during the third year, and at 100% from the fourth year on. This is a conservative assumption and is 15% lower in each of the first three years than the average learning curve of 23 concentrators recently surveyed for the Bank by Charles River Associates, a US consulting firm (Project File B). The productive life of both concentrators is conservatively estimated at 15 years, or half the usual life span for a fixed-location concentrator, to allow for the additional wear and tear resulting from repeated relocation.

7.04 Pilot Mines and Non-Pilot Mines. Production increases of the pilot mines, based on hand-sorted lead concentrate of 60% Pb, have been estimated for different mine types according to the equipment to be installed, present production levels, mine potential and best judgment. Over a 3-year period, production is assumed to increase (i) for the cooperatives Hawanit and Tamslamt, as well as the 30 other mines, by 30%; and (ii) for the cooperative Skendis and the 6 Taouz mines by 50%. Incremental production from (non-pilot) mines receiving equipment credit under subsequent lending cycles of the Equipment Credit Facility has been estimated at 500, 1,000, 1,250 and 1,500 tons in 1986, 1987, 1988 and 1989 to 1994 respectively, based on the assumptions used for the pilot mines and the amounts available for relending (para. 7.29).

7.05 Ore Collection Centers. Additional production resulting from the availability of CADETAF's services in previously unserviced areas with presently very low production has been estimated by CADETAF, based on the number of miners around the new centers and the production potential of known mines in these areas. The concentrator-induced production of additional hand-sorted lead concentrate for direct shipment is based on the assumption, considered realistic, that mining of low-grade ore will be accompanied by the finding of some additional high-grade material.

7.06 Erfoud Mines. As noted, the pumping equipment presently installed in the six Taouz mines selected under the Project is too weak to keep the mines water-free down to 120 m depth as required in the future and thus will be replaced. Since the equipment is still fully operable, it will be reinstalled in four Erfoud mines, which have recently become inactive after mining reached the water level at 40 m depth. Estimates for these mines are based on past production levels.

C. Financial Projections for the Pilot Mines

7.07 Mine budgets have been established for each of the three cooperatives, for one sample Taouz mine and for one other sample mine. Expressed in real 1981 terms, the mine budgets show the additional net income accruing to each miner as compared with estimated present income levels. The additional net income per miner at full production averages DH 1,420 (US$273), representing and average increase of 23% over present income levels. Income variations result from the different ores being mined (ore from the Taouz mines contains up to 300 grams of silver per ton), the production increases estimated for each mine category (para. 7.04) and the number of miners involved. A summary of the mine budgets is shown below (Annex 7-2):

Mine Budgets for Pilot Mines

Mine Type	Number of Miners	Incremental Net Income per Miner (DH--1981 Real Terms)	Increase Over Present Income (%)
Cooperative Hawanit	32	1,040	13
Cooperative Skendis	50	1,680	35
Cooperative Tamslamt	87	560	14
6 Taouz Mines	360	1,664	26
30 Other Mines	990	1,296	27
Total	1,519	Average 1,420	Average 23

7.08 Cash flow projections have been established for the cooperatives, the Taouz mines and the other mines, separately for 1983, 1984 and 1985 on the assumption that equipment loans will be made at the rate of 1 cooperative, 2 Taouz mines and 10 other mines in 1983; 2 cooperatives, 2 Taouz mines, and 20 other mines in 1984; and 2 Taouz mines in 1985 (Annex 7-3). The projections demonstrate that the pilot mines can afford the credit terms proposed under the Project (para. 6.10).

D. Incremental Income for Miners from Sale of Low-Grade Ore

7.09 Revenues from the sale of low-grade lead and zinc ore to CADETAF constitute largely incremental income to the miners, because the low-grade ore is not mined out as such, but is a residual of the hand-sorting process for the high-grade ore. The additional production cost is consequently very low, estimated, in 1981 terms, at DH 31 (US$6) per ton each for lead and zinc ore. At ore purchase prices, in 1981 terms, of DH 140 (US$27) for low-grade lead ore and of DH 88 (US$17) for low-grade zinc ore, the incremental net income from one ton of low-grade ore is DH 109 (US$21) for lead ore and DH 57 (US$11) for zinc ore. Based on the assumption that low-grade ores will be purchased (i) at the rate of 36,000 tpy for lead ore and 29,000 tpy for zinc ore; and (ii) from an estimated 7,500 miners, the average incremental net income per miner will be DH 744 (US$143) in 1981 terms; this represents an average income increase of 57% over the miners' income level in 1980 (para. 8.04).

E. Future Financial Position of CADETAF

1. Sales Revenues

7.10 Sales revenues are based on the metal prices as given in paras. 4.07 and 4.19; they have been calculated net of smelting charges for concentrates grading 60% Pb from hand-sorted mine output, 67% Pb from the concentrator production and 46% Zn for both hand-sorted mining and concentrator production. Where applicable, the silver content of lead concentrate has been assumed at 175 grams per ton yielding, in 1981 terms, US$8 per troy ounce minus refining charges.

7.11 The differential between gross and net revenues which CADETAF will receive for its lead concentrate from the PZ smelter (para. 4.22) has been assumed to be equal to what CADETAF presently receives. This is a conservative assumption because transport cost to the domestic smelter is likely to be lower than to Europe where CADETAF's concentrates have to be shipped now.

2. Ore Purchases

7.12 Ore purchases are based on the production targets in Annex 7-1 and on projected purchase prices for each of six ore types produced by the artisanal miners (Annex 7-4). The pricing formula applied to calculate the projected purchase prices as well as the payment formula are described in paras. 7.16-7.22.

3. Operating Cost

7.13 Incremental Operating Cost. Operating costs for the concentrators have been estimated on the basis of the consultant report (Project File C) and suppliers' information. All other incremental operating costs are based on estimates prepared by CADETAF, which were reviewed and supplemented during the appraisal mission and updated in December 1981. Operating costs are assumed to remain constant in real terms, except for fuel costs, which are projected to increase by 1.6% p.a. in real terms until 1990, in line with present Bank assumptions. After project completion, the incremental operating costs are estimated as follows (Annex 7-5):

Incremental Operating Costs of CADETAF after Project Completion
(DH'000-1981 Terms)

	Annual Costs	%
Lead Concentrator a/	2,039	35.8
Zinc Concentrator a/	841	14.8
Crushing and Grinding Unit	151	2.6
Laboratory Services	492	8.6
Management Staff	185	3.2
Training Mine	132	2.3
Credit Unit	64	1.1
Statistical Unit	40	0.7
Geological Department	138	2.4
Workshops	448	7.8
Ore Collection Centers	468	8.2
Calcination of Pre-concentrated Zinc Ores	710	12.5
Total	5,708	100.0

a/ Excluding purchase of low-grade ore.

7.14 Projected incremental operating costs in current terms until 1990 are shown in Annex 7-6.

7.15 Operating Costs Without Project. CADETAF's operating costs "without the Project" for 1982 are estimated DH 4.0 million, including technical assistance to miners of about DH 1.0 million, in line with the yield of the withholding margin. After 1982, they are assumed to remain constant in real terms as all incremental operating costs are being accounted for separately.

4. Cost Recovery

7.16 Cost recovery under the Project is described in Annex 7-7, which discusses in detail the future pricing and payment formulas for ore purchases from miners, the allocation of CADETAF's withholding margin on the ore purchase price among different cost categories, and the calculation of treatment fees for certain services provided by CADETAF. Annex 7-7 also analyzes the impact of the cost recovery policies on miners, indicating that the resulting ore purchase prices should be acceptable to them. The paragraphs below summarize the major aspects of Annex 7-7.

7.17 Treatment Fees. Part of CADETAF's operating cost will be recovered through treatment fees, which will be charged for use of the concentrators, the crushing and grinding unit, the calcination kilns and the laboratory services. The fees will be calculated so as to recover operating cost, estimated replacement costs and financial charges at market rates on installed cost, as well as working capital. Government has agreed that treatment fees will be calculated and charged as agreed with the Bank (see Annex 7-7 for details).

7.18 The projected fees for the different services are summarized below (Annex 7-8):

Projected Treatment Fees
(DH/ton of Concentrate--Current Terms)

	1982	1983	1984	1985	1987	1990
Concentrator Fee Pb	-	-	979	1,307	1,433	1,638
Concentrator Fee Zn	-	-	410	400	373	408
Calcination Fee	113	125	137	147	167	198
Crushing Fee	30	30	29	29	24	29
Laboratory Fee	21	22	24	25	29	34

7.19 Withholding Margin. All other costs will be recovered through withholding margins of 25% on hand-sorted lead concentrate, and 10% on hand-sorted zinc concentrate, low-grade lead ore and low-grade zinc ore. The allocation of the withholding margin will no longer be at the fixed rates of 40% for technical assistance to miners and 60% for CADETAF's administrative

and investment costs because it has not worked satisfactorily in the past and is no longer appropriate for the widened scope of CADETAF's activities. Instead, annual operating, investment and technical assistance budgets will be established based on CADETAF's actual financial results of the previous year, and projections for the budget year. Based on these budgets, the allocation of the withholding margin will be set (and changed) annually by DOM. It was further agreed, that the budgets will be reviewed in mid-year, and, if necessary, adjusted by DOM according to actual developments.

7.20 Payment Formula. For hand-sorted concentrates, the monthly calculation of ore purchase prices, based on the LME price of the previous month will be maintained (para 3.10). The concentrates will also, as at present, be fully paid for at the time of purchase. Low-grade ore will be purchased at a fixed annual price estimated in advance for a given year. Based on this price, miners will be paid 80% of the ore value at the time of delivery. The remaining 20% will be paid 12 months later. The final payment will be based on the actual metal price and the technical performance of the concentrators during the preceding 12 months.

7.21 The introduction of treatment fees, the changes in the withholding margin, the preparation of operating, technical assistance and investment budgets and the payment formula for low-grade ores have been discussed and agreed upon with CADETAF and DOM. Under this arrangement, beginning July 1, 1982:

(i) the treatment fees and new withholding margins for hand-sorted concentrates as detailed in Annex 7-7 will be applied;

(ii) the specific allocation of part of the withholding margin for investments and technical assistance to miners will be determined on the basis of annual operating, investment and technical assistance budgets; and

(iii) treatment fees and payment formula for low-grade ores, as detailed in Annex 7-7 will be applied for all purchases of low-grade ore.

Until Project completion, changes in the pricing and payment formula as well as the mechanism to calculate the user fees will not be made without prior exchange of views and the Bank's concurrence.

7.22 In view of the pilot nature of the Project, the ore pricing and payment formulas will be reviewed in mid-1984.

5. Financial Projections for CADETAF 1/

7.23 Detailed income statement, sources and application of funds and balance sheet projections are given in Annexes 7-8 to 7-10. The major assumptions underlying these projections are discussed below and further detailed in Annex 7-11.

7.24 The projections are made in current DH through 1990. They assume an annual domestic inflation rate of 12% in 1982, 10% in 1983, 8% in 1984, 7.5% in 1985 and 6% in 1986-90. Annual international inflation, where applicable, has been assumed at 8.5% in 1982, 7.5% in 1983-85 and 6% in 1986-90.

7.25 The financial projections for CADETAF are summarized as follows:

CADETAF--Selected Financial Indicators
(DH 000--Current Terms)

	1982	1983	1984	1985	1987	1990
Pb-Conc. Sales (tons)	8,000	8,000	13,300	17,670	21,470	20,665 a/
Zn-Conc. Sales (tons)	6,000	7,355	6,560	11,510	13,560	13,560
Concentrate Sales	21,478	27,937	43,614	71,913	98,525	115,351
Ore Purchase	12,617	16,326	24,911	38,117	53,409	63,492
CADETAF Oper. Cost	4,230	5,441	7,828	11,387	14,100	16,908
Depreciation/Amort.	-	241	2,050	3,840	5,370	4,793
Net Income	130	(503)	(717)	3,618 b/	998	3,276
Cash Flow	130	(262)	1,333	7,458	6,368	8,069
Ore Stocks	4,000	4,500	6,543	10,820	16,638	17,313
Current Liabilities c/	8,130	8,830	8,030	6,251	6,172	4,367
Long-Term Debt	2,623	12,231	32,649	38,586	33,910	25,384
Current Ratio d/	1.18	1.14	1:57	3.38	4.58	9.03
Debt:Equity Ratio	96:4	75:25	71:29	61:39	53:47	41:59
Debt Service Coverage Ratio	-	-	-	-	1.17	1.86

a/ End of incremental production from Erfoud mines after 1988 (para. 7.02).
b/ Due to free concentrator feed (tailings).
c/ Including short-term portion of long-term debt.
d/ Including excess cash.

1/ Financial projections for CADETAF do not include the Equipment Credit Facility, the future financial position of which is discussed separately in Section G of this Chapter.

