Report No. 15555-EGT

Arab Republic of Egypt
Impact Evaluation Report
El-Dikheila Reinforcing Bar Project (Loan 2280-EGT)

April 23, 1996

Operations Evaluation Department

Currency Equivalents (annual averages)

Exchange Rate
US$/Egyptian ¥

1982	US$1.00	=	¥ .7
1983	US$1.00	=	¥ .84
1984	US$1.00	=	¥ .84
1985	US$1.00	=	¥1.33
1986	US$1.00	=	¥1.36
1987	US$1.00	=	¥2.19
1988	US$1.00	=	¥2.28
1989	US$1.00	=	¥2.38
1990	US$1.00	=	¥2.65
1991	US$1.00	=	¥3.30
1992	US$1.00	=	¥3.33
1993	US$1.00	=	¥3.35
1994	US$1.00	=	¥3.38

Abbreviations and Acronyms

ANSDK	-	Alexandria National Iron and Steel Company El Dikheila
CBM	-	Condition Based Maintenance
CU	-	Coordination Unit
DRI	-	Directly Reduced Iron
DRP	-	Direct Reduction Plant
EU	-	European Union
IFC	-	International Finance Corporation
JC	-	Japanese Consortium
JICA	-	Japanese International Cooperation Agency
OIP	-	Operations Improvement Program
OSC	-	Operating Steel Company
PIU	-	Project Implementation Unit
TPM	-	Total Productive Maintenance
WBG	-	World Bank Group

Fiscal Year

January 1 - December 31

The World Bank
Washington, D.C. 20433
U.S.A.

FOR OFFICIAL USE ONLY

Office of the Director-General
Operations Evaluation

April 23, 1996

MEMORANDUM TO THE EXECUTIVE DIRECTORS AND THE PRESIDENT

SUBJECT: Impact Evaluation on Egypt - El-Dikheila Reinforcing Bar Project (Loan 2280-EGT)

Attached is the Impact Evaluation Report on the Egypt - El Dikheila Reinforcing Bar Project (Loan 2280-EGT, approved in FY83), prepared by the Operations Evaluation Department (OED).

The project consisted of the construction and operation of a reinforcing bar plant with a nominal output of 745,000 tons per year of rebar, at El Dikheila, 15 kilometers west of the city of Alexandria. The project included a natural gas-based direct reduction plant which produced the raw material (instead of the usual scrap iron) for the electric arc furnaces for steelmaking. The gas was supplied from a gas field, discovered in the late 1970s, offshore Alexandria.

In May 1991, OED prepared a Performance Audit Report (PAR Report No. 9593) which discussed the implementation experience and the performance of the plant in its early life. The audit concluded that, despite excellent production performance, the Alexandria National Iron and Steel Company El Dikheila (a partnership of Egyptian public enterprises and banks, the IFC and a consortium of Japanese Steel producing companies) suffered from weaknesses in the international rebar market, cheap imports from Eastern European countries and heavy financial charges due to the large depreciation of the dollar/yen exchange rate in the latter part of the 1980s. The audit rated the outcome of the project as satisfactory and its sustainability as likely. With the passage of more than eight years since the plant entered into production, OED decided to revisit the project and assess its impact and sustainability.

This Impact Evaluation finds that, thanks to the autonomy provided by the legislation under which it was created (Law 43/74 which encouraged joint government ownership with a foreign partner) combined with accountability, a highly competent management, a dedicated workforce and attention to human resource development and plant maintenance, the company has achieved a production record of 1.23 million tons per year—some 65 percent above the plant's nameplate capacity. The company now produces rebars to international standards, meets a substantial share of the country's demand, and has exported up to 30 percent of its production. The plant's environmental performance has been consistently satisfactory. The reestimated ERR is 10.5 percent.

Given these results and in view of the intrinsic competitiveness of the operation, the management's demonstrated capability and the outlook for an expanding market, the project's sustainability appears strong. The plant's capacity is being expanded to 1.5 million tons and IFC's shareholding in the company has been raised from 3 to 5 percent. The private sector share in the firm's capital has increased from 13 percent to 36 percent.

The major lesson of this project is that the creation of large greenfield industrial projects often requires continued involvement, preferably as a shareholder, of a competent operating and producing company with experience. Another important lesson is that the granting of autonomy to State enterprises should be accompanied not only by accountability, but also by exposure to the discipline of the market and a hard budget constraint.

Attachment

Contents

Graphs

Tables

This report was prepared by Farrokh Najmabadi (Task Manager) and Abbas Gholi Bakhtiar (Consultant) who visited Egypt in March 1995. Eneshi Irene K. Davis provided administrative assistance. The report was issued by the Country Policy, Industry and Finance Division, Manuel Peñalver, Chief, of the Operations Evaluation Department, Francisco Aguirre-Sacasa, Director.

Annexes

Preface

1. This is an Impact Evaluation for the El-Dikheila Reinforcing Bar Project in Egypt for which the Board approved US$165.3 million in May 1983. The loan was closed at the end of 1988 after an extension of one year. The last disbursement was made in March 1989 at which time US$25.79 million of the loan was cancelled.

2. In June 1991, a Performance Audit Report (PAR) was prepared by the Operations Evaluation Department (OED, Report No. 9593). The PAR discussed the project's experience and performance up to the end of 1990. With the passage of more than eight years since the plant entered production and nearly five years since the audit, OED decided to revisit the project and carry out an impact evaluation. The main objectives were to reassess the project's outcome and sustainability by studying project performance in recent years, the factors behind its performance, its environmental record, and its various impacts on the economy.

3. For the preparation of this Impact Evaluation, an OED mission visited Egypt in March 1995. In addition to visiting the plant, the mission held extensive discussions with respective government departments and the plant management. Their kind cooperation and assistance is gratefully acknowledged.

4. The draft PAR was sent to the Borrowers. Comments received have been incorporated.

Basic Data Sheet

EL-DIKHEILA REINFORCING BAR PROJECT (LOANS 2280-EGT)

Loan Positions ***(Amounts in US$ million)***

				As of December 31, 1994	
Loan	*Original*	*Disbursed*	*Cancelled*	*Repaid*	*Outstanding*
2280-EGP	165.30	139.51	25.79	91.68	47.82

Project Timetable

Item	*Planned Date*	*Revised Date*	*Actual Date*
Identification	08/78		08/78
Appraisal Mission	05/81		01/82
Postappraisal Mission			05/82
Board Approval	12/81		05/83
Loan Signature			07/83
Loan Effectiveness			11/83
Loan Closing	12/87	12/88	12/88

Loan Disbursements

Bank Fiscal Year/Quarter	*Appraisal estimate (cumul)*	*Actual (cumul)*	*Actual as % of estimate*
1983/84			
1	10.2	-	0
2	21.7	-	0
3	29.6	1.23	4
4	34.8	6.88	20
1984/85			
1	34.8	7.40	21
2	41.6	8.31	20
3	50.1	13.53	27
4	61.1	32.70	54
1985/86			
1	74.5	40.24	54
2	89.9	44.14	49
3	111.3	45.36	41
4	128.3	48.94	39
1986/87			
1	145.9	67.13	46
2	153.9	78.32	51
3	160.3	86.98	54
4	163.3	99.84	61
1987/88			
1	165.3	118.58	72
2	165.3	122.35	74
3	165.3	131.85	80
4	165.3	134.57	81
1988/89			
1	165.3	135.74	82
2	165.3	137.62	83
3	165.3	139.51	84

US$25.79 million was cancelled on 03/29/89.

Staff Inputs *(in staff weeks)*

Stages of Project Cycle	*Final*	*Comments*
Preappraisal	146.0	-
Appraisal	216.7	Includes programs time.
From Appraisal to Board Approval	31.9	-
Supervision	179.5	-
Total	574.1	-

Mission Data

Stages of Project Cycle	*Month/Year*	*No. of Persons*[a]	*Staff Weeks in field*	*Specialization(s) represented*	*Performance rating*[b]	*Types of problems*
Through Board Approval (details unavailable)						
Supervision 1	07/83	2	1.5	Engineer Financial Analyst	1	
Supervision 2	05/84	3	1	Dep. Div. Chief, Sr. Engineer, Sr. Financial Analyst	1	
Supervision 3	11/84	3	2	Dep. Div. Chief, Sr. Engineer, Consultant	2	Minor disbursement problems
Supervision 4	03/85	2	1.5	Dep. Div. Chief Sr. Engineer	1	
Supervision 5	11/85	3	2	Dep. Div. Chief Sr. Engineer Sr. Financial Analyst	1	
Supervision 6	07/86	2	2	Sr. Engineer Sr. Financial Analyst	3	Financial technical (infrastructural)
Supervision 7	04/87	2	1.5	Sr. Engineer Sr. Financial Analyst	3	Financial technical (infrastructural)
Supervision 8	11/87	2	1	Sr. Advisor Sr. Financial Analyst	3	Financial technical (infrastructural)
Supervision 9[c]	06/88	3	2	Sr. Advisor Sr. Financial Analyst Financial Analyst	3	Financial
Supervision 10	10/88	1	1	Sr. Financial Analyst	3	Financial

[a] IFC staff were included on several missions.
[b] 1 = Problem-free or minor problems; 2 = Moderate problems; 3 = Major problems.
[c] Joint mission for Hadisolb Steel Project (Loan 2002-EGT) and Steel Sector Review.

Supervision Ratings (Form 590)

Evaluation Date	*Development Objectives*	*Legal Covenants*	*Management Performance*	*Availability of Funds*
04/13/87	3	-	1	3
10/30/87	3	-	1	3
11/30/87	3	-	1	3
05/16/88	3	-	1	3
08/25/88	3	-	1	3
06/30/89	3	1	1	3

Evaluation Summary

Background

1. In the early 1970s, Egypt's construction industry was highly dependant on steel reinforcing bars which, despite some domestic production by the integrated steel plant at Helwan and other mini-mills, were mainly imported. This high dependency on imports, and the periodic shortages of rebars in the market, had placed a brake on the growth of the construction industry, affecting all economic activities. The discovery of natural gas in 1970, offshore from Alexandria, created a new opportunity for Egypt to meet its domestic requirements for reinforcing bars by constructing a steel mill based, instead of scrap, on directly reduced iron (DRI or sponge iron) which would be produced in a Direct Reduction Plant (DRP) using natural gas as reducing agent for iron ore.

2. Since the early 1960s, the concept of mini-steelworks consisting of electric arc furnace, continuous casting of billets, and rolling mills had been extensively used in the industrial countries and some developing countries (including Egypt) for the manufacture of reinforcing bars. The majority of these plants were based on local scrap iron as their raw materials and the output was mainly directed towards the same geographical area. Because of the erratic nature of the international scrap market and wildly fluctuating prices, none could depend wholly on imported scrap. The technological advances in the production of DRI resolved the problem of scrap availability, especially for that group of developing countries which possessed sufficient quantities of natural gas.

3. In 1976, the idea of creating a steel plant at El Dikheila using the gas-based DRI process was proposed, in an IFC report, to the Government of Egypt. This report suggested the formation of a joint venture company with an expatriate operating steel company (OSC) for the construction of the proposed steelmaking plant. Upon acceptance of the concept by the Egyptian Cabinet, a search got underway for such a partner. In June 1978, the Egyptian Government formally requested the World Bank Group (WBG) to participate in the financing of the project. Discussions between the WBG and the Government culminated in the preparation of a memorandum of understanding that spelt out a framework for implementing and operating the project. The framework envisaged that, in addition to taking an equity position, the OSC would also provide engineering, managerial and training services during the implementation as well as the early years of operation, all provided that such an arrangement with an OSC not be linked to the supply of equipment.