7.26 The financial projections indicate minor losses in 1983 and 1984. The loss in 1983 results in a very small cash loss of DH 0.26 million (US$0.05 million), which CADETAF will cover with short-term borrowing from BMCE. The loss in 1984 does not result in a cash loss. Therefore, financing problems during this period are not expected. In later years, only modest profits are projected for CADETAF. This is to be expected in view of the fact that the ore pricing formulas recover cost, but pass on to the miners as much benefit as possible. The debt service coverage ratio is satisfactory, rising from a low of about 1.2 in 1987 when debt repayment starts in full to about 1.9 in 1990. Following the equity contributions from Government in 1982-85, the long-term debt:equity ratio is projected at 61:39 in 1985 and 41:59 in 1990. The current ratio is satisfactory for the projection period, rising from 1.2 in 1982 to 1.6 in 1984 once the concentrators are producing. The increase of the current ratio to 9.0 in 1990 is a result of the excess cash that is projected from 1986 on and which has not been allocated for new investments or technical assistance to miners.

F. Financial Covenants

7.27 To ensure maintenance of a sound financial position during project implementation and to safeguard CADETAF's position thereafter, it has been agreed that:

(a) CADETAF's non-project investments and technical assistance to miners under the investment and technical assistance budgets (para. 7.19) will not be permitted to exceed in aggregate DH 1.5 million (US$0.29 million) in any one year until project completion without the prior approval of the Bank;

(b) after project completion and until its accumulated reserves exceed DH 5 million, (US$1 million), CADETAF shall not make any investments, including CADETAF's self-constructed assets, nor provide any supporting services to miners whose costs are not recovered directly, in an aggregate amount exceeding 50% of its income obtained during the preceeding 12-month period;

(c) CADETAF will not incur any debt (i) until project completion other than for the financing of the Project (paras. 6.06-6.09) and (ii) thereafter if, after incurring such debt, CADETAF's debt:equity ratio would exceed 60:40 and its current ratio would be less than 1.5;

(e) CADETAF will furnish the Bank with Government-audited financial statements for itself and the Equipment Credit Facility within seven months after the end of the fiscal year; and

(f) any changes in (i) the pricing as well as payment formulas for both hand-sorted concentrate and low-grade ores, as described in paras. 7.16 to 7.22 and Annex 7-7; and (ii) the mechanism to calculate the user fees, as described in Annex 7-7, will require prior Bank approval until Project completion.

G. Financial Projections for the Equipment Credit Facility

7.28 Separate financial projections have been prepared for the Equipment Credit Facility, because its finances will be separate from those of CADETAF (para. 6.11). Credits, which will carry an interest rate of 12% p.a. and have a maturity of five years including one year of grace on the principal, will be disbursed in 1983-85, with repayment starting in 1984 and ending in 1990.

7.29 The projected sources and application of funds statement for the Equipment Credit Facility are summarized below (Annex 7-12):

Cash Flow Summary of Equipment Credit Facility
(DH'000--Current Terms)

	1983	1984	1985	1986	1988	1990
Government Loan (IBRD)	2,545	4,863	1,300	-	-	-
Government Contribution	784	1,308	563	-	-	-
Debt Service--Pilot Mines a/	198	1,154	2,681	3,505	2,666	234
Debt Service--Non-Pilot Mines a/	-	-	-	238	1,985	3,294
Subtotal	3,527	7,325	4,544	3,743	4,651	3,528
Credit to Pilot Mines	3,329	6,171	1,863	-	-	-
Relending to Non-Pilot Mines	-	-	-	4,000	3,000	2,000
Debt Service--IBRD Loan	-	-	-	1,161	2,117	1,885
Subtotal	3,329	6,171	1,863	5,161	5,117	3,885
Annual Surplus	198	1,154	2,681	(1,418)	(466)	(357)
Cumulative Surplus	198	1,352	4,033	2,615	2,380	2,012

a/ Net of 1% defaults.

7.30 For the projection, a default rate of only 1% has been assumed in view of the fact that all credit will be given in kind and, with CADETAF retaining ownership (para. 6.10), the equipment can be physically recovered in case of default. Subsequent re-lending after recovery from the pilot mines will start in 1986 after the review of credit conditions scheduled prior to June 30, 1985 (para. 6.11). For purposes of financial projections, the initial credit terms have been applied during the whole period, although the review to be carried out in mid-1985 may indicate that changes are needed.

H. Reporting Requirements

7.31 During project implementation and until project completion, CADETAF will furnish to the Bank (i) on a semi-annual basis, progress reports on the Project and CADETAF's operations, including a report on the lead mines benefitting from the Equipment Credit Facility; (ii) on an annual basis, CADETAF's proposed operating, investment, and technical assistance budgets as well as information on CADETAF's ore selling agreements; and (iii) brief appraisal notes on and copies of credit agreements with the beneficiaries of the Equipment Credit Facility. CADETAF will also prepare and submit to the Bank, not later than six months following project completion, a report on the execution and initial operation of the Project.

I. Incremental Financial Rate of Return

7.32 The financial rate of return for the pilot Project has been calculated on the basis of incremental cost/benefit streams shown in Annex 7-13 and is 24%. The capital costs include the working capital for the concentrators and CADETAF itself, as well as investments for the concentrators in 1988-91 to replace four-wheel drive vehicles, trucks, front-end loaders and pumps. The working capital for the concentrators is assumed to be recovered in 1997 and 1998, i.e., at the end of the Project life. The cost streams further include CADETAF's incremental operating costs, artisanal production costs estimated at DH 165/ton of concentrate and artisanal labor costs. Incremental artisanal labor input is required for the collection centers' production, the pilot mines, the concentrator-induced production of hand-sorted concentrate and the production of the Erfoud mines (para. 7.02). For the low-grade ore production, no incremental labor is required because low-grade ore is not mined out as such but is a residual of the hand-sorting process. To determine the nominal labor force required to mine the incremental production, a norm production of six tons per man-year has been estimated. The estimate is based on production levels of miners' associations assumed to work continuously. Nominal wages have been assumed at DH 6,600 per man-year, or about 50% above the minimum wage. The results are summarized below:

Sensitivity Test of Financial Rate of Return
(%)

Base Case	24
Capital Costs up 10%	22
Operating Costs up 10%	20
Selling Price up 10%	32
Selling Price down 10%	16
Production up 10%	29
Production down 10%	19
Selling Price and Production down 10%	14
Selling Price down 20%	9
Production down 20%	14
Selling Price and Production down 20%	2

7.33 The resulting return is satisfactory in view of the fact that costs and benefits have been calculated at the margin. The rate of return is most sensitive to changes in the selling price and least sensitive to changes in the capital cost. If artisanal production is 20% below the projections, the rate of return would drop to 14%, which is marginally acceptable but underlines the risk associated with the production behavior of the miners. Lower production due to technical difficulties is not likely because the production assumptions are considered to be conservative. Artisanal production, however, could--as it has in the past--drop 20% or more during periods of low metal prices. On the other hand, artisanal production could also be considerably above the projected production targets during periods of high prices. If selling prices and production fall 15% below the projected levels, the Project becomes marginal.

J. Major Risks

7.34 The major risk that the Project faces is sudden and sharp decreases of lead and zinc prices. Both metals have a history of strong cyclical price movements with large deviations from long-term price trends. While the cycles of low and high prices compensate each other over the long term, a sharp price drop during the project implementation period, in particular 1983-85, would discourage artisanal production which could result in incomplete recovery of CADETAF's operating cost during that period. Project implementation, however, would not be jeopardized as the Government has agreed to provide all funds necessary to complete the Project (para. 6.09). For CADETAF, sharp and sudden price drops also mean that it must sell the hand-sorted concentrate at a lower price than purchased from the miners (para. 3.13). Delivery of lead concentrate to the PZ smelter will considerably reduce the price risk that CADETAF carries because the time lag between the date of ore purchase and the reference date for the price to be paid by the smelter is reduced from presently 4-6 months to 1-2 months.

7.35 The second uncertainty facing the Project is the miners' response to the concentrators, the mining equipment and the modified pricing and payment formula; this response cannot be predicted reliably. Miners could decide that their present mining income is sufficient and can be maintained with less production of hand-sorted concentrate, because of the opportunity to sell low-grade ore. CADETAF, therefore, may have to make purchases of low-grade ore conditional upon delivery of a certain amount of hand-sorted concentrate. On the other hand, even with mandatory hand-sorted deliveries, low-grade ore production could be so high that CADETAF may have to design a selection mechanism for its low-grade ore purchases, which is equitable and accepted as such by the miners. Production in the pilot mines is more amenable to CADETAF's influence through supervision and technical advice. Also, the pilot mines have produced regularly in the past. Changes in the pricing formula have been kept to a minimum, and, as demonstrated in Annex 7-7, should be acceptable to the miners. However, as also mentioned in Annex 7-7, any change is likely to be viewed with a certain suspicion. Therefore, the ore pricing formula will be reviewed in mid-1984 (para. 7.22) to determine if adjustments are necessary.

VIII. ECONOMIC ANALYSIS

A. Project Benefits

1. Foreign Exchange Benefits

8.01 One of the Project's primary benefits will be the increases in production, and thus in foreign exchange earnings, of lead and zinc exports. Zinc concentrates will be exported and increase foreign exchange earnings directly. Lead concentrates will be either processed at the local PZ smelter in Oued el Heimr and exported indirectly in form of metal, or exported directly (para. 4.22). For estimating the foreign exchange benefits, the FOB value of both lead and zinc exports is assumed to be the metal value minus smelting charges, sea freight and insurance. Foreign exchange costs are based on (i) foreign capital expenditures, including interest during implementation and replacement investments for ancillary concentrator equipment; (ii) interest payments; (iii) incremental operating expenditures of CADETAF and the miners for non-fuel consumables and spare parts, with an estimated foreign exchange content of 50%; and (iv) fuel cost with an estimated foreign exchange content of DH 1.0/liter of diesel, derived from cif cost of US$37/bbl of crude petroleum and 1,160 liters of diesel per metric ton. The foreign exchange surplus projected to be generated by the Project is, in real 1981 terms, US$34.0 million through 1990, as summarized below and further detailed in Annex 8-1:

Net Foreign Exchange Balance
(US$ Million--1981 Real Terms)

	1982	1983	1984	1985	1986	1988	1990
Foreign Exchange Outflow	0.1	2.1	4.1	1.6	1.3	1.1	1.0
Export Revenues	-	0.5	2.3	5.5	7.1	8.4	8.0
Net Foreign Exchange Surplus/ (Deficit)	(0.1)	(1.6)	(1.8)	3.9	5.8	7.3	7.0
Accumulated Net Foreign Exchange Surplus/ (Deficit)	(0.1)	(1.7)	(3.5)	0.4	6.2	20.5	34.0

2. Other Benefits

8.02 As mentioned in para. 2.08, the lack of ore concentration facilities has resulted in undesirable exploitation practices as miners tend to mine merely the richest part of a vein. The installation of the two concentrators will encourage miners to mine less selectively, thus increasing the amount of recoverable ores and making better use of Morocco's available mineral resources. Similarly, the equipment provided to the pilot mines will permit bringing the full production potential of these deposits on stream.

8.03 Through its limited but systematic geological program of surveys, exploration and estimate of reserves, the Project will help to identify new deposits suitable for small-scale mining operations and thus to maintain artisanal production in the long run. The geological program will also yield more reliable information on reserves, size and type of deposits. Decisions regarding the selection of appropriate mining methods, necessary equipment and mine organization can be based on this information, leading to a more rational development of new and existing deposits.

B. Project Beneficiaries and Project Area

8.04 Project beneficiaries will be some 7,500 miners and their families, for whom mining is a major source of employment and income. The average income per miner in 1979, a year of very high metal prices for both lead and zinc, was US$361, or about half the agricultural minimum wage. For 1980, the average income was US$277 and for 1981 US$250, respectively, 24% and 30% below 1979, due to lower lead prices. While the mining income is, in many cases, supplemented by other resources, mostly subsistence livestock and agriculture, the income levels of most miners and their families are estimated to be well below the national average. This estimate is supported by the fact that the average income of the pilot miners, who are thought to be in the highest income group, was only about US$1,058 in 1981, 25% above the non-agriculture minimum wage and about equal to the salary of CADETAF's night guards and messengers. A more detailed analysis of the miners' income levels is presently not possible due to the lack of data, particularly on non-mining income. To provide such data is among the objectives of the proposed socio-economic study of the artisanal mining sector (para. 5.34).

8.05 Project benefits in the form of additional income from selling low-grade ores and from increased production of hand-sorted concentrates will accrue to all 7,500 miners. The majority of tangible project benefits, i.e., those resulting from the sale of low-grade ore, will accrue equitably to all these 7,500 miners, as CADETAF will purchase low-grade ore from as many miners as possible. Benefits from the new ore collection centers, representing 7.4% of all incremental income will accrue to some 1,000 miners (among the 7,500), who are thought to be in the lowest income group since their present production, and consequently income, are very low due to the irregular availability of CADETAF's extension services. Benefits from the mining equipment for the pilot mines, representing 19% of all incremental income, will accrue to some 1,500 miners who are in the highest income group.

8.06 Miners who do not directly benefit from the Project will be only marginally affected by the new pricing formula (Annex 7-7) and will be able to continue mining as at present, producing a fully competitive product.