4. Contacts with interested operating steel companies produced two offers: one from a Japanese Consortium (JC), and the other from a German Group. Whereas neither group offered proposals totally in line with the provisions of the memorandum of understanding, the WBG's analysis leaned in favour of the JC. Despite the stipulation in the memorandum of understanding regarding the delinking of equity participation and supply of equipment, the WBG accepted the proposition by the JC that they possessed proprietary technology that could significantly increase the operational efficiency of the meltshop and, therefore, they could supply the meltshop equipment on a negotiated basis. They were also permitted to participate in the international competitive bidding for the rest of the plant, again on the grounds that their previously supplied DRP and rolling mills had performed extremely well. In order to resolve the conflict of interest issue, it was agreed that an independent consultant would conduct the technical and commercial evaluation of the meltshop proposal and all other bids. These provisions were accepted by the Government of Egypt and the JC was nominated as partner in the joint venture in January 1979. In February 1979, the Japanese International Cooperation Agency (JICA), was asked to prepare the feasibility study.

5. Four years ago, the OED prepared an audit of the El-Dikheila Reinforcing Bar Project. The audit gave an account of the efforts that went into its preparation, appraisal, implementation and the first two full years of production. The report rated the project's outcome as satisfactory and its sustainability as likely. In addition, the report concluded that there were: "two major risks which were glossed over in the risk analysis conducted at appraisal—the possibility that long-term international rebar prices would be much lower than the high equilibrium price forecast at appraisal and the possibility of large exchange losses stemming from the high exposure of the project to the cross-currency exchange risk between the yen and the dollar". Since then, both these risks materialized and yet the company has survived the shocks.

6. This Impact Evaluation aims at recounting Alexandria National Iron and Steel Company - El Dikheila's (ANSDK) achievements since the audit, its impact and, finally, the chances of its sustainability.

Performance Since 1991

7. The technical performance of the plant has been truly outstanding. The complex has continuously broken its own records, reaching production levels far above the nameplate capacity in every producing division. In 1994, the actual production figures stood at 8 percent, 55 percent, 33 percent and 67 percent above the rated capacities of the DRP, Meltshop, Bar Mill and Wire Rod Mill, respectively. Considerable productivity gains have, of course, been at the root of this impressive performance. High output to input ratio, declining energy consumption, declining tap to tap time in the Meltshop, increasing operating ratios in the Rolling Mill Shop and improvement in a host of other indicators all speak of an increasingly more efficient operation. These technological improvements have been associated with the introduction of many new grades of rebar as well as the establishment of a quality control system that has made it possible for ANSDK to obtain the ISO 9002 Certification. ANSDK was recognised by Midrex Corporation (the license-holder for the direct reduction plant) as a worldwide leader for its superior performance in 1989 when production reached a level of 12 percent above rated capacity.

8. In contrast with ANSDK's excellent performance, the outcome of the other steel project supported by the Bank at the same time—the HADISOLB Rehabilitation Project (Loan 2002-EGT)—has been disappointing. Therefore, it is important to find out what made ANSDK such a success and which lessons can be learned from it for future projects. As noted later, the incorporation of ANSDK under Law 43/74, which provided for joint government ownership with a foreign partner, and provided a considerable degree of autonomy to the enterprise, accounts for most of the difference with respect to the fully Government-owned HADISOLB. But some specific aspects of ANSDK performance are worth exploring in more detail.

9. ANSDK has fully realized its objective of supplying a major part of Egypt's requirement for reinforcing bars. Its continued excellent technical performance can be attributed to its corporate culture that delegates authority and demands accountability, rewards good performance and retains the loyalty of its workforce. The choice of the top echelon of ANSDK's management and the continuity of their service as well as the selection of other managerial and supervisory personnel contributed greatly to the high human resource quality of the enterprise. The human resource development program has consistently remained at the core of the company's efforts to maintain its competitiveness. The intensive on-the-job training of the workforce has not only resulted in increasing labor productivity, but it has also made it possible to reduce the number of expatriate ahead of time, thereby providing more managerial positions for the Egyptian staff. Meanwhile, the company has taken full advantage of the services and advice of the personnel seconded by the joint venture partners in putting in place an efficient and competent operational organization.

10. Another important factor has been the maintenance philosophy pursued by the company. Starting with preventative maintenance, then introducing condition based maintenance (CBM) and eventually total productive maintenance (TPM) concepts, the company has improved its maintenance systems considerably in the last few years. To improve productivity, safety, plant availability and product quality, the company has instituted quality control circles whose recommendations are often put into practice.

11. The manufacturing costs (variable and fixed costs excluding financial charges and general administrative and sales costs) per ton of rebar have remained fairly stable at US$230 per ton of output in recent years, increasing in 1994 to around US$250 because of the jump in several input costs. ANSDK's total costs per ton of output have now stabilized around the equivalent of US$290-300 which, although marginally higher than the steel mills in the European Union (EU) and ANSDK's own export prices, are considerably lower than export prices for rebars from Japan in recent years. The company started exports in 1988 (when export prices were actually higher than domestic prices), which reached 30 percent of total sales in 1994. The profit and loss account of the company shows that despite heavy depreciation, amortization of pre-operating expenses and financial charges the company has been profitable since 1988 with the net profit increasing to around £E 115-120 million (nearly US$35 million) in recent years. ANSDK has paid dividend every year since 1991.

Impact of the Project

12. In addition to its contribution to the growth of the industrial sector and the creation of 2400 jobs, a major impact of the project has been to provide a secure supply of considerable quantities of reinforcing bars to the domestic construction industry, as well as exports. Now with ANSDK supplying 40-50 percent of the domestic demand, and other rolling mills (including HADISOLB) supplying another 30-40 percent, the local market's dependence on imports has declined to around 15 to 20 percent. While small, these imports, nonetheless, regulate the prices in the domestic market and maintain the competitiveness of the local producers.

13. The project's impact in terms of foreign exchange savings is estimated at US$850 million up to the end of 1994. This level of foreign exchange savings approaches the actual cost of the project at completion, when calculated at the prevailing exchange rates. This is a considerable achievement, especially when viewed against the backdrop of heavy financial charges which resulted from the movements in the yen/dollar exchange rates.

14. The project appears to have also had an important impact, as a role model, on the Egyptian industrial sector in recent years. After incorporation of ANSDK, a number of other entities were created under Law 43/74 and its successor Law 230/89, in which the Government or publicly owned enterprises held the majority of shares, with a minority foreign partner. But these laws were not the right vehicle for the restructuring of the existing public sector enterprises because the main objective of these legislations was to attract foreign investment into Egypt. With the promulgation of Law 203/91 which provides a framework for the reorganization of the public enterprise sector into holding and affiliated companies, some 314 enterprises valued at around £E 70 billion, with a total labor force of about 1.1 million have been earmarked for restructuring and privatization.

15. The environmental impact has been well managed. In the course of iron and steel making, considerable quantities of dust, fumes, noxious gases and waste water effluents are generated. These environmental hazards are much more serious in the traditional large scale steelmaking because the blast furnace process requires sintered iron feed and coke. Steelmaking through the direct reduction process obviates three processes—coke production, sintering and the blast furnace—which generate large quantities

of environmental pollutants. To this extent the problem is more manageable and the mitigation measures less costly. Nonetheless, the DRP itself is the source of significant dust and carbon monoxide emission. So are the remaining processes in the chain such as the electric arc furnace Meltshop, the continuous casting and the rolling mills. The plants also generate considerable quantities of slag, water pollutants and sludge.

16. From the outset, the company decided to adopt environmental pollution control standards applicable in major industrialized countries, in this case Japan. When the plant was being designed, attention was initially focused on two major pollutants: atmospheric dust and sewage water quality. Dust was to be controlled in the DRP, Melt Shop (Electric Arc Furnaces) and the Lime Calcining Plant by dry cyclones, bag filters and wet scrubbers, suitably installed at locations in the plant where considerable dust is generated. A monitoring system was put in place for measuring, on a monthly basis, the dust content in the exhaust gases from bag filters. Measurements of dust content in exhaust gases from various polluting units result in figures that are consistently below the 100 milligram (mg)/cubic meter standard adopted in the original design.

17. In addition to dust monitoring and control, the plant has now instituted the measurement of a number of other parameters such as carbon monoxide, sulphur dioxide, nitrogen oxides, chlorobenzenes, noise and radiation. In terms of the noxious gases, the SO_2 and NO_2 concentrations remain well below the permissible levels both inside and outside of the plant, indicating that the pellets contain low quantities of sulphur. The wastewater from the various units runs through a treatment plant where the sludge is removed and the effluent flow to the sea is brought within the water discharge specification. Most water quality measurements are done on a weekly basis. In addition to the parameters considered at the design stage, analyses include total alkalinity, total hardness, chlorine and calcium content and total iron content. The system handles some 200 cubic meter of water every hour. Except for the suspended solids content which is close but still below the standard, the other parameters are, on average, well below the permissible levels. The plant also generates considerable quantities of slag and other waste materials notably collected dust, sludge, scale and limestone fines. Such wastes including cold slag are disposed of at a special site not far from the plant. All data concerning this disposal such as quantity, type and location are recorded and plotted on maps to ensure that waste materials do not contaminate underground water resources.

Overall Assessment and Sustainability

18. A number of factors account for the current strength of this company and the manner in which it has overcome adversity. To start with, the insistence of the Bank and IFC in having an operating steel company as a joint venture partner with hands on management responsibility both during implementation and the initial operational phase was instrumental in endowing the company with a reasonable chance to succeed. The incorporation of the company under Law 43 provided the necessary autonomy and independence without which it would not have been possible to implement the project ahead of schedule. The role and quality of the Egyptian management team and counterparts was crucial in ANSDK's successful performance. Equally important was the attention paid by the management to human resource development especially through on-the-job training, twinning and other ways of transferring the skills from the expatriate staff and consultants to the Egyptian personnel. This was coupled with delegation of responsibility-cum-accountability, attention to employee welfare and a genuine production incentive system, all providing the motivation for the outstanding performance of the workforce.

19. Since starting production, ANSDK has played a pivotal role in the development of the construction industry. While its production reached close to 63 percent of domestic demand in 1992, its export activities have provided not only a source of foreign exchange revenue for the company, but also a means of checking the level of prices in the international trade. The Company's technological activities have made

different grades of rebar readily available in the Egyptian market while the high quality of its products has opened to it a wide export market. ANSDK enjoys a cost advantage in the production of directly reduced iron (DRI). The cost structure of the Company shows that the cost of producing sponge iron has been less than the landed cost of imported scrap (allowing for the degree of metalization). In 1994 the cost of DRI produced at ANSDK amounted to US$117 per ton as compared with a CIF scrap cost of US$145 per ton.

20. Designed to the Japanese standard of the early 1980s, and well maintained, the plant's environmental protection performance has been quite satisfactory. The installations of air and water pollution mitigation equipment and attention to their remaining in good working order have ensured that dust emissions from stacks and the quality of effluent discharge water have remained well within the prescribed limits. Through periodic studies by outside agencies, the Company makes sure that independent measurements are carried out and remedial suggestions are received. ANSDK has, in recent years, taken additional steps to reduce further the fumes that may still escape from the Meltshop into the atmosphere.

21. ANSDK enjoys all the conditions for a sustainable operation. It is an intrinsically economic and competitive plant operating under a substantially undistorted regime and facing an expanding domestic market. Except for the price of electricity which remains somewhat below long-run marginal cost, the price for other imported or domestic inputs are at, or close, to international prices. It is well established in the export market by virtue of its quality and price competitiveness. It is strategically located on the coast and is close to the natural gas resources. It has been operating within a competitive environment in the domestic market where supplies come from other Egyptian manufacturers and imports. Its impressive technical performance speaks of a most competent and knowledgeable management and work force. It has access to technical assistance through some of the most efficient steel producers in the world. It has successfully internalized the know how brought to it by the expatriate collaborators and built on it to continuously enhance productivity. Constant attention has been paid to cost control and savings. It has been pursuing operating and maintenance practices that have maximized plant availability and resulted in very high operating ratios.