8.07 Artisanal mining activities are mostly located in semi-arid and arid areas which offer very limited alternatives for economic development, aside from oasis agriculture, where water and soil conditions permit. Located in the south-central and eastern economic regions, these areas have also been bypassed by previous development programs with the result that they are poorly endowed in basic physical and social infrastructure. 1/ Development of the mining potential is therefore important, not only to stimulate economic development, but also to prevent a deterioration of living conditions and, eventually, depopulation and increased migration pressures on urban and rural areas in other parts of Morocco.

C. Incremental Economic Rate of Return

8.08 The economic return has been calculated from the financial cost/benefit streams which have been amended to: (i) eliminate all identifiable taxes and subsidies in the capital and operating costs; and (ii) exclude the export tax on lead and zinc concentrates (para. 3.10). Incremental economic cost/benefit streams are shown in Annex 8-2.

8.09 The base economic rate of return, shown below, is 32%. If artisanal production drops 20% below the projected target, the rate of return is 25%. If selling prices are 20% lower than projected, the rate of return is 15%; however the probability of this event is considered to be low as the metal price assumptions for both lead and zinc are more conservative than the estimates of the Bank's Commodities Staff.

1/ Morocco--Basic Economic Report, 1980, IBRD 3289-MOR, pp. 291-293.

Sensitivity Test of Economic Rate of Return
(%)

Base Case	32
Capital Costs up 10%	29
Operating Costs up 10%	27
Selling Price up 10%	40
Selling Price down 10%	24
Production up 10%	35
Production down 10%	28
Selling Price and Production down 10%	20
Selling Price down 20%	15
Production down 20%	25
Selling Price and Production down 20%	7

IX. AGREEMENTS REACHED AND RECOMMENDATIONS

9.01 The following agreements have been reached:

a. With the Government

(i) that it will carry the foreign exchange risk of the Bank loan (para. 6.07);

(ii) that it will ensure the prompt availability of appropriate funds to complete the Project in the event of overrun financing being required (para. 6.09);

(iii) that new pricing formulae will be used for hand-sorted concentrates and low-grade ores (paras. 7.16-7.22 and Annex 7-7) starting October 1, 1982;

(iv) that the percentage of the withholding margin ear-marked for CADETAF's administrative and investment costs will be set (and changed) annually by DOM, based on annual budgets for CADETAF's operating, investment, and technical assistance costs; further that the budgets will be reviewed in mid-year and, if necessary adjusted by July 31 (para. 7.19);

(v) Until project completion, not make any changes in the pricing and payment formulas for either handsorted concentrates or low-grade ores, or the mechanism to calculate the user fees, without prior Bank concurrence (para. 7.21); and

(vi) that the pricing and payment formulas, as well as the user fees, will be reviewed, together with the Bank, by not later than June 30, 1984 (para. 7.22).

b. With CADETAF, that it will

(i) (a) prepare a detailed training program including selection criteria for the trainees and submit it to the Bank, not later than September 30, 1982, for comments, and (b) promptly thereafter, implement said program, taking into account the Bank's comments thereon (para. 5.24);

(ii) (a) prepare terms of reference for the metallogenic survey and submit them, not later than March 31, 1983, to the Bank for comments, (b) take into account the Bank's comments, if any, (c) furnish to the Bank a copy of the contract that it has entered into for the execution of this survey, and (d) upon completion, promptly furnish to the Bank a copy of the report (para. 5.26);

(iii) employ consultants for the geochemical survey whose selection, qualifications, and terms and conditions of employment will be acceptable to the Bank, hired by December 31, 1983 (para. 5.27);

(iv) (a) prepare terms of reference for the socio-economic study and submit them, not later than June 30, 1983, to the Bank for comments, (b) take into account the Bank's comments, if any, (c) furnish to the Bank a copy of the contract that it has entered into for the execution of the study, and (d) upon completion, promptly furnish to the Bank a copy of the report (para. 5.34);

(v) hire, not later than September 30, 1982, consultants to provide technical assistance in the financial area, whose selection, qualifications, and terms and conditions of employment will be acceptable to the Bank; further review, not later than June 30, 1983, in consultation with the Bank, staffing levels and training needs in the financial area in light of the consultant's recommendations (para. 5.35);

(vi) hire suitably-qualified staff for middle management positions according to a schedule acceptable to the Bank (para. 5.38);

(vii) establish an Equipment Credit Facility, staffed with two credit agents, and with operating policies and procedures approved by the Bank, by January 1, 1983 (para. 6.11);

(viii) exchange views with the Bank, not later than June 30, 1985, on the contents of the appraisal for beneficiaries, the terms of financing and the guidelines for supervision, and promptly thereafter make any modifications for future lending cycles of the Credit Facility as may be agreed upon between itself and the Bank (para. 6.11);

(ix) adhere to certain financial covenants as spelled out in para. 7.27; and

(x) furnish to the Bank various budgets, reports and financial statements as required under paras. 7.31.

9.02 The following will be a condition of effectiveness:

(i) that CADETAF will enter into a technical services contract with BRPM, on terms and conditions satisfactory to the Bank (para. 5.39).

9.03 Given the preceding assurances and agreements, the Project is suitable for a Bank loan of US$9.5 million to the Government of Morocco, which will be on-lent to CADETAF.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

GLOSSARY OF MINING TERMS

Calamine	A generic term used for secondary zinc carbonates, oxides and silicates, normally with a 50-55% Zinc content.
Fracture Filling Deposit	The deposit of ore, geologically formed over a long period, in a broken surface of a rock or a cleavage.
Galena	A term used for lead sulfide, PbS, the most common ore of lead, containing 86.6% lead.
Geochemical Survey	A survey involving the geochemical analysis of systematically collected samples of rock, soil, plants or water.
Metallogenic Survey	A survey involving the study of the origin of an ore deposit and concentration of particular metals, or of a particular metal type.
Mine Gallery	A horizontal or nearly horizontal underground passage or tunnel in a mine.
Mine Shaft	An excavation of limited area compared with its depth, made for finding or mining ore, raising water, hoisting and lowering men and material, or ventilating underground.
Mine Tailings	The parts, or part, of the ore separately treated as inferior in quality or value. In mining, it is also defined as the residuum after most of the valuable ore has been extracted.
Ore Concentrator	The plant in which--by the aid of water and specific gravity--low-grade ore is concentrated into a higher grade. Ore concentration may also be performed in this plant by using chemical reagents via the flotation method in which a froth, created in water by chemical reagents, floats some finely-crushed minerals, whereas other minerals sink.

Ore Reserve	The term is usually restricted to ore of which the grade and tonnage have been established with reasonable assurance by drilling and other means.
Out-Croppings	This term is applied to a rock or ore vein as seen exposed on the surface.
Possible Reserves	A class of ore, the existence of which is a reasonable possibility, based primarily upon the strength and continuity of geologic-mineralogic relationships and upon the extent of ore deposits already developed. Because of the comparative absence of mine workings which could reveal assay values, possible ore cannot be assigned a grade with any certainty, nor can the quantity be expressed as a definite, absolute amount.
Probable Ore	A class of ore, the occurrence of which is, for all essential purposes, reasonably assured, but not absolutely certain. A definite grade can be assigned to the tons thus classified. Probable ore, however, is not amenable to immediate mining, although the probable ore could, through development work, become mineable in a relatively short time.
Proven Reserves	Ore deposits which have been reliably established as to their volume, tonnage and quality by approved sampling, valuing and testing methods.
Tramming	To haul ore with a carrier that travels on an overhead cable or on rails.
Vein Deposit	Usually narrow and steeply inclined zones of mineralized rock lying within boundaries clearly separating them from non-mineralized rock.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

CADETAF INCOME STATEMENTS 1974-81

(DH '000)

	1974	1975	1976	1977	1978	1979	1980	1981 a/
Concentrate Sales (Tons)	35,388	31,140	19,504	18,094	13,527	15,777	15,500	15,000
Average Price (DH/Ton)	915	616	650	831	949	1,853	1,533	1,390
Sale of Concentrates	32,389	19,198	12,678	15,041	12,848	29,241	23,776	20,850
Sale of Consumables to Miners	935	839	415	438	303	518	204	185
Self- constructed Assets b/	1,681	2,476	1,852	1,569	543	299	1,013	-
Other Revenues c/	112	149	57	141	134	133	35	35
Total Revenues	35,117	22,662	15,002	17,189	13,828	30,191	25,028	21,070
Ore Purchases	22,377	11,317	6,296	8,851	7,124	17,075	12,513	10,500
Purchase of Consumables for Sale to Miners	935	839	415	438	303	518	204	185
Internal Transport	2,892	1,718	1,251	1,541	1,588	2,132	1,830	1,380
Storing and Handling	586	348	266	296	352	422	233	200
Freight and Insurance	1,798	1,046	846	1,130	992	1,527	1,507	1,136
Export Tax	178	160	71	73	70	924	1,067	160
Inventory Adjustment	(7,402)	574	569	10,045	1,515	(3,031)	2,143	(111)
CADETAF Operating Cost	5,237	6,374	4,980	5,495	3,711	4,730	5,257	4,715
Depreciation on fixed and self-constructed assets	2,070	2,873	2,315	2,071	1,026	691	1,241	500
Depreciation on accounts receivable	-	-	-	-	199	-	-	-
Financial Charges	50	214	402	485	432	282	95	135
Operating Surplus (Deficit)	6,396	(2,801)	(2,409)	(13,236)	(3,484)	4,921	(1,062)	2,270
Other Income (Charges)	-	105	80	95	(95)	105	55	(197)
Net Income (Loss)	6,396	(2,696)	(2,329)	(13,141)	(3,579)	5,026	(1,007)	2,073
CADETAF Operating Cost in % of Ore Purchases	23.4	56.3	79.1	62.1	52.1	27.7	42.0	44.9

a/ Preliminary, based on Statements to 10/31/81.
b/ Investments on behalf of miners: Mine works, exploration work, construction of ore collection centers, and calcination kilns, road work and studies.
c/ Fees for dewatering flooded Taouz/Erfoud mines.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

CADETAF FUNDS FLOW STATEMENTS 1975-81

(DH '000)

	1975	1976	1977	1978	1979	1980	1981[a/]
SOURCES OF FUNDS							
Net Income (Loss)	(2,696)	(2,329)	(13,141)	(3,579)	5,026	(1,007)	2,073
Depreciation	2,873	2,315	2,071	1,026	691	1,241	500
Total Internal Sources	177	(14)	(11,070)	(2,533)	5,717	234	2,573
Short-Term Loans	3,958	301	106	(1,138)	(710)	(2,485)	201
Government Advance	-	-	-	2,000	-	-	-
Relief Fund	19	(51)	18	12	87	12	9
TOTAL SOURCES OF FUNDS	4,154	236	(10,946)	(1,679)	5,094	2,239	2,783
APPLICATION OF FUNDS							
Capital Expenditures	3,229	2,161	1,850	539	337	1,306	480
Increase (Decrease) of Working Capital	1,614	(1,844)	(13,097)	(2,095)	4,696	3,549	1,513
Total Capital Expenditures	4,843	317	(11,247)	(1,556)	5,033	2,243	1,993
Repayment of Government Advance	-	-	200	-	-	-	-
TOTAL APPLICATION OF FUNDS	4,843	317	(11,047)	(1,556)	5,033	2,243	1,993
Increase (Decrease) in Cash	(689)	(81)	101	(123)	61	4	790
Cash at Beginning of Year	856	167	66	187	64	125	129
Cash at End of Year	167	86	187	64	125	129	919

a/ Preliminary, based on Statements of 10/31/81

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

CADETAF BALANCE SHEETS 1974-81
(DH '000)

	1974	1975	1976	1977	1978	1979	1980	1981[a/]
ASSETS								
Cash at Bank	856	167	86	187	64	125	129	919
Accounts Receivable	1,709	4,163	3,774	4,574	4,079	6,369	4,086	6,400
Stock of Concentrates	14,771	14,294	13,861	3,801	2,504	5,692	3,633	4,047
Stock of Consumables	1,300	1,204	1,068	1,083	866	708	624	320
Total Current Assets	18,636	19,828	18,789	9,645	7,513	12,894	8,742	11,636
Gross Fixed Assets	9,277	12,506	14,667	16,517	17,056	17,393	18,699	19,179
Accumulated Depreciation	(8,099)	(10,972)	(13,287)	(15,358)	(16,384)	(17,075)	(18,316)	(18,816)
Net Fixed Assets	1,178	1,534	1,380	1,159	672	318	383	363
TOTAL ASSETS	19,815	21,362	20,169	10,804	8,185	13,212	8,855	12,049
LIABILITIES								
Short-Term Debt	-	3,958	4,259	4,365	3,227	2,517	32	233
Other Current Liabilities	4,356	4,623	5,509	9,361	9,447	10,071	9,194	10,105
Total Current Liabilities	4,356	8,581	9,768	13,726	12,674	12,588	9,226	10,338
Interest-free Government Advance	200	200	200	-	2,000	2,000	2,000	2,000
Total Long-Term Debt	200	200	200	-	2,000	2,000	2,000	2,000
Relief Fund (Caisse de Secours)	354	373	322	340	352	439	451	460
Accumulated Reserve (deficit)	14,904	12,208	9,879	(3,262)	(6,841)	(1,815)	(2,822)	(749)
Total Equity	15,258	12,581	10,201	(2,922)	(6,489)	(1,376)	(2,371)	(289)
TOTAL LIABILITIES AND EQUITY	19,815	21,362	20,169	10,804	8,185	13,212	8,855	12,049
Current Ratio	4.3	2.3	1.9	0.7	0.6	1.0	0.9	1.1
Debt/Equity Ratio	1:99	2:98	2:98	neg.	neg.	neg.	neg.	neg.

a/ Preliminary, based on Statements of 10/31/81

Industrial Projects Department
February, 1982

MOROCCO

PILOT PROJECT FOR SMALL SCALE MINING

LIST OF EQUIPMENT AND WORKS

1. MOBILE LEAD CONCENTRATOR

a. Concentrator Unit Equipment

1 Concentrator
8 Water Basins (concrete)
5 Tents
4 Rubber Tanks
1 Truck
1 Four Wheel Drive Vehicle
1 Front End Loader (1.2 m^3)
Concentrator Spares
Commissioning and Training (10 man months)
Internal Transport
1 Water Pump (200 M pipe)

b. Laboratory Equipment

1 Jaw Grinder
1 PH Meter
1 Oven
1 Magnetic Stirrer
1 Sifter
1 Sifter Box
1 Scale
1 Heating Plate
1 Water Still

2. MOBILE ZINC CONCENTRATOR

1 Concentrator
1 Pump incl. Motors
400 M Pipes
3 Water Basins (concrete)
1 Truck
1 Front End Loader (1.2m^3)
16 Km Road Work
Concentrator Spares
Commissioning and Training (10 man months)
Internal Transport

3. CRUSHING AND GRINDING UNIT

1 Crushing and Grinding Unit
2 Storage Bins (50T)
Crushing and Grinding Unit Spares
Internal Transport

4. GEOLOGICAL PROGRAM

a. Equipment

2 Four Wheel Drive Vehicles
2 Tents
1 Radio Set (2-Way)
2 Hoists
1 Jack-Leg Drill
1 Theodolite
400 M Rails
2 Turntables
2 Wagons
1 Exploration Drill (incl. accessories and spare parts)
Geologist's Tools (compass, altimeter, hammer)

b. Consultants

Metallogenical Survey (36 man months)
Geochemical Survey (42 man months)

c. Reserve Estimation

Technical Assistance
CADETAF Staff
Exploration Drilling
Mine Development Work

5. COLLECTION CENTERS and SUB-CENTERS

9 Scales (2T)
1 Truck Scale (30T)
9 Radio Sets (2-Way, 12 Channels)
5 Four Wheel Drive Vehicles
4 Pumps
800 M Pipes
Furniture
Construction of Four Centers
Construction of Four Sub-Centers

6. TRAINING MINE

2 Compressors (3.5m^3/min.)
2 Light Drills (12 kg) (incl.^{2} accessories and spare parts)
1 Jack Leg Drill
1 Hoist (2T, 130 M Cable)
2 Tents
6 Wagons
200 M. Rails
2 Turntables
7 Km Road Work
1 Four Wheel Drive Vehicle
Mining Timber

7. TECHNICAL SERVICES

a. Workshop Equipment

2 Electric Welding Units
2 Diesel Welding Units
4 Cutting Torches
2 Electric Air Pumps
4 Portable Electric Drills
3 Heaters
3 Battery Chargers
3 Electric Blowers
3 Electric Grease Pumps
3 Double Drum Electric Wrenches
4 Screwplates and Taps
2 Pulley Blocks (2T)
2 Pulley Blocks (5T)
2 Pulley Blocks (10T)
2 Pneumatic Wrenches
4 Jacks (2.5T)
2 Grinding Machines
4 Electricians Tool Sets
2 Stationary Electric Drills
4 Presses
1 Four Wheel Drive Vehicle
4 Workshop Benches
2 Workshop Vans
3 Extractors
8 Wrench Sets
4 Mechanics Tool Sets
2 Equilibrators
4 Bit Sharpeners
Miscellaneous

b. Laboratory Equipment

3 Jaw Grinders
2 PH Meters
2 Ovens
4 Magnetic Stirrers
2 Sifters
2 Sifter Boxes
2 Lab. Scales
2 Heating Plates
2 Water Stills
Miscellaneous Glassworks

c. Surveying Equipment

3 Theodolites (T16)
3 Levels (NK01)

8. PILOT MINES

a. Mining Cooperative Hawanit

1 Hoist (2T)
1 Pump incl. Motor
150 M Pipes
1 Drill Bit Sharpener
200 M Rails
6 Wagons
4 Turntables

b. Mining Cooperative Skendis

1 Compressor (7.1m^3/min.)
400 M Rails
6 Wagons
4 Turntables
1 Scale (2T)
1 Drill Bit Sharpener
3 Light Drills (12 kg) (incl. accessories and spare parts)

c. Mining Cooperative Tamslemt

1 Compressor (4.8m^3/min.)
300 M Rails
6 Wagons
4 Turntables
1 Pumps with Motor
150 M Pipes
1 Drill Bit Sharpener
1 Scale (2T)
2 Light Drills (12kg) (incl. accessories and spare parts)

d. Equipment and Works for Six Taouz Mines (aggregate)

6 Compressor (12.6m^3/min.)
12 Pumps
6 Hoist (2T)
1200 M Rails
12 Turntables
12 Wagons
18 Light Drills (12kg) (incl. accessories and spare parts)
600 M Mine Works (driving of haul tunnel)
Accessories

e. Equipment for the Group of 0 Mines

20 Compressor (3.0 m^3/min.)
20 Light Drill (12kg) (incl. accessories and spare parts)
20 Pneumatic Hoist
2000 M Steel Cable

f. Equipment for the Group of 10 Mines

10 Compressor (2.5m^3/min.)
2000 M Rails
20 Wagons
10 Turntable
10 Light Drill (12kg) (incl. accessories and spare parts)

9. STUDIES (Consultants)

Consultants
Geochemical (42 man-months)
Financial Management (36 man-months)

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

CAPITAL COST BREAKDOWN
(DH '000)

	Base Cost [a]			Physical Contingency			Price Contingency			Tax	Total		
	Foreign	Local	Total	Foreign	Local	Total	Foreign	Local	Total	Local	Foreign	Local	Total
Lead Concentrator	7,837	1,228	9,065	1,149	147	1,296	1,619	366	1,985	1,864	10,605	3,605	14,210
Zinc Concentrator	4,450	591	5,041	660	86	746	1,022	193	1,215	1,079	6,132	1,949	8,081
Crushing and Grinding Unit	1,143	320	1,463	171	48	219	145	57	202	279	1,459	1,884	3,343
Equipment and Work for Mines	7,137	840	7,977	-	90	90	1,571	287	1,858	1,437	8,708	2,654	11,362
Training Mine	446	59	505	-	-	-	49	8	57	82	495	149	644
Geological Program	4,697	3,282	7,979	354	321	675	1,337	1,015	2,352	968	6,388	4,618	11,974
Ore Collection centers	799	1,838	2,637	-	233	233	168	611	779	159	967	2,841	3,808
Equipment for CADETAF's Technical Services	1,123	151	1,274	-	-	-	149	27	176	210	1,272	388	1,660
Technical Assistance to CADETAF	936	687	1,623	93	69	162	193	108	301	250	1,222	864	2,336
Socio-Economic Study	-	320	320	-	32	32	-	52	52	48	-	452	452
Sub-Total	28,568	9,316	37,884	2,427	1,026	3,453	6,253	2,724	8,977	6,376	37,248	19,442	56,690
Working Capital	-	-	-	-	-	-	-	-	-	-	-	10,220	10,220
Project Cost	28,568	9,316	37,884	2,427	1,026	3,453	6,253	2,724	8,977	6,376	37,248	29,662	66,910
Interest during Construction	-	-	-	-	-	-	-	-	-	-	12,172	-	12,172
TOTAL Financing Required	28,568	9,316	37,884	2,427	1,026	3,453	6,253	2,724	8,977	6,376	49,420	29,662	79,082

a/ End-1981 terms

Industrial Projects Department
February 1982

ANNEX 6-2

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

CADETAF: INCREMENTAL WORKING CAPITAL REQUIREMENTS
(DH'000--Current Prices)

	1984	1985	1986	Total
1. Lead Concentrator				
a. Concentrate Stock	77	40	29	146
b. Low-grade ore stock	1,368	3,394	3,262	8,024
Sub-total	1,445	3,434	3,291	8,170
2. Zinc Concentrator				
a. Concentrate Stock	93	48	57	198
b. Low-grade ore stock	103	253	-	356
Sub-total	196	301	57	554
3. Stock of Hand-Sorted Lead Concentrate	402	542	552	1,496
TOTAL	2,043	4,277	3,900	10,220

Assumptions for Working Capital Requirements:

Concentrators

Concentrate Stock: Lead: 0.5 month output
Zinc: 1 month output

Low-Grade Ore Stock (tons):	1984	1985	1986
Lead	10,500	33,500	51,750
Zinc	1,600	7,600	8,350

Stock of Hand-Sorted Lead Concentrate: 1984: 250 tons
1985: 500 tons
1986: 750 tons

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

EQUIPMENT CREDIT FACILITY FOR SMALL-SCALE MINES

1. Establishment and Resources. CADETAF shall establish, effective January 1, 1983, a unit, staffed with the two credit agents referred to in para. 5.41, in charge of operating the Equipment Credit Facility (the Facility) for the financing and provision of equipment and mine works to selected beneficiaries according to the policies and procedures set forth hereunder. CADETAF shall initially fund said Facility out of the Government contribution in an estimated amount of DH 2.66 million (US$0.51 million) and the proceeds of the Bank Loan relent to it, in an estimated total amount of DH 8.71 million (US$1.67 million).

2. Credit Contract. CADETAF shall provide any financing for equipment and mine works under leasing-purchasing arrangements, on terms whereby CADETAF shall obtain by written contract, in form and substance satisfactory to the Bank, with any beneficiary, rights adequate to protect the interests of the Government, the Bank and CADETAF, including the right of CADETAF to:

(a) require the beneficiary to exploit his mine with due diligence and efficiency and in accordance with appropriate financial, engineering and mining practices;

(b) require that the goods to be financed out of the Facility shall be used exclusively for production in the beneficiary mine;

(c) inspect, by itself or jointly with representatives of the Government and the Bank, if the Government or the Bank shall so request, such goods, the sites, works and operations of the beneficiary, and any relevant records and documents;

(d) require the beneficiary to maintain the equipment and mine works provided to it, and promptly to make all necessary repairs or renewals thereof, in accordance with appropriate engineering and mining practices;

(e) obtain all such information the Government, the Bank or CADETAF shall reasonably request relating to the foregoing and to the operations and financial condition of the beneficiary; and

(f) suspend or terminate the right of the beneficiary to the use of the equipment financed out of the Government's funds or of the proceeds of the Loan upon failure to perform its obligations under its contract with CADETAF.

3. Appraisal and Approval of Financing. For any proposed beneficiary, CADETAF shall:

(a) prepare a brief appraisal note including a summary description of the equipment and mine works to be provided under leasing-purchasing arrangements and the estimated cost thereof, the name and status of the beneficiary, and verifying that eligibility criteria determined in agreement with the Bank have been met;

(b) approve the financing of equipment and mine works to be provided to any said beneficary in an amount determined pursuant to paragraph 4 (a) and (b) hereunder and any further financing referred to in paragraph 4 (g) hereunder; and

(c) promptly thereafter, until the completion of the Project, forward to the Bank the appraisal notes referred to in sub-paragraph (a) above and copies of the contract entered into between CADETAF and the beneficiaries.

4. Amount and Terms of Financing.

(a) The amount of financing shall be the equivalent in Dirhams of the cost for equipment and mine works to be provided to each beneficiary according to packages determined, until the completion of the Project, in agreement between the Bank and CADETAF and procured by CADETAF;

(b) The estimated amount of financing for the first 39 beneficiaries of the Facility shall be the equivalent in Dirhams of the following amounts or such other amounts as may be agreed between the Bank and CADETAF:

(i) about US$92,000 each, for three mining cooperatives;

(ii) about US$166,000 each, for about six miners' associations; and

(iii) about US$30,000 each, for about 30 individual miners or miners' associations, each operating one mine;

(c) In the case that the equipment and the mining works to be financed out of the Government's funds and of the proceeds of the Loan shall require a change and as a result thereof the amount of financing to be provided shall exceed 25% of any of the estimated amounts set forth in sub-paragraph (b) above, CADETAF shall provide the Bank with a justification for said change and obtain its approval thereon.