22. The weakest aspect of the project has always been the financing package, which was fully discussed in the audit. The audit concluded that, as the project was appraised and approved at a time of a high dollar exchange rate in the early 1980's, despite the fact that the greatest part of the equipment was to come from Japan, the high level of cross currency risk was not appreciated and no efforts were made to advise ANSDK to hedge against those exchange risks. ANSDK was particularly vulnerable since the project's capacity to earn foreign exchange, either through exports or through domestic sales designated in foreign exchange were mainly in dollars.

23. In recent years, ANSDK has succeeded, with the help of the IFC, to reduce its currency exposure by swapping its Yen-denominated obligation into US dollars. This has brought in some measure of predictability to its costs until the loans are completely retired in the next decade. The re-estimated economic rate of return based on the actual performance in the last eight years comes to 10.5 percent. Once the initial project investments are depreciated and loans paid off, ANSDK will become similar to many mature steel plants where incremental investments will be associated with handsome returns. In fact one such expansion project is currently underway.

24. This project entitled: "The Production Rationalization and Expansion Project" is aimed at eliminating the imbalance that has arisen because practically all existing plants operate at levels totally different from their respective nominal capacities. The project also aims at upgrading the steel making facilities and expanding the rod mill capacity to meet the anticipated increase in demand for the small gauge wire rods. Once completed, the annual capacity of ANSDK will be increased from 1.1 million tons to

around 1.5 million tons of reinforcing bars and rods. This project is likely to be followed by a Second Direct Reduction Plant Project which aims at duplicating the existing direct reduction plant to provide the raw materials for the meltshop.

25. The shareholding structure of the company has, in recent years, changed significantly towards more private ownership (and lower debt/equity ratio). The IFC played a very crucial catalytic role in the privatization drive. The most important change came with the Employee Fund subscribing nearly £ E 96 million (13.72 percent) to the new capital of ANSDK. The IFC also decided to increase its shareholding from 3 to 5 percent, whereas the Japanese shareholders chose to maintain theirs at 10 percent. This latest capital increase has helped the Company to reduce its debt to equity ratio to around 66/34 from about 80/20 in 1991. With other private shareholders buying nearly another 7 percent of the company's shares, the private shareholding stood at about 36 percent at the end of October 1995.

Conclusions and Lessons Learned

26. Had it not been for its outstanding performance and early start of production, the project would have succumbed to the financing problems it faced arising from factors beyond its control. The project's technical and managerial aspects were sound, bringing together several elements that have had satisfactory results. Its main weakness in the financial area was in failing to predict the long term change in the US dollar/yen exchange rate. Had the cross currency exchange rates remained at the levels assumed in the appraisal, the savings in the investment together with the early start of production would have easily compensated for the sluggish increase in rebar prices in the international market. By the time the plant was producing at capacity in 1988, almost all import prices were far below those anticipated at appraisal (direct production cost was US$200 per ton against an appraisal estimate of US$345).

27. The major lesson of this project is that the creation of large greenfield industrial projects often requires the heavy and continued involvement, as a shareholder, of a competent operating and producing company with extensive experience. This kind of intimate association cannot be replaced by other combinations such as the purchase of services of consulting engineers because the owners are devoid of the necessary experience in the construction and management of similar facilities. The close involvement of a competent operating company, preferably as an owner, fills this void and usually guarantees a smoother implementation. This is not to say that all industrial projects should be implemented in this way. Where there exists an operating entity and the management has a proven track record, new projects can be constructed under a different regime with greater dependence on the in-house project management capability, managing consulting engineers and services provided by vendors. What is important is that the owners have a clear appreciation of their capabilities and seek the most appropriate type of assistance for the successful realization of the project.

28. But the intimate involvement of an operating company, though necessary, is not sufficient. What is needed is the transfer of know how and work ethics to the work force of the project. This requires an intelligent, competent and knowledgeable indigenous management that creates an atmosphere conducive to the maximum transfer from the expatriates to the nationals. Consequently, the choice of top managers and, through them, the selection of middle management is of paramount importance. A management philosophy that considers its human resource as its greatest asset and is willing to invest heavily in this resource will find that its efforts are handsomely rewarded. The lesson is that the quality of management is of utmost importance in creating the likelihood of success and top managers should be selected on the basis of their track records.

29. The incorporation of the Company under Law 43 provided the autonomy for ANSDK, but it also brought in a good measure of accountability. Law 43 allowed the company to compete in the labor market, but it also brought its discipline. When confronted with the financial crisis, the Company was tempted (in 1987/88) to seek financial relief or increased protection from the government, but its Law 43 status stopped it from doing so. It could, however, legitimately ask for the revision of the Government's Price Decree which was clearly against the provisions of Law 43. The management's philosophy of delegating a high degree of responsibility has been balanced with commensurate accountability. Thus, while Law 43 provides other facilities which help the conduct of business, it also creates a hard budget constraint for the enterprise because it weans it from the Government. But the autonomy provided in Law 43 can only be of value if it is used by an alert and fair-minded management in motivating the work force.

30. Another lesson of the project is that, for investments of this magnitude, adequate financial engineering should include careful attention to cross-currency exchange risks. The currency swaps of 1991, 1992 and 1994 were useful in reducing the cross-currency risk exposure, but such measures to minimize financial risks should have been taken as part of the project's initial financial package.

31. This project satisfied a need, brought in new technology and up-to-date management style, created employment, used resources and inputs efficiently, had useful linkage effects, provided input to the construction industry at reasonable prices, helped dampen wild market fluctuations and, above all, provided a role model in a generally inefficient public industrial enterprise sector. This experience should help the Government of Egypt in its ambitious restructuring and privatization efforts.

1. Introduction

1.1 The Bank's involvement with the Egyptian iron and steel sector started with the approval of a loan in the amount of US$2.5 million to the government-owned Egyptian Iron and Steel Company (HADISOLB) in 1977[1]. This project aimed at carrying out a feasibility study for beneficiation of domestically mined low grade iron ore from Bahariya mines to produce an improved feed for steel making operations at HADISOLB. In addition, the project envisaged the preparation of a diagnostic study for the rehabilitation and balancing of HADISOLB's existing plant and equipment including the management assistance required to enable HADISOLB to operate at its design capacity, thus satisfying a larger share of the domestic market. The completed diagnostic study covered five topics: iron ore beneficiations, market and facilities, operations improvement, overall management and corporate structure and improvement.

1.2 Based on the conclusions of the diagnostic study, a rehabilitation project was prepared which attempted to address the many problems then facing HADISOLB[2]. From a technical point of view, there was a need for balancing investment in the facilities so that the plant could operate closer to its rated capacity. But a more challenging objective was to put in place a program that would bring about operational and managerial improvements including improvements in product quality, energy efficiency, environmental protection, industrial safety and manpower training. The project approved in 1980, envisaged the setting up of two new organizational units within HADISOLB to implement the project: (i) a Project Implementation Unit (PIU) under a qualified manager to be selected; and (ii) a Coordination Unit (CU) in charge of the Operations Improvement Program (OIP) assisted by a foreign consultants group, preferably an operating steel company. In addition, recognizing the difficulties arising from the regulations and policies governing the public sector enterprises in Egypt, the Bank obtained a general undertaking from the Government to allow HADISOLB an "adequate" degree of autonomy in the areas of investment, wages and salaries, prices and management policies in order to enable it to achieve the project objective. The Bank viewed this project design as a test case to demonstrate to the Government how an inefficient public enterprise could be turned around.

1.3 In the late 1970s and early 1980s, the existing steel plants in Egypt including HADISOLB and several smaller rebar manufacturing units were capable of producing only around 300 thousand tons of reinforcing bars per year. Given its diversified output in flat and long products, HADISOLB, even after rehabilitation (with capacity increasing to 1.2 million tons per year of liquid steel), could only add incrementally to the above-mentioned annual production of reinforcing bars (300,000 tons). With demand increasing at a rapid pace during the 1970s, Egypt's imports of rebars had grown from 130,000 tons in 1970 to around 740,000 tons in 1980. It was the prospects of this growth in imports that induced the Government and the World Bank Group (WBG) to consider another producing facility dedicated to the production of reinforcing bars, at the same time that the HADISOLB Rehabilitation project was being prepared and appraised. The consideration of another steel mill was also prompted by the discovery of natural gas offshore Alexandria, which made it possible to design a new project through the application of

---

[1] Iron Ore Benefication and Engineering Project - Loan No. S-005 EGT.

[2] HADISOLB Rehabilitation Project (Loan 2002-EGT). Using the classic Blast Furnace and LD Converter Technology, the plant had an annual meltshop rated capacity of 1.5 million tons, but operated at .7 million tons per year and produced annually only around 0.5 to 0.6 million tons of finished products. The project aimed at increasing the meltshop's operable capacity to 1.2 million tons per year.

the mini-steelworks concept (Annex I) with directly reduced iron (DRI) as its raw material input. The concept, initially proposed by the IFC, was to create a joint venture with a foreign operating steel company (OSC) which would materially assist in the implementation and operation of the mini-steel plant. Having accepted this concept and started a search for a prospective partner with the assistance of the WBG—notably the IFC—, the Government of Egypt formally requested the WBG to participate in the financing of the project to produce reinforcing bars through the direct reduction process.

1.4 The project comprised the construction and operation of a reinforcing bar plant with a nominal output of 745,000 tons per year of rebar, at El Dikheila, 15 kilometers west of the City of Alexandria. The major project facilities consisted of: (i) a natural gas-based direct reduction plant (DRP) to produce around 716,000 tons per year of DRI with 92-95 percent metalization; (ii) a steel-making plant with 4 electric arc furnaces capable of producing 840,000 tons per year of molten steel and three 4 strand continuous casters to cast 798,500 tons per year of billets; (iii) a bar mill with the capacity of 425,000 tons per year; and (iv) a wire rod mill with a capacity of 320,000 tons per year. The project also included the construction of auxiliary facilities: a lime calcining plant, a briquetting plant, an oxygen generating plant and workshop facilities. The location of the plant permitted access to a mineral jetty which could be used for the import of raw materials. The project cost was estimated at US$800 million to be financed 30 percent by equity and 70 percent by loan.

1.5 A major difference from previous large steel projects in Egypt was that this project was to be implemented by a joint venture company (Alexandria National Iron and Steel Company El Dikheila - ANSDK) incorporated under Law 43. The initial shareholding consisted of: 87 percent Egyptian interests distributed among public enterprises and banks, 10 percent held by a Japanese Consortium (JC) and 3 percent by the IFC. The company entered into three agreements with the JC: an engineering services agreement for basic engineering, procurement, detailed construction drawings, construction supervision, start up and commissioning; a management agreement for implementation, operation and marketing with guarantees regarding the annual secondment of a specific number of expatriate professionals and including production bonus for actual production beyond defined targets; a training services agreement to provide in-house and overseas training. On the above basis, the project was appraised and finally approved in May 1983.

The Project Performance Audit Report

1.6 Four years ago, OED prepared an audit of three projects related to the steel sector in Egypt[3]. The first of these projects—the Iron Ore Beneficiation and Engineering Project—resulted in the preparation of a detailed engineering plan for the establishment of a semi-industrial pilot plan for ore beneficiation. However, this plan proved to be infeasible because no cost effective solution could be found to the environmental problems resulting from the disposal of salt-laden waste water. The project, nonetheless, achieved its other objective of presenting a diagnostic study for the rehabilitation of the HADISOLB plant.