(d) CADETAF shall provide any financing for a term of five years, including one year of grace on the principal, at a rate of interest of 12% per annum on the principal amount outstanding from time to time, with repayment terms of principal and interest in quarterly installments through deductions from payments for ore deliveries by the beneficiary or payable in cash;

(e) A benefiary shall have the legal title to the equipment provided to him only upon the full repayment of the financing;

(f) In the case that a beneficiary is a miners' association: CADETAF shall ensure that the miners' association is duly established as an entity and entrusted with appropriate responsibilities under the Borrower's laws which, inter alia, permit the entering into a written agreement with CADETAF and enable its members to be jointly and severally responsible for the repayment of the financing; and

(g) CADETAF shall use the proceeds of repayments of principal and interest made by the beneficiaries with respect to the financing provided to them by the Facility in the following order of priority: (i) servicing the proceeds of the portion of the Bank Loan allocated to it as set forth in para. 1 and (ii) financing and providing additional equipment and mine works to beneficiaries mentioned in para. 4 (b) as well as other beneficiaries selected pursuant to para. 3 (a) above.

5. Supervision. CADETAF shall closely monitor the performance of the beneficiaries and make periodic visits to the mines operated by said beneficiaries. CADETAF shall prepare regular evaluation and supervision reports based on guidelines to be determined in agreement with the Bank.

6. Not later than June 30, 1985, or such other date as the Bank and CADETAF may agree, CADETAF shall exchange views with the Bank on the contents of the appraisal for beneficiaries, the terms of financing and the guidelines for supervision, and promptly thereafter make any modifications thereon as they may be agreed between CADETAF and the Bank.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

LIST OF EQUIPMENT TO BE FINANCED OUT OF THE PROCEEDS OF THE BANK LOAN
(US$ Thousand)

A. Equipment to be Procured through International Competitive Bidding	Approximate Value 1/
1. Lead Concentrator	1,685
2. Zinc Concentrator	954
3. Crushing and Grinding Unit	244
4. Compressors	843
Sub-total	3,726

B. Equipment to be Procured through International Shopping	
1. Front-end Loaders	109
2. Light Hoists	124
3. 4-Wheel Drive Vehicles	81
4. Light Exploration Drills, incl. accessories and spare parts	135
5. Two-ton Hoists	230
6. Pumps	67
7. Rails	241
8. Turntables	36
9. Wagons	126
10. Pipes	51
11. Radio Sets (2-way)	25
12. Surveying Equipment	30
13. Jaw Grinder	47
14. Workshop Vans	54
15. Light Hand Drills, incl. accessories and spare parts	150
Sub-total	1,506

C. Equipment to be Procured by Prudent Local Shopping 2/	Approximate Value 1/
1. Trucks	20.8
2. Truck Scale	16.1
3. Scales	31.0
4. Electric Welding Units	2.5
5. Diesel Welding Units	8.6
6. Gas Welding Units	9.4
7. Electric Air Pumps	1.0
8. Portable Electric Drills	11.7
9. Heaters	2.3
10. Battery Charger	5.3
11. Electric Compressors	1.6
12. Electric Grease Pumps	5.8
13. Double Drum Electric Wrenches	0.6
14. Screw Plate and Taps	1.2
15. Pulley Blocks	1.9
16. Pneumatic Wrenches	2.3
17. Jacks	1.0
18. Grinding Machines	5.0
19. Electrician's Tool Sets	1.9
20. Stationary Electric Drills	5.8
21. Presses	1.9
22. Work Benches	0.8
23. Extractors	1.0
24. Wrench Sets	2.1
25. Mechanic's Tool Sets	11.7
26. Equilibrators	7.8
27. Misc. Tools	17.5
28. PH Meters	3.9
29. Ovens	3.8
30. Magnetic Stirrers	0.9
31. Sifters	5.4
32. Sifter Boxes	1.9
33. Laboratory Scales	6.4
34. Heating Plates	0.6
35. Water Stills	2.5
36. Misc. Glassworks	8.2
37. Drill Bit Sharpeners	1.2
38. Miscellaneous	0.7
Sub-total	214.1
Total Equipment Cost	5,446.1
Physical contingency	523.0
Grand Total	5,969.1

1/ Incl. Escalation.
2/ Value represents indirect foreign exchange contained in the equipment.

Industrial Projects Department
February 1982

ANNEX 6-5

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

ESTIMATED DISBURSEMENT SCHEDULE FOR THE BANK LOAN a/
(US$ Million)

Calendar Year	Quarter	Estimated Disbursements	Cumulative Estimated Disbursements	% Total Disbursements
1982	III	0.03	0.03	0.3
	IV	0.11	0.14	1.5
1983	I	0.08	0.22	2.3
	II	1.13	1.35	14.2
	III	0.53	1.88	19.8
	IV	0.55	2.42	25.5
1984	I	1.78	4.21	44.3
	II	1.78	5.99	63.1
	III	0.59	6.58	69.3
	IV	0.69	7.26	76.4
1985	I	0.22	7.49	78.8
	II	0.69	8.18	86.1
	III	0.25	8.43	88.7
	IV	0.49	8.92	93.9
1986	I	-	8.92	93.9
	II	0.52	9.44	99.3
	III	0.03	9.47	99.7
	IV	0.03	9.50	100.0

a/ Based on a country-wide disbursement profile for the mining subsector in EMENA countries adjusted for particular features of the Project procurement.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

PROJECTED PRODUCTION OF LEAD AND ZINC CONCENTRATE

(Metric Tons)

	1982	1983	1984	1985	1986	1987	1988	1989	1990
A. LEAD CONCENTRATE									
1. Without Project									
a. Lead with Silver	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000	2,000
b. Lead without Silver	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000
Sub-total	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000	8,000
2, Incremental Production									
a. Lead with Silver									
Taouz Mines (Project Equipment)	--	145	480	915	1,250	1,395	1,440	1,440	1,440
Erfoud Mines (Old Equipment from Taouz Mines)	--	400	1,500	2,000	2,000	2,000	2,000	--	--
New Ore Collection Center	--	200	500	800	900	1,000	1,000	1,000	1,000
Lead Concentrator	--	-	325	1,185	1,650	1,960	2,225	2,275	2,285
Non-Pilot Mines	--	-	-	--	250	500	625	750	750
Sub-total	--	745	2,805	4,900	6,050	6,855	7,290	5,465	5,475
b. Lead without Silver									
Cooperative (Project Equipment)	--	45	200	345	415	445	445	445	445
Other Mines (Project Equipment)	--	240	1,020	1,740	2,040	2,160	2,160	2,160	2,160
New Ore Collection Centers	--	325	450	500	550	550	550	550	550
Lead Concentrator	--	-	325	1,185	1,650	1,960	2,225	2,275	2,285
Concentrator induced production of hand-sorted concentrate	--	-	500	1,000	1,000	1,000	1,000	1,000	1,000
Non-Pilot Mines	--	-	-	--	250	500	625	750	750
Sub-total	--	610	2,495	4,770	5,905	6,615	7,005	7,180	7,190
B. ZINC CONCENTRATE									
1. Without Project	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6.000
2. Incremental Production									
Zinc Concentrator	--	--	560	5,510	7,490	7,560	7,560	7,560	7,560
C. TOTAL INCREMENTAL PRODUCTION									
1. Lead Concentrate	--	1,355	5,300	9,670	11,955	13,470	14,295	12,645	12,665
2. Zinc Concentrate	--	--	560	5,510	7,490	7,560	7,560	7,560	7,560
D. TOTAL ARTISANAL PRODUCTION	14,000	15,355	19,860	29,180	33,445	35,030	35,855	34,205	34,225

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

INCREMENTAL PRODUCTION AND INCOME OF PILOT MINES
(DH'000--1981 Real Terms)

MINING COOPERATIVE HAWANIT

	Year 1	Year 2	Year 3-5
Production of lead concentrate (tons) a/	90	105	120
Sales revenues b/	119	138	158
Expenses			
(a) Consumables	24	24	24
(b) Debt Service	37	101	101
Incremental net income	58	13	33
Incremental net income per member c/	2	0.4	1

Net income per member without project: DH 8,000/year (estimated)
Average income increase with project: 13%

a/ Production without project: 400 tpy.
b/ 1,317 DH/ton at 60% Pb.
c/ 32 members

EACH OF SIX TAOUZ MINES

	Year 1	Year 2	Year 3-5
Production of lead concentrate (tons) a/	144	192	240
Sales revenues b/	216	288	360
Expenses			
(a) Consumables	46	46	46
(b) Debt Service	73	201	201
Incremental net income	97	41	113
Incremental net income per member c/	1.5	0.7	2

Net income per member without project: DH 6,400/year (estimated)
Average income increase with project: 26%

a/ Production without project: 480 tpy.
b/ 1,499 DH/ton (including DH 251/t silver premium) at 60% Pb.
c/ 60 members

MINING COOPERATIVE SKENDIS

	Year 1	Year 2	Year 3-5
Production of lead concentrate (tons) a/	108	144	180
Sales revenues b/	142	190	237
Expenses			
(a) Consumables	24	24	24
(b) Debt Service	41	112	112
Incremental net income	77	54	101
Incremental net income per member c/	1.5	1	2

Net income per member without project: DH 4,800/year (estimated)
Average income increase with project: 35%

a/ Production without project: 360 tpy.
b/ 1,317 DH/ton at 60% Pb.
c/ 50 members

EACH OF 30 "OTHER MINES"

	Year 1	Year 2	Year 3-5
Production of lead concentrate (tons) a/	48	60	72
Sales revenues b/	63	79	95
Expenses			
(a) Consumables	12	12	12
(b) Debt Service	13	36	36
Incremental net income	38	31	47
Incremental net income per member c/	1	1	1.5

Net income per member without project: DH 4,800/year (estimated)
Average income increase with project: 27%

a/ Production without project: 240 tpy.
b/ 1,317 DH/ton at 60% Pb.
c/ 33 miners

MINING COOPERATIVE TAMSLAMT

	Year 1	Year 2	Year 3-5
Production of lead concentrate (tons) a/	96	120	144
Sales revenues b/	126	158	190
Expenses			
(a) Consumables	24	24	24
(b) Debt Service	43	118	118
Incremental net income	59	16	48
Incremental net income per member c/	0.7	0.2	0.6

Net income per member without project: 4,000 DH/year (estimated)
Average income increase with project: 14%

a/ Production without project: 480 tpy.
b/ 1,317 DH/ton at 60% Pb.
c/ 87 members

Industrial Projects Department
February 1982

ANNEX 7-3

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

PROJECTED CASH FLOW OF PILOT MINES
(DH '000 - Current Terms)

	1983	1984	1985	1986	1987	1988	1989	1990
1. Cooperative Hawanit								
a. Incremental Sales Revenue	57	146	199	224	237	126	-	-
b. Consumables	14	30	32	34	36	19	-	-
c. Debt Service	25	100	140	128	115	53	-	-
Cash Surplus	18	16	27	62	86	54	-	-
2. Cooperative Skendis								
a. Incremental Sales Revenue	-	81	222	302	355	377	199	-
b. Consumables	-	15	32	34	36	39	21	-
c. Debt Service	-	30	119	166	152	138	63	-
Cash Surplus	-	36	71	102	167	200	115	-
3. Cooperative Tamslamt								
a. Incremental Sales Revenue	-	71	191	246	284	302	160	-
b. Consumables	-	15	32	34	36	39	21	-
c. Debt Service	-	31	125	174	159	144	66	-
Cash Surplus	-	25	34	38	89	119	73	-
4. 1 Taouz Mine (1st Group)								
a. Incremental Sales Revenue	106	289	434	510	539	286	-	-
b. Consumables	26	57	62	66	70	37	-	-
c. Debt Service	48	192	270	246	222	104	-	-
Cash Surplus	32	40	102	198	247	145	-	-
5. 1 Taouz Mine (2nd Group)								
a. Incremental Sales Revenue	-	124	338	459	539	573	303	-
b. Consumables	-	28	62	66	70	74	39	-
c. Debt Service	-	52	207	291	267	240	110	-
Cash Surplus	-	44	69	102	202	259	154	-
6. 1 Taouz Mine (3rd Group)								
a. Incremental Sales Revenue	-	-	145	357	485	573	606	322
b. Consumables	-	-	31	66	70	74	79	41
c. Debt Service	-	-	55	221	310	284	255	118
Cash Surplus	-	-	59	70	105	215	272	163
7. 1 Other Mine (1st Group)								
a. Incremental Sales Revenue	30	81	116	134	142	75	-	-
b. Consumables	7	15	16	17	18	10	-	-
c. Debt Service	9	36	51	46	42	18	-	-
Cash Surplus	14	30	49	65	82	35	-	-
8. 1 Other Mine (2nd Group)								
a. Incremental Sales Revenue	-	36	95	123	142	151	80	-
b. Consumables	-	8	16	17	18	19	10	-
c. Debt Service	-	10	39	54	49	45	20	-
Cash Surplus	-	18	40	52	75	87	50	-

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

PROJECTED ORE PURCHASE PRICES PER TON OF HAND-SORTED LEAD CONCENTRATE

(DH - Current Prices)