1.7 The HADISOLB Rehabilitation Project never achieved its objectives. Given the poor efficiency indicators and production performance, the audit rated the outcome as unsatisfactory and the sustainability as only marginally likely. The audit also concluded that: "HADISOLB is subsidized through low energy prices, and low iron ore costs since it pays no royalties on its mining operation. The low level of operating efficiency as measured by labor productivity, product quality, energy efficiency, capacity utilization rate,

---

[3] Report No. 9593, Iron Ore Beneficiation and Engineering Project (Loan S-005-EGT), Hadisolb Rehabilitation Project (Loan 2002-EGT), and, El Dikheila Reinforcing Bar Project (Loan 2280-EGT) - May 1991.

and conversion rates stem fundamentally from lack of basic management systems and procedures and from public sector laws and regulations which severely inhibit management initiative and enterprise, allow no autonomy and demand little accountability" (para 5.01). Nonetheless, the audit suggested that it would be worth while for the government to formulate and implement a drastic restructuring of the company, focussing on the same issues identified at appraisal: strengthening management, job grading, rationalization of workforce, remunerations and incentive systems, greater autonomy and accountability, price decontrol, etc.

1.8 The audit then discussed the outcome of the El-Dikheila Reinforcing Bar Project. It gave an account of the genesis of the project and the efforts that went into its preparation, appraisal and implementation. It also discussed the serious financial problems that emerged during the early productive years as a result of the weakness in the international rebar market, cheap imports from the Eastern European countries, heavy financial charges due to the large depreciation of the dollar/yen exchange rate and the imposition of a low price level for the company's output by the Egyptian Ministry of Housing, Reconstruction and New Communities. Already by the end of 1990, the plant's annual production had reached 977,000 tons (31 percent above rated capacity) and many of the earlier financial problems had disappeared. While rating the outcome as satisfactory and the sustainability as likely, the report came to the conclusion that:

(a) the comprehensive and thorough project preparation allowed detailed engineering and procurement work to be rapidly initiated;

(b) the establishment of ANSDK as a joint venture with a committed partner (JC) and its incorporation under Law 43 of 1974 were crucial to its performance. By avoiding the crippling rules and regulations applied to the public sector enterprises, the company had been able to attract a competent and qualified workforce and manage its affairs efficiently;

(c) careful project planning, scheduling, monitoring and control by the project management team had resulted in the timely completion and start up of the plant;

(d) the JC's intimate familiarity with the steel-making technologies and its extensive experience had resulted in the choice of equipment and embodied technologies that were responsible for the superior performance of the plant;

(e) the involvement of expatriate professionals in actual project management as well as the operation of the plant on a one-to-one basis with Egyptian counterparts had been critical to the efficient transfer of managerial and technical know-how to the Egyptian nationals and the establishment of operating practices at ANSDK on the basis of those in force at the modern efficient plants in the industrialized countries;

(f) the WBG played a major role in designing the project, the legal and organizational aspects of the joint venture and the three agreements between the Company and the JC, thus laying the foundation for the successful execution and operation of the project; and,

(g) "the two major risks which were glossed over in the risk analysis conducted at appraisal—the possibility that long-term international rebar prices would be much lower than the high equilibrium price forecast at appraisal and the possibility of large exchange losses stemming from the high exposure of the project to the cross-currency exchange risk between the yen and the dollar—both materialized with disastrous consequences for the

financial viability. On top of these risks, the project has been afflicted by price controls on domestic sales and inadequate access to foreign exchange from Egypt's banking system. Nevertheless, ANSDK has been able to take all those adverse developments in its stride and there is high expectation that it will achieve financially viability. The main reason for this turnaround is the project's superlative production performance and high level of operating efficiency which has enabled the Company to generate enough revenues to clear its debt service arrears and other obligations" (para 9.01).

1.9 With the passage of more than eight years since the plant entered production and nearly four years since the audit, it is important to revisit the project to see how the project performed in recent years, the factors behind its performance, its environmental record, its various impacts in the Egyptian economic setting and, finally, the chances of its sustainability.

2. Project's Performance Since 1991

Technical Performance

2.1 The technical performance of this project has been truly outstanding. The complex has continuously broken its own output records, reaching production levels far above the nameplate capacity in every producing division. The plant reached full capacity production two years after the start up and fully one year ahead of schedule.

Table.1 - Performance of Various Units

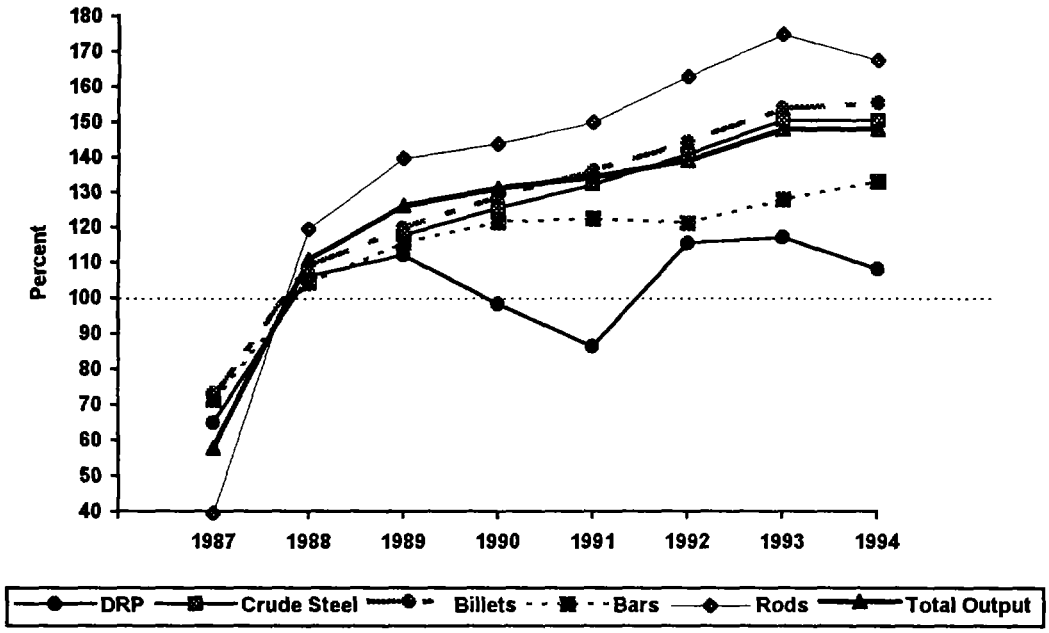
1000 tons/year

	Capacity	1986	1987	1988	1989	1990	1991	1992	1993	1994
DRP	716.0	30.6	463.6	759.4	801.6	703.7	617.0	825.7	837.3	773.9
Crude Steel	840.0	101.8	596.6	893.9	988.0	1,053.4	1,110.8	1,181.6	1,265.3	1,263.0
Billets	798.5	97.7	583.9	868.3	955.9	1,029.9	1,085.8	1,151.4	1,227.9	1,240.5
Bars	425.0	46.8	299.5	442.3	485.0	509.6	520.2	514.2	543.5	565.3
Rod	320.0	-	125.6	382.4	447.0	460.0	479.9	520.6	558.7	535.8
Total Output	745.0	46.8	425.1	824.7	932.0	969.6	1,000.1	1,034.8	1,102.2	1,101.1

As shown in Table.1 above, the company, in 1994, produced 1.1 million tons of rebars and 30,000 tons of saleable billets from a plant with a rated capacity of 745,000 tons. Except for the DRP that needed to undergo a major repair operation during the last quarter of 1991, all plants have been on an ascending production trend reaching a plateau in 1993/94. A similar trend is, of course, observed in the ratio of actual production to rated capacity. In 1994, the actual production figures stood at 8 percent, 55 percent, 33 percent and 67 percent above the rated capacity of the DRP, Meltshop, Bar Mill and Wire Rod Mill, respectively[4].

[4] Results for 1995 indicate an even higher output: (i) DRP, 850,300 tons; (ii) Crude Steel, 1,320,000 tons; Bar Mill, 656,800 tons; and, (iv) Total Output, 1,234,000 tons.

Figure 1: Ratio of Actual Production to Rated Capacity



2.2 The plant's conversion (input/output) ratios, as shown below, have all remained in a range only achievable under the most efficient operating conditions. These high conversion figures, sustained over a long period and without much variation or significant deterioration speak of a highly effective maintenance and production management capability. As earlier noted, after nearly six years of operation, the DRP underwent a major repair operation during the last quarter of 1991 which resulted in the recovery of the conversion ratio from a low of 63 in that year to 66 percent, in 1994.

Table.2 - Plant Conversion (input/output) Indices - percent

	1989	1990	1991	1992	1993	1994
DRP Sponge Iron/Pellets-Ore	65.8	63.2	63.3	64.1	65.5	66.0
Melt Shop	90.8	90.7	90.8	91.4	91.3	90.0
Continuous Casting Plant	96.7	97.8	97.7	97.4	97.0	98.2
Bar Mill	97.2	96.9	95.7	95.5	95.6	95.2
Rod Mill	98.7	97.7	97.5	97.7	97.9	97.8
Both Finished Product Mills	97.9	97.3	96.6	96.6	96.7	96.4

Productivity

2.3 Considerable productivity gains have, of course, been at the root of this impressive performance. To begin with, the tap to tap time in the electric arc furnaces has been reduced from 140 minutes in 1988 to

around 118-119 minutes in 1994. In addition to a continuous improvement in the melting time, the electric arc furnace charge has been successfully increased with the result that the amount of molten steel per heat has risen to 82.3 tons in 1994. This has made it possible to increase the output from the continuous casting plant to around 80 tons per hour. The operating ratio in the rolling mills (rolling hours as a percentage of total hours) has also improved considerably, increasing from 65 percent in the first year of full capacity utilization (1988) to nearly 80 percent in 1994 (Annex II).

2.4 All this has been combined with sizeable economies in the consumption of utilities and consumables. Again, from 1988 to 1994, the natural gas, electricity and water consumptions have declined appreciably. More importantly, the energy consumption figures are well below the design values. In the case of natural gas, consumption has declined to 283 cubic meters of gas per ton of rebar in 1994, some 18 percent below the design figure of 347 cubic meters. As for electricity consumption, the actual figure for 1994 is some 8 percent below the design value (Annex II). Table.3 below shows the trend in total energy consumption (defined in gigajoules per ton of rebar) for the entire plant and the front end up to and including the meltshop.

Table.3 - Trend in total energy consumption per ton of output

	Design Value	1989	1990	1991	1992	1993	1994
DRP & Meltshop - GJ	NA	16.8	16.0	14.2	15.5	15.6	15.0
Entire Plant - GJ	24.2	20.5	20.0	18.7	21.5	21.4	20.9

This performance is remarkable not only when compared with the design parameters but, more so, when compared, for example, with the world-wide good practice prevalent in the early 1980s[5]. Even today, ANSDK's total energy consumption per ton of output compares favourably with the most efficient mini-mills. ANSDK was recognized by Midrex Corporation (the license-holder for the direct reduction plant) as a worldwide leader for its superior performance in 1989 when production reached 801,000 tons (12 percent above rated capacity). Since that year, the DRP achieved another record production of 837,000 tons in 1993.

2.5 The productivity improvements have been associated with the introduction of many new steel grades in the production of reinforcing bars. In addition to the basic low carbon and high carbon steel products (grades 24 to 52), the company has successfully produced rebars with aluminium and vanadium alloys[6]. With the necessary upgrading in the quality control system, the company obtained the ISO 9002 certification in August 1994 from Germanischer Lloyd. This was a notable achievement because it will assist the company further in its export activities, especially to the European Union.