	1982	1983	1984	1985	1986	1987	1988	1989	1990
1. LME - Price of Lead	4,290	4,915	5,615	6,420	6,810	7,200	7,645	8,085	8,580
2. Lead Concentrate at 60% Pb [a/]	2,445	2,802	3,201	3,659	3,882	4,104	4,358	4,608	4,891
3. Silver Premium	271	292	312	337	358	379	402	426	451
4. Smelting Charges	623	673	724	778	829	878	931	987	1,046
5. Freight and Insurance	101	109	117	126	135	143	151	160	170
6. Internal Transport	178	198	215	232	250	266	282	299	317
7. Storage and Handling	16	18	20	21	23	24	26	27	29
8. Crushing Fee	30	30	29	29	29	28	31	30	30
9. Laboratory Fee	21	22	24	25	28	29	31	32	34
10. Gross Minehead Value									
a. Ore with Silver	1,747	2,044	2,384	2,785	2,946	3,115	3,308	3,499	3,716
b. Ore without Silver	1,476	1,752	2,072	2,448	2,588	2,736	2,906	3,073	3,265
11. Export Tax [b/]									
a. Ore with Silver	86	201	235	274	290	307	326	345	366
b. Ore without Silver	73	173	204	241	255	269	286	303	322
12. Net Minehead Value [c/]									
a. Ore with Silver	1,635	1,843	2,149	2,511	2,656	2,808	2,982	3,154	3,350
b. Ore without Silver	1,381	1,579	1,868	2,207	2,333	2,466	2,620	2,770	2,943
13. CADETAF Withholding Margin [d/]									
a. Ore with Silver	327	369	430	502	531	561	596	631	670
b. Ore without Silver	276	316	374	442	467	493	524	554	589
14. Ore Purchasing Price									
a. Ore with Silver	1,308	1,474	1,719	2,009	2,125	2,247	2,386	2,523	2,680
b. Ore without Silver	1,105	1,263	1,494	1,765	1,866	1,973	2,096	2,216	2,355

a/ 0.95 x 0.60 x LME.
b/ On gross minehead value net of 1.5% losses; export tax is 5% if LME-price is equal to or below ₺ 450/ton and 10% if above.
c/ Net of 1.5% loss and export tax.
d/ 25% on ore purchase price.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

PROJECTED ORE PURCHASE PRICES PER TON OF LOW-GRADE LEAD ORE

(DH - Current Prices)

	1984	1985	1986	1987	1988	1989	1990
1. LME - Price of Lead	5,165	6,420	6,810	7,200	7,645	8,085	8,580
2. Lead Concentrate of 67% Pb a/	3,574	4,086	4,335	4,583	4,866	5,146	5,461
3. Silver Premium	312	337	358	379	402	426	451
4. Smelting Charges	724	778	829	878	931	987	1,046
5. Freight and Insurance	117	126	135	143	151	160	170
6. Internal Transport	215	232	250	266	282	299	317
7. Storing and Handling	20	21	23	24	26	27	29
8. Laboratory Fee (CADETAF)	24	25	28	29	31	32	34
9. Concentrating Fee (CADETAF)	979	1,307	1,378	1,433	1,472	1,543	1,638
10. Gross Minehead Value							
a. Ore with Silver	1,807	1,934	2,050	2,189	2,375	2,524	2,678
b. Ore without Silver	1,495	1,597	1,692	1,810	1,973	2,098	2,227
11. Equivalent Value Per Ton of Low Grade Ore at 10% Pb b/							
a. Ore with Silver	229	246	260	278	302	321	340
b. Ore without Silver	190	203	215	230	251	266	283
12. Export Tax c/							
a. Ore with Silver	23	24	26	27	30	32	34
b. Ore without Silver	19	20	21	23	25	26	28
13. Net Minehead Value d/							
a. Ore with Silver	203	218	230	247	268	285	301
b. Ore without Silver	168	180	191	204	223	236	251
14. CADETAF Withholding Margin e/							
a. Ore with Silver	18	20	20	23	25	26	27
b. Ore without Silver	15	16	18	19	21	22	23
15. Ore Purchasing Price							
a. Ore with Silver	185	198	210	224	243	259	274
b. Ore without Silver	153	164	173	185	202	214	228

a/ 0.95 x 0.67 x LME.
b/ Conversion Factor = 0.127
c/ On equivalent minehead value net of 1.5% losses; export tax is 5% if LME-price is equal to or belwo £ 450/ton and 10% if above.
d/ Net of 1.5% loss and export tax.
e/ 10% on ore purchase price.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

PROJECTED ORE PURCHASE PRICES FOR TON OF HAND-SORTED ZINC CONCENTRATE

(DH - Current Prices)

	1982	1983	1984	1985	1986	1987	1988	1989	1990
1. LME - Price on Zinc	4,705	5,225	5,800	6,420	6,865	7,360	7,850	8,400	8,995
2. Zinc Concentrate at 46% Zn a/	1,788	1,986	2,203	2,440	2,608	2,796	2,984	3,191	3,418
3. Smelting Charges	728	783	842	905	966	1,024	1,085	1,150	1,219
4. Freight and Insurance	101	109	117	126	135	143	151	160	170
5. Internal Transport	158	175	191	206	221	236	250	265	281
6. Storing and Handling	16	18	20	21	23	24	26	27	29
7. Crushing Fee (CADETAF)	30	30	29	29	29	28	31	30	30
8. Laboratory Fee (CADETAF)	21	22	24	25	28	29	31	32	34
9. Calcination Fee (CADETAF)	113	125	137	147	157	167	177	187	198
10. Gross Minehead Value	621	724	843	981	1,049	1,145	1,233	1,340	1,457
11. Equivalent Value before Calcination (35% Zn) b/	472	550	641	746	797	870	937	1,018	1,107
12. Export Tax c/	2	3	3	4	4	4	5	5	5
13. Net Minehead Value	470	547	638	742	793	866	932	1,013	1,102
14. CADETAF withholding margin	43	49	58	67	72	79	84	92	101
15. Ore Purchase Price	427	498	580	675	721	787	848	921	1,001

a/ (0.46-0.08) x LME
b/ Conversion Factor: 0.76
c/ On gross minehead value net of 1.5% losses, export tax is 0.5%.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

PROJECTED PURCHASE PRICES PER TON OF LOW-GRADE ZINC ORE

(DH - Current Prices)

	1984	1985	1986	1987	1988	1989	1990
1. LME - Price of Zinc	5,800	6,420	6,865	7,360	7,850	8,400	8,995
2. Zinc Concentrate at 46% Zn[a]	2,203	2,440	2,608	2,796	2,984	3,191	3,418
3. Smelting Charges	842	905	966	1,024	1,085	1,150	1,219
4. Freight and Insurance	117	126	135	143	151	160	170
5. Internal Transport	191	206	221	236	250	265	281
6 Storing, Handling	20	21	23	24	26	27	29
7. Laboratory Fee (CADETAF)	24	25	28	29	31	32	34
8. Calcination Fee (CADETAF)	137	147	157	167	177	187	198
9. Concentrating Fee (CADETAF)	410	400	386	373	375	384	408
10. Gross Minehead Value	462	610	692	796	889	986	1,079
11. Equivalent Value per ton of low-grade ore at 15% Zn[b]	120	159	180	207	231	256	281
12. Export Tax[c]	1	1	1	1	2	3	3
13. Net Minehead Value	118	156	176	203	226	250	273
14. CADETAF Withholding Margin	11	14	16	19	21	23	25
15. Ore Purchase Price	107	142	160	184	205	227	248

a/ (0.46-0.08) x LME
b/ Conversion Factor: 0.26
c/ On equivalent minehead value net of 1.5% losses, export tax is 0.5%.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

CADETAF: INCREMENTAL STAFFING AND OPERATING COST
(end 1981 Prices)

	DH/Year	
1. Concentrators	Lead	Zinc
a. Labor		
1 Technician	41,400	34,500
3 Foremen	62,100	41,400
19 Skilled Workers	209,800	-
16 Unskilled Workers	154,600	-
9 Skilled Workers	-	99,400
3 Unskilled Workers	-	29,000
Sub-Total	467,900	204,300
b. Fuel		
Lead concentrator (40 l/hr)	927,300	-
Zinc concentrator (20 l/hr)	-	463,600
c. Consumables		
Chemical reagents	230,000	-
Grinding balls	115,000	-
Spares and maintenance	115,000	80,500
Relocation of concentrator	92,000	46,000
Sub-Total	552,000	126,500
TOTAL	1,947,200	794,400

2. Crushing and Grinding Unit	DH/Year
5 Unskilled Workers	48,300
Maintenance and spares	34,500
Power	69,000
TOTAL	151,800

3. Laboratory Services	
2 Laboratory technicians and 2 Assistants	154,100
Power	50,600
Reagents and miscellaneous	287,500
TOTAL	492,200

4. Management Staff	
1 Technical Director	103,500
1 Ore Beneficiation Engineer	82,800
TOTAL	186,300

5. Training Mine	DH/Year
1 Foreman	16,500
4 Skilled miners	41,400
2 Unskilled workers	16,500
Consumables	58,600
TOTAL	133,000

6. Credit Unit	
2 Credit agents	41,400
Consumables	23,000
TOTAL	64,400

7. Statistical Unit	
2 Staff	34,500
Consumables	5,700
TOTAL	40,200

8. Geological Department	
1 Geologist	55,200
2 Surveyors	41,400
2 Geologist Technicians	41,400
TOTAL	138,000

9. Workshops	
14 Unskilled workers	270,400
2 Drivers	27,600
Consumables	149,500
TOTAL	447,500

10. Ore Collection Centers and Sub-Centers	
4 Centers Chiefs	55,200
4 Sub-Center Chiefs	49,700
12 Workers, Laborers, Guards	91,900
Sub-Total	196,800
Fuel	110,400
Miscellaneous	161,000
TOTAL	468,200

TOTAL INCREMENTAL OPERATING COST:	4863,300

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

CADETAF: INCREMENTAL OPERATING COST
(DH'000 Current Terms)

	1982	1983	1984	1985	1986	1987	1988	1989	1990
A. Recovery through Fees									
1. Lead Concentrator	-	-	811	2,375	2,850	3,039	3,259	3,482	3,724
2. Zinc Concentrator	-	-	126	915	1,175	1,245	1,346	1,442	1,492
3. Crushing and Grinding Unit	-	58	188	202	217	229	243	258	273
4. Laboratory Services	129	284	612	659	706	745	792	844	888
5. Calcination of preconcentrated Zinc ore	-	-	110	714	1,019	1,076	1,143	1,218	1,282
Sub-total	129	342	1,847	4,865	5,967	6,334	6,783	7,244	7,659
B. Recovery through Withholding Margin									
6. Ore Collection Centres	-	68	218	393	588	709	753	803	844
7. Training Mine	-	76	164	177	189	200	213	226	238
8. Workshops	-	259	558	600	643	679	721	768	809
9. Credit Unit	-	75	82	88	95	100	106	113	119
10. Statistical Unit	-	47	51	55	60	62	66	70	74
11. Geological Staff	-	163	177	190	204	215	229	243	257
12. Management Staff	101	171	237	255	274	289	307	326	344
Sub-total	101	859	1,487	1,758	2,053	2,254	2,395	2,549	2,685
TOTAL	230	1,201	3,334	6,623	8,020	8,588	9,178	9,793	10,344

Industrial Projects Department
Feburary 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

COST RECOVERY

1. Summary. Previously CADETAF has purchased only high-grade ores suitable for direct use as a concentrate and has deducted 25% of the purchase price of the concentrate from the payment made to the miners in order to cover its operating costs and to provide for technical assistance and investments for the mining operations. As a result of the Project, CADETAF will now be able to purchase low-grade ores in addition to continued purchases of high-grade ores. The low-grade ores will require processing and treatment by CADETAF to produce concentrates. A schedule of charges for treatment, etc., of the low-grade ore has been agreed with CADETAF. These charges include full recovery of costs including charges on net fixed assets and interest. Associated with the introduction of these charges, it is also proposed that instead of the present system which requires that a fixed proportion of the 25% of the ore purchase price be withheld by CADETAF for technical assistance and investments, CADETAF will introduce a budget system to determine the annual level of assistance and investments outside the scope of the Project. This change should strengthen CADETAF's financial stability and stabilize CADETAF's technical assistance/ investment assistance.

2. Ore Pricing Formula for Purchases from Miners: The present ore pricing formula, which provides for a withholding margin of 25% on the ore purchase price to cover CADETAF's operating expense and technical assistance to miners (para. 3.10) would not generate enough revenues to recover the incremental operating cost and capital expenditures under the Project. The two principal options are: (i) to increase the withholding margin across the board; or (ii) to levy treatment fees for specific services. While recognizing that any upward change of the pricing formula is a sensitive matter, the second option has been agreed with CADETAF because (i) it is equitable in that those miners benefiting directly from certain project activities will support the resulting additional charges; and, related to that (ii) it minimizes the impact on miners who benefit only marginally from project activities.