---

[5] See Small-Scale Steelmaking by R.D. Walker, Applied Science Publishers, 1983. The energy consumption per tone of liquid steel is given as 21.85 GJ for the traditional blast furnace/LD Converter plants and 20.88 GJ for direct reduction/electric arc furnace. See also "Energy Efficiency in The Steel Industry with Emphasis on Developing Countries", World Bank Technical Paper No. 22, 1982. In this publication (page 16) energy consumption, up to the meltshop, is estimated at 20 GJ per ton of output. For the entire plant, the figure is given at 24.2 GJ per ton of output.

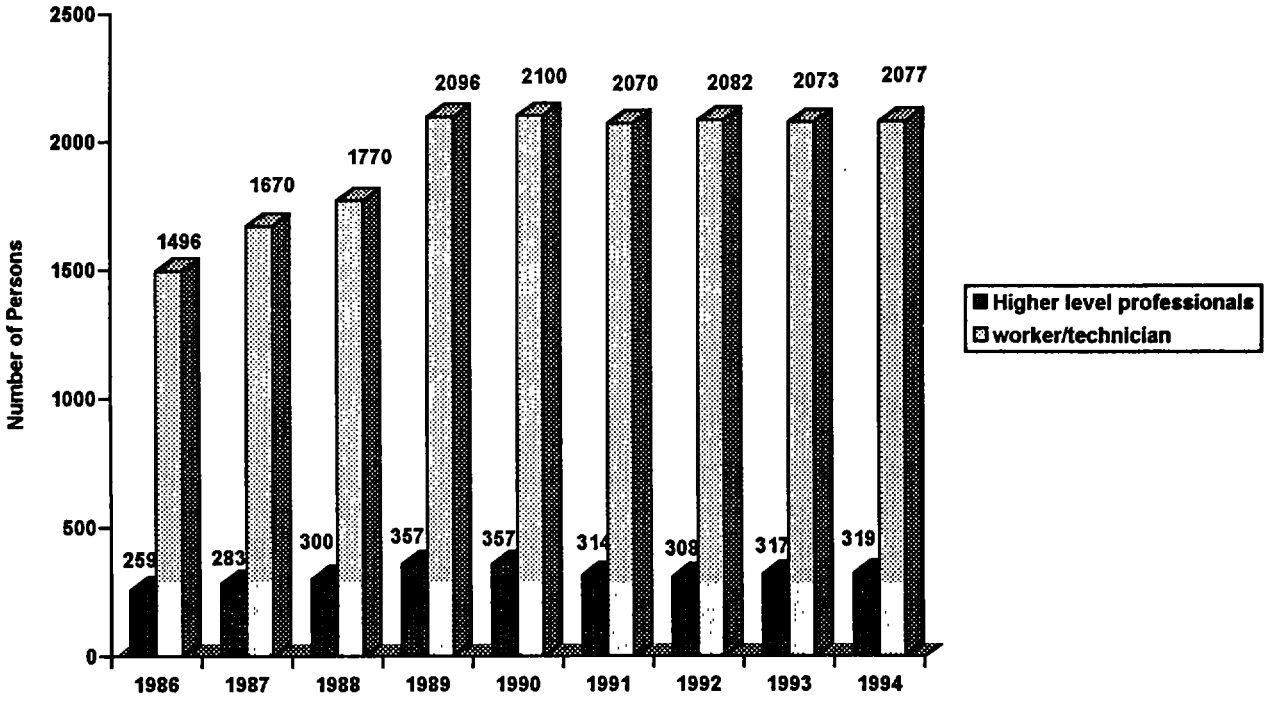
[6] ANSDK now produces concrete reinforcing bars to the following standards: Egyptian Standard 262/88 for grades 24/35 and grades 36/52; American Standard ASTM A615/87, grades 40 and 60; Italian Standard UNI G6407/69 for grade FEB44K; British Standard BS4449/88 for grades 250 and 460; French Standard NFA35-016/86 for grades 400, categories 1, 2 and 3. Wire rods for cold drawing are manufactured to American Standard AISI grades 1006, 1008, 1010 and 1012.

Major Factors Affecting Technical Performance

2.6 The continued excellent technical performance of this project can be attributed to a number of factors that were previously enumerated in the Project Audit Report (para 1.6 above). The company has developed a corporate culture that: (i) delegates authority and responsibility but demands accountability; (ii) rewards excellence but penalizes sloth; and (iii) treats its workforce fairly but demands loyalty. The quality of management, the Management Agreement between the JC and ANSDK, the training program, the maintenance activities and the establishment of a management information system all played crucial roles in the achievement of these results. To stay progressive and competitive, targets were set in the company's corporate plan for return on investment, personnel, technology and production equipment availability. The management never wavered from pursuing those targets at the core of which lies ANSDK's human resource development program.

2.7 *Human Resource Development.* By 1990/91, the company's workforce reached its maximum level of around 2450 persons. This level has actually fallen somewhat in recent years to 2396 at the end of 1994, while output has risen from 977,000 tons in 1990 to 1.1 million tons in 1994 indicating a continuous increase in labor productivity. This increase in labor productivity has been achieved despite the fact that the company, encouraged by the result of its on-the-job and intensive training and the developed capabilities of its staff and professionals, decided to amend its Management Agreement with the JC into a Consultancy Agreement as from the beginning of 1989. The change in the Management Agreement resulted in a sharp decline in the number of expatriates employed at ANSDK (from 83 in 1988 to 22 in 1989), thereby providing more opportunities for the Egyptian staff to fill managerial positions as well as saving costs. This number has now fallen to 9 and the expatriates consultants continue to provide a valuable advisory service, helping the company in maintaining its high productivity.

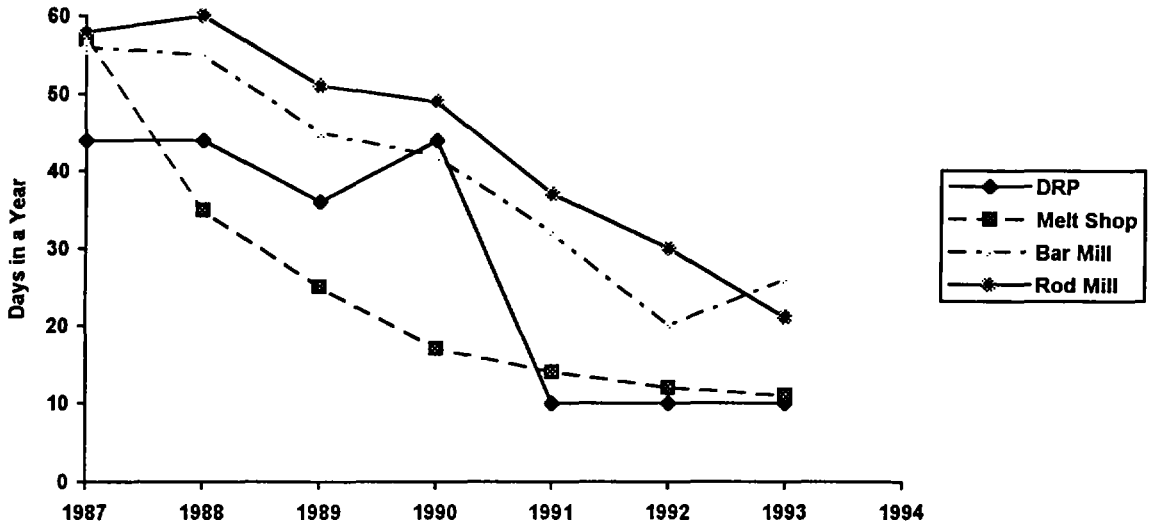
Figure 2: Year-end Workforce



In order to maintain and improve its high operational performance, the company has continued with an active and comprehensive training program in recent years. As can be seen in Annex III, there are an increasing number of technical courses being attended by a rising number of worker/technicians. This shows a focused attention on the upgrading of this group's technical skills as the backbone for higher productivity. The professional staff of the company have also been attending training courses, on the average, twice every year. There are basic training courses designed for this group according to their grade and position in the company. At each level, the training program is related to the level of responsibility, the span of control and the capabilities commensurate with the job requirement. At level 7 which is the highest line management position—Deputy General Manager just below the General Manager—for example, subjects include strategic planning, crisis management, organizational behavior, advanced information technology management, international management systems and marketing management.

2.8 *Maintenance.* Another important factor explaining the impressive technical performance of the plant has been the maintenance philosophy pursued by the company. Starting with preventative maintenance, then introducing condition based maintenance (CBM) and eventually total productive maintenance (TPM) concepts, the company has improved its maintenance system considerably in the last few years. The basic concept, currently followed, is to improve equipment availability and productivity through self maintenance by operators during normal operation supported by specialized maintenance carried out in the context of periodic scheduled maintenance activities The application of these concepts including tendency control, computer controlled condition monitoring, replacement of broken down parts with preassembled units and a change in production manpower scheduling have made it possible for the company to succeed in reducing the total number of scheduled repair days of the 4 major plants from 215 in 1987 to 68 in 1993.

Figure 3: Scheduled Maintenance



As shown above, the number of scheduled maintenance days for the rolling mills has nearly halved since 1987. It has dropped even more dramatically for the DRP and the Meltshop by a factor of 4 and 3, respectively. This performance is captured in the cost of normal repairs that has stayed around 4-5 percent of total manufacturing cost since 1990, despite the aging of the plant.

2.9 *Safety Record.* The company's safety performance has been on a continuously improving trend. As shown in Annex IV, total injuries have declined from 204 in 1988 to 64 in 1994. Correspondingly, the number of lost days through injury has also declined to 2,143 days in 1994 from 4,786 in 1988. The company uses various means including safety campaigns, review of safety standards and instructions and safety commendations in order to enhance safety awareness among its workforce. The highest incidence of injuries in 1994 was in the Production Department (46) followed by Maintenance and Utilities Department (10), Production Technology Control Department (4) and Purchasing and Transport Department (4).

2.10 To help improve productivity, safety, plant availability and product quality, the company continues with its quality control circles. Since its inception, many proposals have received commendations and several have been chosen as themes for quality control conferences. In addition to enhancing morale and communication skills, these activities have helped team work and exchange of job experiences and knowledge.

Cost Structure, Sales, Financial Performance and Profitability

2.11 Annex V shows the cost structure of the company. ANSDK operates under a substantially undistorted regime. It purchases its raw materials (e.g. pellets/ore, hot briquetted iron, scrap, ferromanganese, ferrosilicon) and many consumables (e.g. electrodes and refractories) in the international market at international prices. Out of the three major domestic inputs namely: domestic scrap iron, natural gas and electricity, two—domestic scrap and natural gas—are received at close to international prices (Annex VI). The price of power, though on the rise in recent years, still remains below long run marginal costs[7]. Constituting around 7 percent of the variable cost, the relatively low electricity price cannot be considered a serious distortion. The duties on imported rebars currently stand at 20 percent of the CIF price. This protection is likely to be reduced along with the deepening of the trade policy reforms

2.12 All in all, variable costs per ton of output have been rising steadily from US$132.6 in 1988 to US$187 in 1994. This has been, to some extent, because of the gradual increase in the prices of most raw materials and consumables (Annex VI). But, more importantly, these cost increases have been due to the steep rise in domestic costs such as the costs associated with the use of mineral jetty, internal transportation costs from the Alexandria Port to the plant for such inputs as imported scrap, Hot Briquetted Iron (HBI) and other consumables, cost of local scrap and the duties charged on raw material inputs[8].

2.13 On the other hand, fixed costs per ton of output have actually declined since reaching their peak at US$81.3 in 1990. The main reasons for the decline are the productivity gains, relatively lower depreciation charges and consultancy fees, while repairs and maintenance costs have been kept under control. Consequently, manufacturing costs per ton of rebar have remained fairly stable at US$230 per ton of output in recent years, increasing only in 1994 because of the jump in a few input costs[9].