3. The ore pricing formula to be applied in the future will therefore include, as applicable for the different ore types, calcination, crushing, concentrator and laboratory fees, while lowering the withholding margin to 10% for certain ore types to compensate for the introduction of treatment fees presently not charged. The changes are shown in the table below:

Proposed Changes in Ore Pricing Formula

Hand-sorted Lead Concentrate	Low-Grade Lead Ore	Hand-sorted Zinc Concentrate	Low-Grade Zinc Ore
	Present Situation		
25% Withholding Margin	- a/	25% Withholding Margin	- a/
	Proposed Formula		
25% Withholding Margin	10% Withholding Margin	10% Withholding Margin	10% Withholding Margin
-	-	Calcination Fee	Calcination Fee
Crushing Fee	-	Crushing Fee	-
-	Concentrator Fee	-	Concentrator Fee
Laboratory Fee	Laboratory Fee	Laboratory Fee	Laboratory Fee

a/ Not purchased at present.

4. Where the old and the new formulas can be directly compared, i.e., for hand-sorted lead and zinc concentrates, the new pricing formula will, when introduced in 1982, result in the following relative decreases of the ore purchase prices paid to the miners: 3.5% for lead concentrate with silver, 4.1% without silver, and 8.8% for hand-sorted zinc concentrate. In absolute terms, however, the projected current 1982 purchase prices, calculated according to the new formula, will still be above the current 1981 prices calculated according to the old formula: 8.5% for lead concentrate with silver, 9.3% without silver, and 6.6% for hand-sorted zinc concentrate. This is considered acceptable to the producers of hand-sorted lead concentrate, among whom will be the majority of those miners whose direct benefits from the Project are expected to be marginal. For the producers of hand-sorted zinc concentrate, this is also considered to be acceptable because zinc prices are projected to increase in real terms at an average rate of 1.0% p.a. until 1990. Also, most producers of hand-sorted zinc concentrate will regularly benefit from the zinc concentrator.

5. Under the proposed pricing formula for low-grade ores, projected current purchase prices for 1984, the first year of low-grade ore purchases, are DH 185/t for low-grade lead ore with silver, DH 153/t without silver, and DH 107/t for low-grade zinc ore. At an estimated production cost of DH 40/t of low-grade ore, between 63% and 78% of the revenues from low-grade ore constitute net incremental income to the miners, providing a strong production incentive.

6. Ore Payment Formula. Hand-sorted concentrates will, as at present, be fully paid at the time of purchase, whereas low-grade ores will be paid in two installments, 80% at the time of purchase and the remaining 20% twelve *months later. This is necessary to reduce the amount of working capital* required for the concentrators as well as the price risks that CADETAF must carry between purchase of low-grade ore and concentrate sales. The payment of low-grade ore in two installments is considered acceptable to the miners because of the largely incremental nature of this income.

7. For hand-sorted concentrates, the monthly calculation of ore purchase prices, based on the LME price of the previous month, will be maintained. Low-grade ore will be purchased at a fixed annual price, which CADETAF will estimate for a given year, and the 80% down payment at the time of ore purchase will be made against this estimated price. At the end of each year, CADETAF will establish the actual average price, based on actual metal prices, and on the technical performance of the concentrators. Payment of the remaining 20% will be based on this actual price.

8. Allocation of Withholding Margin. The present ore pricing formula stipulates that the 25% withholding margin be allocated as follows: 15% to cover administrative costs (10%) and investments (5%), and 10% for technical assistance to miners. This allocation is unrealistic because it assumes that CADETAF's administrative cost can be manipulated according to the prevailing level of ore purchases and the resulting theoretical margin for administrative cost. The allocation further assumes that CADETAF's administrative costs can be held at or below 10% of ore purchases under normal circumstances, which in practice has never been the case as, even in good years, administrative costs have been at 12% to 14%. Also, the correct allocation of cost to one of the three categories is, in practice, difficult to determine, particularly regarding staff resources, and is thus open to judgment. Therefore, and in view of the new withholding margins (para. 3) the allocation of the withholding margin will be determined according to annual operating, investment and technical assistance budgets. They will be based on CADETAF's actual financial results of the previous year and projections for the coming year. DOM, responsible for all changes in the pricing formula (the "Bareme d'Achat") will then set (and change) the percentage allocation of the withholding margin on an annual basis. It was further agreed, that the budgets will be reviewed in mid-year, and, if necessary, adjusted by July 31 to reflect actual developments during the first six months. This will assure that investments and technical assistance are planned on a realistic basis, and thus are likely to be carried out.

9. Cost Recovery Through Treatment Fees. The treatment fees for the two concentrators and the crushing and grinding unit will be calculated as follows:

(a) Operating Cost. CADETAF will establish an annual operating budget for each of the three cost centers based on the operating cost of the previous year and expected cost increases for the year for which the budget is prepared.

(b) Replacement Charge. Replacement costs will be calculated for each facility based on actual installed cost inflated over 15 years at a compound escalation rate of 5% p.a., representing a compounding factor of 2.079. Annual replacement charges will be 5% of replacement cost in each of the first five years, 6.7% in each of the following five years and 8.3% in each of the last five years, thus recovering the full amount of estimated replacement cost. The lower charge at the beginning is intended to contribute to attractive current ore purchase prices during the initial years. Under the above formula above, installed cost will be recovered after 8.5 years.

(c) Financial Charge on Fixed Assets. An annual charge will be calculated for notional interest on net fixed assets, i.e., installed cost minus accumulated replacement charges. The interest rate applied will be 11%, which is the effective rate that BNDE charges on medium and long-term loans for industrial projects.

(d) Financial Charge on Working Capital (for concentrators only). An annual charge will be calculated for notional interest on working capital. For practical purposes, working capital will be defined as the average stocks of low-grade ore and processed concentrate, which constitute most of the working capital of the concentrators. The interest rate applied in a given year will be the one applicable to short-term loans in Morocco.

The fees thus charged the miners will not only recover operating and installed cost, but also financial charges at market rates on all capital expenditures and therefore contain no subsidy element. Recovering estimated replacement costs of fixed assets will strengthen the self-financing capacity of CADETAF with regard to future investments, in particular since no sinking fund provision is included in the replacement charge.

10. The treatment fees for the concentrators and the crushing unit will be calculated on a per ton basis according to expected output. The concentrator fees during the start-up period, i.e. 1984 and 1985, will be based on output at full capacity to avoid a distorted introductory price when low-grade ores are first purchased.

11. The calcination fee will be calculated on the basis of an annual operating budget for the calcination facilities, which will include maintenance work on the kiln such as refractory relining. No other charges will be included because the kilns, as self-constructed assets, have been fully depreciated during construction.

12. The laboratory fee will be calculated on the basis of an annual operating budget. No other charges will be included.

13. Cost Recovery Through Withholding Margin. All other operating costs, capital expenditures and financial charges will be recovered through CADETAF's withholding margin of 25% on the purchase price for hand-sorted lead concentrate and of 10% on the purchase price for low-grade ores and hand-sorted zinc concentrate (para. 3).

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

CADETAF PROJECTED INCOME STATEMENT

(DH '000 - current prices)

	1982	1983	1984	1985	1986	1987	1988	1989	1990
Concentrate Sales (Tons)	14,000	15,355	19,860	29,180	33,445	35,030	35,855	34,205	34,225
Average Price (DH/Ton)	1,534	1,819	2,196	2,464	2,615	2,813	3,016	3,159	3,370
Sale of Concentrates	21,478	27,937	43,614	71,913	87,451	98,525	108,150	108,059	115,351
Sale of Consumables to Miners	400	550	700	850	1,000	1,150	1,300	1,450	1,600
Other Revenues a/	135	140	145	150	155	160	165	170	175
Total Revenues	22,013	28,627	44,459	72,913	88,606	99,835	109,615	109,679	117,126
Ore Cost									
Ore Purchases	12,617	16,326	24,911	38,117	46,269	53,409	59,574	59,380	63,492
Purchase of Consumables for Sale to Miners	400	550	700	850	1,000	1,150	1,300	1,450	1,600
Internal Transport	2,372	2,902	4,113	6,471	7,970	8,911	9,677	9,765	10,361
Storing and Handling	224	276	397	613	769	841	932	924	993
Freight and Insurance	1,414	1,674	2,324	3,677	4,515	5,009	5,414	5,473	5,818
Export Tax	626	1,720	2,853	4,340	5,143	5,816	6,447	6,260	6,648
Total Ore Cost	17,653	23,448	35,298	54,068	65,666	75,136	83,344	83,252	88,912
CADETAF Operating Cost									
Ore Treatment b/ and Laboratories (recovered through fees)	129	342	1,847	4,865	5,967	6,334	6,783	7,244	7,659
Operating Cost Without Project	4,000	4,240	4,494	4,764	5,200	5,512	5,842	6,193	6,564
Incremental Operating Cost (recovered through withholding Margin)	101	859	1,487	1,758	2,053	2,254	2,395	2,549	2,685
Total Operating Cost	4,230	5,441	7,828	11,387	13,220	14,100	15,020	15,986	16,908
Depreciation and Amortization of IDC	-	241	2,050	3,840	4,902	5,370	5,343	5,078	4,793
Financial Charges									
Government Loan (IBRD) c/	-	-	-	-	2,239	4,231	3,899	3,568	3,237
Net Income (Loss)	130	(503)	(717)	3,618	2,579	998	2,009	1,795	3,276

a/ Fees for dewatering Erfoud Mines.
b/ Concentrators, Crushing Unit, Calcination Kilns.
c/ Excluding Equipment Credit Facility.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

CADETAF PROJECTED FUNDS FLOW STATEMENT
(DH '000 - Current Terms)

	1982	1983	1984	1985	1986	1987	1988	1989	1990
SOURCES OF FUNDS									
Internal Sources									
Net Income (Loss)	130	(503)	(717)	3,618	2,579	998	2,009	1,795	3,276
Interest on Long-Term Debt a/	-	-	-	-	2,239	4,231	3,899	3,568	3,237
Depreciation and Amortization	-	241	2,050	3,840	4,902	5,370	5,343	5,078	4,793
Total Internal Sources	130	(262)	1,333	7,458	9,720	10,599	11,251	10,441	11,306
Borrowings									
Government Loan (IBRD) a/	623	9,608	20,418	7,358	3,008	-	-	-	-
Equity Investments									
Government Contribution a/	269	4,558	10,150	7,048	1,820	-	-	-	-
TOTAL SOURCES OF FUNDS	1,022	13,904	31,901	21,864	14,548	10,599	11,251	10,441	11,306
APPLICATION OF FUNDS									
Capital Expenditures									
Proposed Project b/	697	13,116	25,208	5,258	1,058	-	-	-	-
Increase in Working Capital (project related)	-	-	2,043	4,277	3,900	1,918	401	133	141
Interest during Implementation	195	1,050	3,317	4,871	2,739	-	-	-	-
Replacement Expenditures	-	-	-	-	-	-	-	592	230
Increase (decrease) of Working Capital (non-project related)	281	304	1,333	3,854	2,057	537	2,324	346	429
Total Capital Expenditures	1,173	14,470	31,901	18,260	9,754	2,455	2,725	1,071	800
Debt Service									
Interest on Long-Term Debt a/	-	-	-	-	2,239	4,231	3,899	3,568	3,237
Repayment of IBRD Loan a/	-	-	-	-	1,421	2,842	2,842	2,842	2,842
Repayment of Government Advance	-	-	-	-	-	2,000	-	-	-
Total Debt Service	-	-	-	-	3,660	9,073	6,741	6,410	6,079
TOTAL APPLICATIONS OF FUNDS	1,173	14,470	31,901	18,260	13,414	11,528	9,466	7,481	6,879
INCREASE (DECREASE) IN CASH	(151)	(566)	-	3,604	1,134	(929)	1,785	2,960	4,427
CASH AT BEGINNING OF YEAR	717	566	-	-	3,604	4,738	3,809	5,594	8,554
EXCESS CASH AT END OF YEAR	566	-	-	3,604	4,738	3,809	5,594	8,554	12,981
Debt Service Coverage Ratio	-	-	-	-	2.66	1.17	1.67	1.63	1.86

a/ Excluding Equipment Credit Facility.
b/ Excluding Equipment and Works for Pilot Mines (Equipment Credit Facility).