2.14 In the financial area, and as a result of three loan swap operations arranged by the IFC in March 1991, August 1992 and, June 1994 covering a total of 40.8 billion yen, the financial charges have begun to decline counteracting the effect of other cost increases[10]. All in all, ANSDK's total costs per ton of output have now stabilized around the equivalent of US$290-300 which, although marginally higher than EU and ANSDK's own export prices, are considerably lower than export prices for rebars from Japan in recent years (Annex VIII).

---

[7] See Report No. 10013-EGT, Staff Appraisal Report, Arab Republic of Egypt, Kureimat Power Project, February 1992, Annexes 2.3 and 5.6. A customer of electric power at very high voltage, the company enjoys a relatively lower tariff than the customers which are connected to high or medium voltage grid. But is pays the highest rate at this tariff level along with Somed Pipeline, Assreit Cement, and Amiria Spinning, while the aluminium industry is afforded a discount.

[8] According to IFC reports, ANSDK's variable production cost is $20-40 per ton of output lower than those of similar plants in Argentina, Brazil, USA and Western Europe.

[9] The manufacturing cost up to meltshop (liquid steel) stage was as follows: 1989 - US$174 per ton; 1990 - US$200 per ton; 1991 - US$186 per ton; 1992 - US$182 per ton; 1993 - US$186 per ton; and 1994 - US$207 per ton. These manufacturing cost figures compare well with even those given for developed countries - US$179 per ton. They are somewhat better than those indicated for Newly Industrializing Economies - US$205 per ton. (See International Trends in Steel Mini-Mills, Keeping Pace with Technological Change, World Bank Industry Series Paper No. 52, Dec. 1991, page 20).

[10] A fourth swap operation was arranged by IFC in the fourth quarter of 1995. Through these four operations, ANSDK has been able to swap approximately 71 percent of its total Yen loan obligations into US dollars.

2.15 The production and sales performance of the Company is shown in Annex IX. The company has succeeded in selling its annual production without any undue inventory build up. In line with the increase in production, total annual sales have now grown to around 1.1 million tons in 1994 from 963,000 tons in 1990. In recent years, the Company has supplied up to 50 percent of the domestic market demand. ANSDK's rebars have also found a ready export market in many parts of the world, notably in the EU and the Arab countries. Exports started in 1988 (when export prices were actually higher than the average domestic prices) and reached 30 percent of total sales (335,000 tons) in 1994. In the last two years, low priced imports have again been pouring into Egypt from the CIS countries with CIF delivery prices as low as US$240 per ton (exports from ANSDK have been made at US$270-280 pet ton during the same period). The Egyptian Customs has introduced a deemed CIF price for import duty calculation purposes which partially compensates for what may well be dumping practices (Annex X). Through this mechanism, the Company has been permitted to enjoy the protection which currently stands at 20 percent of the CIF price. But the competition from imports has forced ANSDK to intensify its export activities in recent years, realizing export prices at approximately the same level as those quoted for exports from the European Union.

2.16 The profit and loss Account of the Company is shown in Annex XI. Despite heavy depreciation, amortization of preoperating expenditures and financial charges, the Company has been profitable since 1988 with the net profit increasing to around £E 115-120 million (nearly US$35 million) in recent years. At these levels ANSDK's profit is equivalent to a return of 5 percent on total assets, 9 percent on sales and 20 percent on net worth. Moreover, the preoperating expenses will have been fully amortized by the end of 1995. Financial expenses have begun to ebb as a result of the loan swap operations. Currently the Company enjoys a sound financial situation. Its current ratio, debt to equity ratio and debt service cover stand at 1.8, 66 percent and 1.43, respectively. ANSDK has paid dividend every year since 1990 (see Annex XII - Balance Sheet).

3. Impact of the Project

3.1 In addition to its contribution to the growth of the industrial sector and the creation of 2400 jobs, a major impact of the project has been to provide a secure supply of considerable quantities of reinforcing bars to the domestic construction industry. Prior to the establishment of ANSDK, Egypt's import requirement had reached levels in excess of one million tons, leaving the Egyptian construction industry exposed to the vagaries of the international rebar market. Many times during the 1970s and early 1980s, the unavailability of sufficient supply of building materials, including rebars, had slowed down the Egyptian construction sector and acted as an effective brake on the rapid investment growth. Because of the high price volatility in the international market, the Government had often stepped in with price controls[11] which introduced distortions in the rebar market. Now with ANSDK supplying 40-50 percent of the domestic demand, and other rolling mills (including HADISOLB) supplying another 30-40 percent, the local market's dependence on imports has declined to around 10 to 30 percent. While small, these imports, nonetheless, regulate the prices in the domestic market and maintain the competitiveness of the local producers.

---

[11] The last time was in mid-1988 when the Egyptian Ministry of Housing Reconstruction and New Communities issued a decree fixing the base price of rebars delivered by domestic producers to the Egyptian Cement Sales Office at £E617.5 per ton compared with a market price of £E725 per ton.

3.2 The foreign exchange savings of the project is estimated at US$850 million since 1988 (Annex XIII). This estimation assumes total import substitution and ignores the difference between the import and export prices into and from Egypt which tend to cancel each out over the period. Although the calculation includes the debt service payments, it does not account for the foreign exchange component of some domestically purchased inputs such as electricity and natural gas. By this measure, the project had, by the end of 1994, generated a total foreign exchange savings that approached the actual cost of the project at completion, when calculated at the prevailing exchange rates (Annex XIV). This is a considerable achievement, especially when viewed against the backdrop of heavy financial charges which had resulted from the adverse movements in the yen/dollar exchange rates[12].

3.3 *Institutional Impact: Laws 43/74, 230/89 and 203/91.* The project appears to have had an impact, as a role model, on the Egyptian industrial sector in recent years. After incorporation of ANSDK, a number of other entities were created under Law 43/74 and its successor Law 230/89, in which the Government or publicly owned enterprises held the majority of shares, with a minority foreign partner. The laws provided a useful first step in creating a new partnership between the public and private sectors in manufacturing[13]. But these laws were not the right vehicle for the restructuring of the existing public sector enterprises because the main objective of these legislations was to attract foreign investment into Egypt. For example, despite efforts by the Bank to free Hadisolb from the regulatory shackles and the implicit agreement of the Egyptian Government to effect reforms, little was achieved in practice. The company is still plagued with redundant workforce (more than 20,000 employees for the production of 1.07 million tons of finished products during Fiscal Year 1993/94). Conceivably, the foreign investors could have been attracted, under these laws, to buy out or take an interest (in joint venture form) in these existing public sector industrial entities, but this would have required the existence of both an enabling environment and a legal and regulatory framework that could lead to valuation and divestiture.

3.4 A new framework was put in place in 1991 with the promulgation of Law 203/91 which reorganized the public enterprise sector into holding and affiliated companies. Theoretically, this law was meant to create joint stock companies which would be granted the necessary autonomy to conduct their business without undue government interference. In practice, while the new entities were required to take over the entire labor force, they were not provided with the power and the means of reducing the chronic overmanning that existed in most public sector enterprises. As a result they could not be put under a hard budget constraint and in many cases they continued to depend on subsidies from the Government. Currently most of these companies have been earmarked for privatization. The privatization program covers some 314 enterprises valued at around £E70 billion, with a total labor force of about 1.1 million persons[14].

---

[12] There has been a heated debate about the investment cost of this project. Prima facie, the cost per ton of installed capacity, calculated at the yen/dollar exchange rates at the time of disbursement (US$952.7 million for 745,000 tons or US$1280 per ton installed) is exorbitant and out of line with the cost of similar plants in other parts of the world (quoted as US$500-900 per ton installed; see "Energy Efficiency in the Steel Industry With Emphasis on Developing Countries", World Bank Technical Paper No. 22, 1982, page 7). The investment cost becomes more acceptable if the capacity is upgraded to the actual 1.1 million tons per year, resulting in US$866 per ton installed, which is still at the higher end of the spectrum.

[13] Eleven of these companies: Suez Cement Co., Chloride Egypt, Ashti Co., Egypt Narden International, Egyptian International Pharmaceutical Co., Egyptian German Electrical Products Co., Schindler Egypt, Egyptian German Dyes Co., Misr Carbonated Beverages, Arabian Ceramic Co., and Sinai Diving Club are on the list of enterprises to be privatized.

[14] According to the statement of the Privatization Authority, some 7 percent of the total assets of these enterprises (including total divestiture of a few entity) have been sold, as of the end of June 1994. Hadisolb still remains a company whose fate has not yet been decided.

Environmental Impact

3.5 This project was appraised and approved before the Bank issued its first Operational Manual Statement (OMS 2.36) on environmental issues[15]. Nevertheless, in line with the prevailing Bank policy and procedure, the environmental issues received considerable attention. As indicated in para 5.08 of the SAR: "The Company had decided to adopt environmental pollution control standards applicable in major industrialized countries", in this case, Japan. At the time, there were no comprehensive laws in Egypt regulating the environmental impact of industrial enterprises, though there existed some laws and regulations that partially addressed pollution issues. Law No. 92 of 1962 prescribed the permissible levels of pollutants contained in waste waters being discharged into the sea in order to protect beaches, marine constructions and aquatic life. Ministerial Resolution No. 470 of 1971 prescribed the dust control standards and Law No. 72 of 1968 addressed the Prevention of Sea Water Pollution by Oil. In recent years the main concern appears to have been with the pollution of the Nile river. This was addressed in the Law No. 48 of 1982 concerning the Protection of the Nile and other Waterways[16].

3.6 In the course of iron and steel making, considerable quantities of dust, fumes, noxious gases and waste water effluents are generated. These environmental hazards are much more serious in the traditional large scale steelmaking because the blast furnace process requires sintered iron feed and coke. Ore preparation and sintering can provide large quantities of dust, sulphur dioxide and tailings. Coke production also generates significant quantities of waste water which contains ammonia and other components released in the coking process such as phenols, cyanides, sulphides and chlorides (potentially in toxic concentrations). Air emissions from coke ovens contain visible smoke, coke dust and many volatile chemicals. Blast furnace gases are significant sources of particulate emissions and contain carbon monoxide. Slag could be a source of hydrogen sulphide. In the steel making process (Basic Oxygen Furnace - BOF) considerable quantities of hot off-gases containing carbon monoxide and dust are generated.

3.7 Steelmaking through the direct reduction process obviates three processes—coke production, sintering and the blast furnace—which generate large quantities of environmental pollutants. To this extent the problem is more manageable and the mitigation measures less costly. Nonetheless, the DRP itself is the source of significant dust and carbon monoxide emission. So are the remaining processes in the chain such the electric arc furnace Meltshop, the continuous casting and the rolling mills. The plants also generate considerable quantities of slag, water pollutants and sludge.

---

[15] Although environmental issues had been receiving ample attention in the Bank projects, the first Operational Manual Statement (OMS-2.36) entitled: "Environmental Aspects of Bank Work" was issued in May 1984. The OMS articulated the reasons why attention to environmental consideration was necessary and discussed the Bank's policy and approach. The important step taken by the Bank was to bring the treatment of environmental issues into the project cycle. The above-mentioned Statement was superseded in 1989 by the issuance of a new Operational Directive (OD 4.00) which, once again, defined the Bank's approach to environmental issues and through its Annexes, laid out the procedure to be followed in the project cycle. In the new OD, Environmental Assessments (EAs) became the major tool for addressing the environmental issues of large industrial projects. Such EAs were expected to identify ways of improving the projects environmentally by preventing, minimizing, mitigating or compensating for adverse effects and to propose environmental management, training and monitoring plans.

[16] A comprehensive law was promulgated in 1994 (Law No. 4) which dealt with all aspects of environmental protection. The Executive Regulations related to this Law were to be issues early this year.