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

CADETAF PROJECTED BALANCE SHEET

(DH '000 Current Terms)

	1982	1983	1984	1985	1986	1987	1988	1989	1990
ASSETS									
Operating Cash	242	346	479	733	890	1,027	1,146	1,142	1,221
Cash for Other Purposes	566	-	-	3,604	4,738	3,809	5,594	8,554	12,981
Accounts Receivable	4,400	4,700	5,000	5,300	5,600	5,900	6,200	6,500	6,800
Stocks of Ore	4,000	4,500	6,543	10,820	14,720	16,638	17,039	17,172	17,313
Stocks of Consumables	400	500	600	700	800	900	1,000	1,050	1,100
Total Current Assets	9,068	10,046	12,622	21,157	26,748	28,274	30,979	34,418	39,415
Gross Fixed Assets	20,071	34,237	62,762	72,891	76,688	76,688	76,688	77,280	77,510
Acc. Depreciation/Amortization	18,816	19,057	21,107	24,947	29,849	35,219	40,562	45,640	50,433
Net Fixed Assets	1,255	15,180	41,655	47,944	46,839	41,469	36,126	31,640	27,077
TOTAL ASSETS	10,863	25,226	54,277	69,101	73,587	69,743	67,105	66,058	66,492
LIABILITIES									
Short-Term Debt a/	25	25	25	1,446	4,867	2,867	2,867	2,867	2,867
Other Current Liabilities	8,105	8,805	8,005	4,805	3,305	3,305	1,500	1,500	1,500
Total Current Liabilities	8,130	8,830	8,030	6,251	8,172	6,172	4,367	4,367	4,367
Interest-free Government Advance	2,000	2,000	2,000	2,000	-	-	-	-	-
Government Loan (IBRD) b/	623	10,231	30,649	36,586	36,752	33,910	31,068	28,226	25,384
Total Long-Term Debt	2,623	12,231	32,649	38,586	36,752	33,910	31,068	28,226	25,384
Relief Fund (Caisse de Secours)	460	460	460	460	460	460	460	460	460
Government Contribution b/	269	4,827	14,977	22,025	23,845	23,845	23,845	23,845	23,845
Accumulated Reserves (Deficit)	(619)	(1,122)	(1,839)	1,779	4,358	5,356	7,365	9,160	12,436
Total Equity	110	4,165	13,598	24,264	28,663	29,661	31,670	33,465	36,741
TOTAL LIABILITIES AND EQUITY	10,863	25,226	54,277	69,101	73,587	69,743	67,105	66,058	66,492
Current Ratio (including cash for other purposes)	1.18	1.14	1.57	3.38	3.27	4.58	7.09	7.88	9.03
Debt/Equity Ratio	96:4	75:25	71:29	61:39	56:44	53:47	50:50	46:54	41:59

a/ Including Current Portion of Long-Term Debt.
b/ Excluding Equipment Credit Facility.

Industrial Projects Department
February 1982

ANNEX 7-11

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

ASSUMPTIONS IN FINANCIAL FORECASTS OF CADETAF

1. Depreciation and Amortization Periods

	Years
Lead Concentrator	15
Zinc Concentrator	15
Crushing and Grinding Unit	15
Mining Equipment and Works	7
Exploration Drill	10
Workshop, Laboratory and Survey Equipment	10
Equipment of Ore Collection Centers	7
Front End Loaders	8
4-Wheel Drive Vehicles and Trucks	5
Civil Works	20
Geologicl Studies and Works	7
Technical Assistance to CADETAF and Socio-Economic Study	5
Interest during Implementation	13

2. Replacement Investments

	Amount (DH'000 - Current Terms)
Lead Concentrator	
1989: 1 Truck	134
1 4-WD Vehicle	108
Zinc Concentrator	
1989: 1 Truck	134
Other Vehicles	
1989: 2 4-WD Vehicles	216
1990: 2 4-WD Vehicles	230

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

PROJECTED SOURCES AND APPLICATION OF FUNDS FOR EQUIPMENT CREDIT FACILITY
(DH '000 - Current Terms)

	1983	1984	1985	1986	1987	1988	1989	1990
SOURCES								
CADETAF (Government contribution)	784	1,308	563	-	-	-	-	-
CADETAF (IBRD-Loan)	2,545	4,863	1,300	-	-	-	-	-
Sub-Total	3,329	6,171	1,863	-	-	-	-	-
Debt Service from Pilot Mines								
- Interest	200	750	1,105	932	590	268	55	3
- Repayment	-	416	1,603	2,608	2,841	2,425	1,238	233
Sub-Total	200	1,166	2,708	3,540	3,431	2,693	1,293	236
- Minus 1% defaults	2	12	27	35	34	27	13	2
Sub-Total	198	1,154	2,681	3,505	3,397	2,666	1,280	234
Debt Service from Non-Pilot Mines								
- Interest	-	-	-	240	578	755	862	827
- Repayment	-	-	-	-	500	1,250	1,875	2,500
Sub-Total	-	-	-	240	1,078	2,005	2,737	3,327
- Minus 1% defaults	-	-	-	2	11	20	27	33
Sub-Total	-	-	-	238	1,067	1,985	2,710	3,294
TOTAL SOURCES	3,527	7,325	4,544	3,743	4,464	4,651	3,990	3,528
APPLICATIONS								
Credits to Pilot Mines	3,329	6,171	1,863	-	-	-	-	-
Relending to Non-Pilot Mines	-	-	-	4,000	2,000	3,000	2,000	2,000
Debt Service on IBRD Loan								
- Interest	-	-	-	670	1,251	1,135	1,019	903
- Repayment	-	-	-	491	982	982	982	982
Sub-Total	-	-	-	1,161	2,233	2,117	2,001	1,885
TOTAL APPLICATIONS	3,329	6,171	1,863	5,161	4,233	5,117	4,001	3,885
Annual Surplus (Deficit)	198	1,154	2,681	(1,418)	231	(466)	(11)	(357)
Cumulative Surplus	198	1,352	4,033	2,615	2,846	2,380	2,369	2,012

Industrial Projects Department
February 1982

ANNEX 7-13

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

COST/BENEFIT STREAMS FOR FINANCIAL RATE OF RETURN
(DH'000--1981 Real Terms)

Year	Capital Cost[a/]	Operating Costs[b/]	Other Costs[c/]	Revenues
1982	648	218	-	-
1983	14,488	2,082	605	2,746
1984	27,189	7,366	6,041	12,404
1985	8,650	13,410	7,247	29,985
1986	3,566	15,498	7,745	36,577
1987	1,305	16,285	8,014	39,395
1988	257	16,627	7,087	41,027
1989	360	14,178	7,115	36,511
1990	125	14,216	7,115	37,559
1991	-	14,216	5,190	37,559
1992	487	9,099	5,190	25,116
1993	-	9,099	5,190	25,116
1994	279	9,099	5,190	25,116
1995	125	9,099	5,190	25,116
1996	-	9,099	5,190	25,116
1997	-	9,099	5,190	25,116
1998	-3,892	9,099	5,190	25,116
1999	-3,892	9,099	5,190	25,116

a/ Includes Working Capital and Replacement Investments.
b/ Incremental Operating Cost of CADETAF Artisanal Production Costs and Nominal Labor Costs.
c/ Export Tax, Freight and Insurance, Internal Transport, Storing and Handling.

Industrial Projects Department
February 1982

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

ESTIMATED FOREIGN EXCHANGE GENERATED BY THE PROJECT
(US$ 1,000 - 1981 Real Terms)

	1982	1983	1984	1985	1986	1987	1988	1989	1990
I. FOREIGN EXCHANGE INFLOW									
1. Export Revenues a/	-	503	2,276	5,462	7,055	7,951	8,443	7,798	7,998
II. FOREIGN EXCHANGE OUTFLOW									
1. Capital Cost b/	134	2,027	4,000	1,269	417	-	-	-	-
2. Replacements	-	-	-	-	-	-	-	34	15
3. Operating Cost (CADETAF + Miners)	-	23	141	360	437	469	488	471	487
4. Interest on Bank Loan	-	-	-	-	402	717	621	535	455
Total Foreign Exchange Outflow	134	2,050	4,141	1,629	1,256	1,186	1,109	1,040	957
III. FOREIGN EXCHANGE SURPLUS (DEFICIT)	(134)	(1,547)	(1,865)	3,833	5,799	6,765	7,334	6,758	7,041
IV. ACCUMULATED FOREIGN EXCHANGE SURPLUS/DEFICIT	(134)	(1,681)	(3,546)	287	6,086	12,851	20,185	26,943	33,984

a/ Net of smelting charges, seafreight and insurance.
b/ Including indirect FE and interest during implementation.

Industrial Projects Department
February 1982

ANNEX 8-2

MOROCCO

PILOT PROJECT FOR SMALL-SCALE MINING

COST/BENEFIT STREAMS FOR ECONOMIC ANALYSIS
(DH'000--1981 Real Terms)

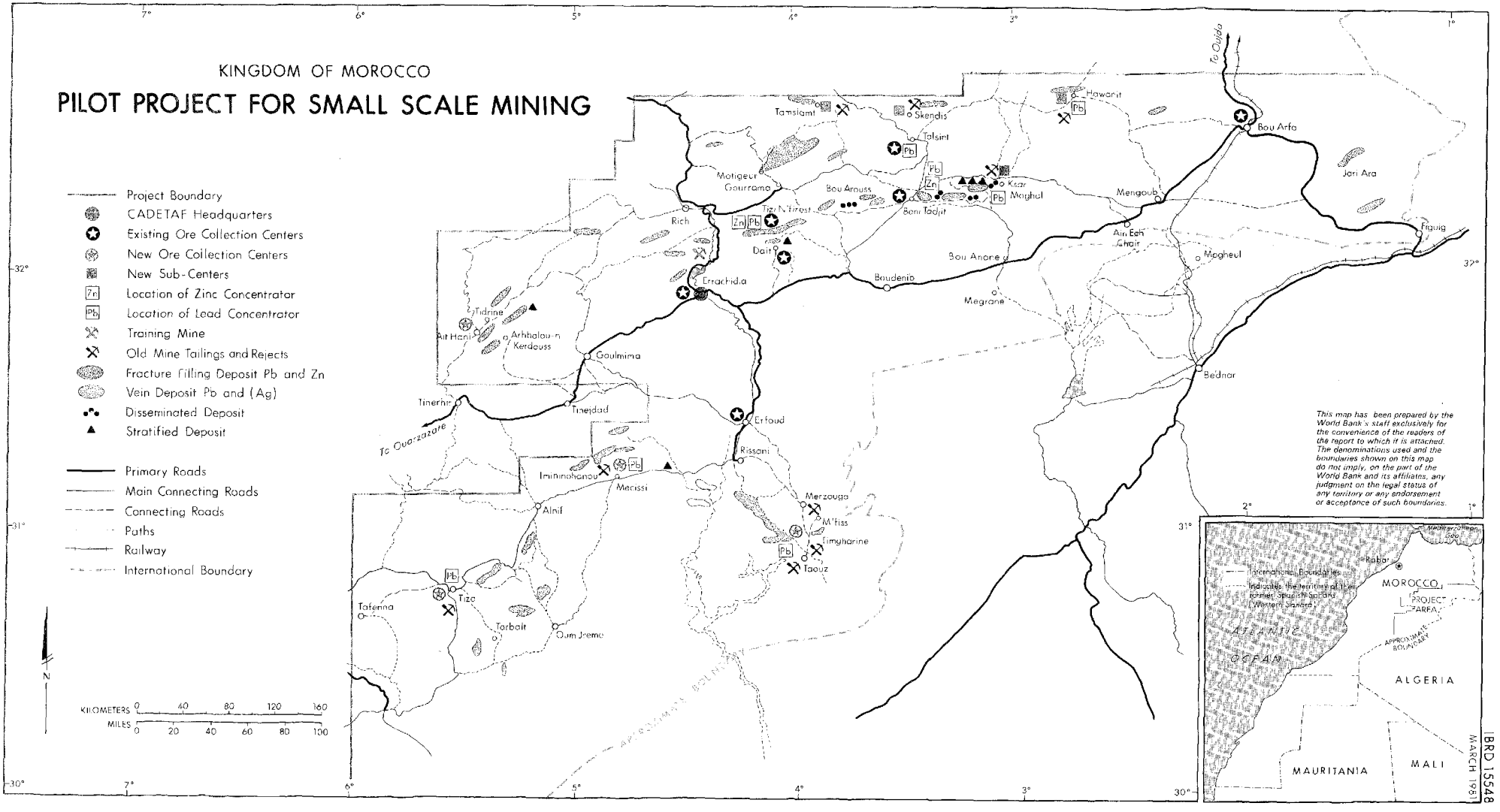
Year	Capital Cost[a/]	Operating Costs[b/]	Other Costs[c/]	Revenues
1982	583	218	-	-
1983	12,802	2,082	378	2,746
1984	24,067	7,366	1,632	12,404
1985	8,145	13,410	4,261	29,985
1986	3,524	15,498	5,187	36,577
1987	1,305	16,285	5,527	39,395
1988	257	16,627	5,670	41,027
1989	331	14,178	5,132	36,511
1990	112	14,216	5,156	37,559
1991	-	14,216	5,156	37,559
1992	418	9,099	4,012	25,116
1993	-	9,099	4,012	25,116
1994	250	9,099	4,012	25,116
1995	112	9,099	4,012	25,116
1996	-	9,099	4,012	25,116
1997	-	9,099	4,012	25,116
1998	-3,892	9,099	4,012	25,116
1999	-3,892	9,099	4,012	25,116

a/ Includes Working Capital and Replacement Investments.
b/ Incremental Operating Cost of CADETAF Artisanal Production Costs and Labor Costs.
c/ Freight and Insurance, Internal Transport, Storing and Handling.

Industrial Projects Department
February 1982

KINGDOM OF MOROCCO

PILOT PROJECT FOR SMALL SCALE MINING



IBRD 15548
MARCH 1971