3.8 When the plant was being designed, attention was initially focused on two major pollutants: atmospheric dust and sewage water quality. In these two areas, the designs were made with the objective of achieving the standards then prevailing in Japan (Annex XV). Dust was to be controlled in the DRP, Melt Shop (Electric Arc Furnaces) and the Lime Calcining Plant by dry cyclones, bag filters and wet scrubbers, suitably installed at locations in the plant where considerable dust is generated. On line gas analyzers were used in the Direct Reduction Plant to assure that carbon monoxide, methane gas, hydrogen disulphide gas would not be leaked to the atmosphere and the working environment. A monitoring system was put in place for measuring, on a monthly basis, the dust content in the exhaust gases from bag filters. In addition to monitoring the level of atmospheric dust on a regular basis, the Company has carried out periodic studies with the assistance of outside bodies. Twice in the last few years (1991 and 1995), the Department of Environmental Studies of the Institute of Graduate Studies and Research of the University of Alexandria has measured and prepared reports on the analysis of air pollutants from the El Dikheila Plant. These measurements and studies clearly show that the plant has a reasonably workable air pollution abatement system, but in need of upgrading. Measurements of dust content in exhaust gases from various polluting units result in figures that are consistently below the 100 micrograms per cubic meter standard adopted in the original design—In 1993, for example, the average dust content was 9.29 and 12 micrograms per cubic meter in the exhaust gases from the DRP, the Meltshop and the Lime Calcining plants, respectively. The concentration of dust inside the DRP and the Meltshop are close to the standard while measurements taken both inside the plant site, at various gate locations and outside the plant boundaries show concentrations that vary but, at times, are above the standard acceptable for the City of Alexandria (230 micrograms per cubic meter - Annex XVI). This annex also shows the chemical composition of the dust.

3.9 In addition to dust monitoring and control, the plant has now instituted the measurement of a number of other parameters such as carbon monoxide, sulphur dioxide, nitrogen oxides, chlorobenzenes, noise and radiation. In terms of the noxious gases, the SO_2 and NO_2 concentrations remain well below the permissible levels (60 and 200 micrograms per cubic meter, respectively) both inside and outside of the plant, indicating that the pellets contain low qualities of sulphur. It should be noted that ANSDK is situated just west of the El-Mex industrial zone where a number of large and potentially polluting industries including an oil refinery, a basic chemical plant and a cement kiln exist.

3.10 The wastewater from the various units runs through a treatment plant where the sludge is removed and the effluent flow to the sea is brought within the water discharge specification. Most water quality measurements are done on a weekly basis. In addition to the parameters considered at the design stage, analyses include total alkalinity, total hardness, chlorine and calcium content and total iron content. The analysis of effluent water for the last four years is shown in Annex XVII. The system handles some 200 cubic meter of water every hour. The pH of the effluent has varied between 7.4 and 8.3 but always remaining within the permissible range. Except for the suspended solids content which is close but still below the standard (55 micrograms per liter against a standard of 60 micrograms per liter which is to be expected in a steel plant), the other parameters are, on average, well below the permissible levels.

3.11 The plant also generates considerable quantities of slag and other waste materials notably collected dust, sludge, scale and limestone fines. Some of these wastes such as the sludge from DRP, scale and limestone fines are marketable and are sold to customers. Others including cold slag are disposed of at a special site from the plant. All data concerning this disposal such as quantity, type and location are recorded and plotted on maps to ensure that waste materials do not contaminate underground water resources. From the start of production to mid-1994, the plant generated nearly 1.75 million tons of slag and waste materials (Annex XVIII).

3.12 ANSDK has put in place a monitoring system that allows it to take the necessary steps to counter environmental degradation. The company's environmental protection guidelines describe the organization and duties of the relevant personnel, monitoring standards and measurement methods, reporting and decision-making levels. For environmental management, ANSDK has established a steering committee and task teams associated with different parts of the complex. The waste material and sludge is disposed in a special site away from the plant. All data concerning this disposal such as the quantity, type and location are recorded and plotted on maps to insure that waste materials do not contaminate underground water resources.

3.13 In its ongoing expansion project (Production, Rationalization and Expansion Project discussed in para 4.10 below), ANSDK is taking steps to solve the air pollution problem in the Meltshop by installing a totally new fume extraction system instead of upgrading the existing equipment. This is likely to result in a costly but necessary investment. In the interim period until the new system becomes operational, ANSDK has come up with a temporary solution (in conjunction with engineers from Cairo University) to install ducts that suck the fugitive gases from the electric arc furnaces during the oxygen lancing and tapping.

4. Overall Assessment and Sustainability

4.1 Despite its extraordinary technical achievements, this project has not resulted in a matching financial success because of two major factors. One is the adverse market development since the start of production (market weakness and price control) and second—and largest—is the crippling effect of the trend in yen/dollar exchange rate between the beginning of the project and the present time. But a combination of positive factors have allowed the company to counteract these problems and to achieve its current strength.

4.2 The first and, perhaps, the most important factor was the prescient insistence of the Bank and IFC in having an operating steel company as a joint venture partner with hands on management responsibility both during the implementation and the initial operational phase. The value of this arrangement cannot be either underestimated or overemphasized. During preparation and appraisal, the Bank and IFC fought every step of the way in order not to allow these arrangements to be sidestepped. The incorporation of the Company under the provisions of Law 43 also provided ANSDK with the necessary autonomy and independence without which it would not have been possible to implement the project ahead of schedule. Except for one instance when the company was subjected to governmental price control (in contravention of Law 43), its autonomy was fully respected. The presence of the Japanese Consortium and the IFC as shareholders must have helped this outcome.

4.3 The choice of the top echelon of ANSDK's management, the selection of the other managerial and supervisory personnel and eventually the rest of the work force contributed greatly to the high human resource quality of the enterprise. The role and the quality of the Egyptian management team and counterparts was crucial in ANSDK's successful performance. It was the management skills and the leadership of this group that made the generally harmonious and effective performance possible. ANSDK's management philosophy can be characterized by the delegation of authority combined with accountability and a management information system capable of providing very rapidly the information crucial for decision-making. Equally important was the attention paid by management to training, especially through on-the-job training, twinning and other ways for transferring the skills from the expatriate staff and consultants to the Egyptian personnel. So successful were these efforts that the Company could amend the Management Agreement ahead of time and transfer many responsibilities to Egyptian nationals with the joint venture partners supporting this decision. There can be no doubt, given the performance of the plant

in the years following 1989, that this decision was managerially sound and psychologically astute. Together with a generous production incentive system introduced in 1989, this timely decision appears to have provided the motivation for the outstanding performance of the work force and the resultant successes. Through the delegation of responsibility and close attention to accountability, many of the operational practices, work habits, discipline and hard work have been internalized by the work force. Proud of its achievements, the company continues with its quest for excellence, aware that it has a hard earned reputation to defend, if it is to remain a role model in the Egyptian industrial sector.

4.4 The concern with hard work, discipline and quality and the quest for excellence is matched by attention to employee welfare and well being. The company has introduced a host of measures to uplift, and maintain morale and loyalty. 1989 was a watershed year when many new practices ranging from the distribution of hot meals to employees at work sites to the introduction of an incentive scheme connected to productivity were instituted. In addition to providing 192 dwellings to the key plant personnel at a site next to the plant battery limit, the ANSDK has helped the setting up and financing of the Employee Housing Cooperation Society which provided flats for 1286 employees up to the end of 1993. These employee-owned flats were to be expanded by another 1000 units in the near future. These activities along with a competitive salary scale have helped reduce the employee turn over ratio considerably.

4.5 ANSDK has realized its objective of supplying a major part of Egypt's requirements for reinforcing bars. Since starting production, it has played a pivotal role in the development of the construction industry. While its production reached close to 63 percent of domestic demand in 1992, its export activities have provided not only a source of foreign exchange revenue for the company allowing it to finance its imports, but also a means of checking the level of prices in the international trade. This has made it possible for ANSDK to successfully argue against dumping from the CIS countries in recent times, convincing the Egyptian Customs Authorities to levy import taxes on the basis of higher deemed prices. The Company's technological activities have made different grades of rebar readily available in the Egyptian market while the high quality of its products has opened to it a wide export market.

4.6 ANSDK enjoys a cost advantage in the production of directly reduced iron (DRI). The cost structure of the Company shows that the cost of producing sponge iron has been less than the landed cost of imported scrap (allowing for the degree of metalization).

Cost of Directly Reduced Iron at ANSDK versus Imported Scrap

	CIF Cost of Imported Scrap $/ton	Cost of DRI Produced at ANSDK $/ton
1990	135. 7	143.7
1991	136.8	130.5
1992	129.3	121.7
1993	132.9	119.4
1994	145.0	116.9

Source: ANSDK

As can be seen, the cost of producing a ton of sponge iron (corrected for iron content) has consistently been less than that of the CIF cost of imported scrap. In recent years, with the DRP plant operating at above rated capacity, the DRI cost of production has declined, widening the gap. This gap is likely to fluctuate in the years to come, but the existence of the DRP has provided ANSDK with a secure source of supply at advantageous costs. While the scrap market does not appear to exhibit undue volatility in the last five

years, it might have behaved differently if ANSDK were to be in the market for quantities in the neighborhood of one million tons.

4.7 Designed to the Japanese standard of the early 1980s, the plant's environmental protection performance has been quite satisfactory. The installations of air and water pollution mitigation equipment and attention to their remaining in good working order have ensured that dust emissions from stacks and the quality of effluent discharge water have remained well within the prescribed limits. Through periodic studies by outside agencies, the Company makes sure that independent measurements are carried out and remedial suggestions are received. ANSDK has, in recent years, taken additional steps to reduce further the fumes that may still escape from the Meltshop into the atmosphere.

Sustainability

4.8 ANSDK enjoys all the conditions for a sustainable operation. It is an intrinsically economic and competitive plant facing an expanding domestic market[17]. It is well established in the export market by virtue of its quality and price competitiveness. It is strategically located on the coast and is close to the natural gas resources. It has been operating within a competitive environment in the domestic market where supplies come from other Egyptian manufacturers and imports. Its impressive technical performance speaks of a most competent and knowledgeable management and work force. It has access to technical assistance through some of the most efficient steel producers in the world. It has successfully internalized the know how brought to it by the foreign shareholders and built on it to continuously enhance productivity. ANSDK's operation-oriented research and development activities have already resulted in new designs and practices that have enhanced the operational efficiency. Constant attention has been paid to cost control and savings. It has been pursuing operating and maintenance practices that have maximized plant availability and resulted in very high operating ratios.

4.9 In recent years, ANSDK has also succeeded, with the help of the IFC, in reducing its currency exposure by swapping its Yen-denominated obligation into US dollars[18]. This has brought some measure of predictability to its costs until the loans are completely retired in the next decade. Once the initial project costs are depreciated and loans paid off, ANSDK will become similar to many mature steel plants where incremental investments will be associated with handsome returns. In fact one such expansion projects is currently underway.

4.10 The ongoing "Production Rationalization and Expansion Project" is aimed at eliminating the imbalance that has arisen because all existing plants operate at levels different from their respective nominal capacities. The project also aims at upgrading the steel making facilities and expanding the rod mill capacity to meet the anticipated increase in demand for the small gauge wire rods. Once completed, the annual capacity of ANSDK will be increased from 1.1 million tons to around 1.5 million tons of reinforcing bars and rods. The major expansion will take place in the rolling mill shop where a second rod mill, identical with the first, will be installed. The existing lay out was originally designed in such a way as to accommodate this second mill. In order to provide the additional billet requirements, the meltshop capacity will be expanded through the introduction of state of the art technological advances such as ladle

---

[17] A study carried out in 1992/93 by a firm of consultants to ANSDK projects the domestic consumption of rebars in the year 2000 at around 3.1 million tons.

[18] IFC arranged three yen to dollar swaps in March 1991, August 1992 and, more recently, in June 1994 covering a total of 40.8 billion yens. A fourth was arranged in October 1995.

furnaces, Eccentric Bottom Tapping (EBT), oxygen lancing and carbon injection. New systems for secondary fume extraction in the meltshop will enhance the existing environmental protection measures.

4.11 The shareholding structure of the company has changed significantly towards more private ownership (and lower debt/equity ratio), through the capital increase to finance the Production Rationalization and Expansion Project (US$70 million). The IFC played a very crucial catalytic role in the privatization drive. The most important change came with the Employee Fund subscribing nearly £ E 96 million (13.72 percent) of the new capital of ANSDK. The IFC also decided to increase its shareholding from 3 to 5 percent, whereas the Japanese shareholders chose to maintain theirs at 10 percent. While some public sector banks decided to maintain their shareholding in the Company, the other shareholders including the Egyptian General Petroleum Corporation all reduced their shareholding in order to make way for new shareholders (Annex XIX). The privatization process was assisted by the dispersion of public sector shareholding amongst many entities (in this case, 11 enterprises). This capital increase has also helped the Company to reduce its debt to equity ratio to around 66/34 from about 80/20 in 1991.

4.12 This project is being followed by a Second Direct Reduction Plant Project which aims at duplicating the existing direct reduction plant to provide the raw materials for the meltshop. As discussed in paragraph 4.6 above, the economics of producing direct reduction iron has been amply demonstrated by the performance of the DRP unit and its cost advantage compared with the landed cost of scrap steel at Alexandria. Until such time as the new DRP comes on stream the plant will have to depend on imported scrap or hot briquetted iron to meet its meltshop requirements. This new direct reduction unit will, in turn, create another imbalance because the quantity of sponge iron produced will be in excess of the capacity of the meltshop. For sometime ANSDK will have to market this product to other mini mills in Egypt, but it is certain that this excess capacity would provide the seeds of another expansion of the plant in the near future.

4.13 The company is taking confident steps in the direction of expanding its facilities and further enhancing its profitability. Being a low cost producer and having placed itself in the export market, it is likely to enjoy the same success as hitherto experienced. With an expanding domestic market, a highly skilled and competent management and work force, a well maintained plant, a reassuring financial situation (despite its earlier crisis) and close attention to environmental issues, the operation is eminently sustainable, bringing many benefits to the Egyptian economy. Currently, its foreign exchange savings stand at annual rate of close to US$170 million. Through its technological activities and local vendor promotion, it has increased its purchases of spare parts and small subassemblies from local fabricators. The reestimated economic rate of return, based on the actual performance in the last eight productive years and assumptions as indicated in Annex XX, is 10.5 percent.

5. Conclusions and Lessons Learned

5.1 Had it not been for its outstanding performance and early start of production, the project would have succumbed to the financial problems it faced arising out from factors beyond its control. The project's technical and managerial aspects were sound, bringing together several elements that have had satisfactory results. Its main weakness in the financial area was in failing to predict the long term change in the US dollar/yen exchange rate. Had the cross currency exchange rates remained at the levels assumed in the appraisal, the savings in the investment together with the early start of production would have easily compensated for the sluggish increase in rebar prices in the international market. By the time the plant was producing at capacity in 1988, almost all import prices were far below those anticipated at appraisal (direct production cost was US$200 per ton against an appraisal estimate of US$345).

5.2 The major lesson of this project is that the creation of large greenfield industrial projects often requires the heavy and continued involvement, as a shareholder, of a competent operating and producing company with extensive experience. This kind of intimate association cannot be replaced by other combinations such as the purchase of services for consulting engineers because the owners are devoid of the necessary experience in the construction and management of similar facilities. The close involvement of a competent operating company, preferably as an owner, fills this void and usually guarantees a smoother implementation. This is not to say that all industrial projects should be implemented in this way. Where there exists an operating entity and the management has a proven track record, new projects can be constructed under a different regime with greater dependence on the in-house project management capability, managing consulting engineers and services provided by vendors. What is important is that the owners have a clear appreciation of their capabilities and seek the most appropriate type of assistance for the successful realization of the project.

5.3 But the intimate involvement of an operating company, though necessary, is not sufficient. What is needed is the transfer of know how and work ethics to the work force of the project. This requires an intelligent, competent and knowledgeable indigenous management that creates an atmosphere conducive to the maximum transfer from the expatriates to the nationals. Consequently, the choice of top managers and, through them, the selection of middle management is of paramount importance. A management philosophy that considers its human resource as its greatest asset and is willing to invest heavily in this resource will find that its efforts are handsomely rewarded. The lesson is that the quality of management is of utmost importance in creating the likelihood of success and top managers should be selected on the basis of their track records.

5.4 The incorporation of the Company under Law 43 provided the autonomy for ANSDK, but it also brought in a good measure of accountability. Law 43 allowed the company to compete in the labor market, but it also brought its discipline. When confronted with the financial crisis, the Company was tempted (in 1987/88) to seek financial relief or increased protection from the government, but its Law 43 status stopped it from doing so. It could, however, legitimately ask for the revision of the Government's Price Decree which was clearly against the provisions of Law 43. The management's philosophy of delegating a high degree of responsibility has been balanced with commensurate accountability. Thus, while Law 43 provides other facilities which help the conduct of business, it also creates a hard budget constraint for the enterprise because it weans it from the Government. But the autonomy that is provided in Law 43 can only be of value if it is used by an alert and fair-minded management in motivating the work force.

5.5 Another lesson of the project is that, for investments of this magnitude, adequate financial engineering should include careful attention to cross-currency exchange risks. The currency swaps of 1991, 1992 and 1994 were useful in reducing the cross-currency risk exposure, but such measures to minimize financial risks should have been taken as part of the project's initial financial package.

5.6 This project satisfied a need, brought in new technology and up-to-date management style, created employment, used resources and inputs efficiently, had useful linkage effects, provided input to the construction industry at reasonable prices, helped dampen wild market fluctuations and, above all, provided a role model in a generally inefficient public industrial enterprise sector. This experience should help the Government of Egypt in its ambitious restructuring and privatization efforts.

Annex I

Development of Mini-Mills

Prior to the 1960s, the predominant view among steelmakers was that the large scale integrated steel plants using the blast furnace and basic oxygen steelmaking technology was economically unassailable. The corollary to this school of thought was that the developing countries could only start a steel industry, if the size of the domestic market justified the creation of a big economic unit (either in one or two stages). A serious challenge to this line of thinking came with the advent of mini-mills. A widely accepted, definition of a mini-steelworks consists of a plant capable of melting and refining cold metal—usually, but not invariably, scrap iron—in an electric arc furnace and casting it into billet or slab in a continuous casting machine; thereafter carrying out rolling operations. The proliferation of the mini-steelworks that followed in the industrial countries opened the way for many developing countries to aspire to become producers of steel for their own market. The mini-mills are especially attractive to the developing countries because of four main characteristics: lower economies of scale (as compared with blast furnace and basic oxygen steelmaking) permits them to serve smaller markets; the investment cost per ton of capacity installed is relatively low; they can be constructed in a shorter time and the production build up is normally more rapid; and they have substantially lower specific energy consumption when based on scrap. The capacity of the mini-mills could be as low as 50,000 tons per year extending to an annual capacity of around one million tons. Many produce reinforcing bars only; some make billets and slabs only; others go beyond the original concepts and roll wide and narrow strip, angles, tees and channels, even universal beams or rail.

The mini-steelworks concept was faulted on two basic grounds: first, that the market for a single product output could fluctuate and contract, leaving the works without orders; and, second, that in the event of an upsurge in world trade, scrap supplies would become scarce and more expensive and the mini-steelworks would be at a disadvantage compared with their more powerful integrated steel mill competitors. The former problem was resolved by the mini-mills exhibiting surprising flexibility and moving into other markets and the latter problem never became serious because the advances in direct reduction technology made the consistent supply of highly metallized sponge iron available as input to the electric arc furnace instead of scrap. It was then clear that while not all developing countries could start a mini-steelworks based on scrap—because of the highly volatile international scrap trade—the gas rich countries could replace scrap with sponge iron produced by a gas-based direct reduction plant, thereby stabilizing their operations and costs.

ANSDK - Productivity ratios in the Meltshop, Continuous Casting Plant and Rolling Mill Plant

		1986	1987	1988	1989	1990	1991	1992	1993	1994
Tap to Tap Time (minutes)		140.0	141.1	141.0	135.5	129.9	126.2	122.9	120.4	118.5
Good Billets (tons/heat)		69.8	71.9	78.5	74.8	75.8	77.0	78.9	79.9	80.0
Heat per Tundish		1.8	3.2	3.7	4.0	5.0	4.9	5.2	5.8	6.2
Rolling Mill Operating Ratio %	BAR	47.2	55.9	67.9	71.1	72.3	73.5	73.7	75.6	75.4
	ROD		42.2	66.2	74.8	76.7	78.3	82.6	86.1	83.6

ANSDK - Specific Consumption ratios (per ton of output)

	Design Values	1987	1988	1989	1990	1991	1992	1993	1994
Natural Gas Cubic Meter/ton rebar	347	393.0	315.3	265.1	270.6	231.2	285.4	266.5	257.1
Electricity Kilowatt Hour/ton rebar	1046	1362.0	1097.0	991.0	931.0	944.0	972.9	975.6	959.7
Water cubic meter/ton rebar	-	4.4	3.2	3.2	3.1	3.7	3.5	3.1	2.9
Refractories kilogram/ton molten steel	-	N/A	23.6	19.6	18.5	17.6	16.0	16.2	17.0
Electrodes kilogram/ton molten steel	-	4.0	3.8	3.5	3.7	3.7	3.7	3.7	3.6

Source: ANSDK

ANSDK - Training for Workforce Annex III

Workers/Technicians

	1990	1991	1992	1993	1994
Total Number of Training Courses	39	27	52	77	63
Technical	3	21	32	59	57
Administrative	36	6	20	18	6
Total Number of Participants	708	231	619	825	622
Technical	6	130	312	568	597
Administrative	702	101	307	257	25
Total Training Man Days	3,586	1,100	2,802	2,164	1,891
Technical	62	588	1,675	1,328	1,766
Administrative	3,524	512	1,127	836	125

Source: ANSDK

Professional Staff

	1990	1991	1992	1993	1994
Total Number of Training Courses	94	121	115	90	112
Technical	57	60	62	43	52
Administrative	37	61	53	47	60
Total Number of Participants	613	1,063	494	483	659
Technical	296	197	172	229	177
Administrative	317	866	322	254	482
Total Training Man Days	2,598	5,040	1,997	2,349	2,769
Technical	1,351	847	562	910	696
Administrative	1,247	4,193	1,433	1,439	2,073

Source: ANSDK

Annex IV

ANSDK - Safety Performance

	Number of Injuries	Number of Days Lost
1988	204	4,786
1989	165	3,836
1990	140	3,887
1991	105	3,227
1992	85	2,709
1993	52	1,732
1994	64	2,143

Source: ANSDK

Annex V

Cost Structure of ANSDK

US$/ton

	1988	1989	1990	1991	1992	1993	1994
Variable Cost	132.6	149.1	171.2	170.0	168.6	168.7	187.0
Fixed Cost	68.8	73.4	81.3	60.2	58.2	61.4	66.2
Manufacturing Cost	201.4	222.5	252.5	230.2	226.8	230.1	253.2
Selling and General Administrative Expenses	8.1	9.1	9.4	9.1	8.2	9.5	9.4
Financial Charges	68.4	84.9	60.7	64.1	48.4	62.4	27.2
Total Cost	277.9	316.5	322.6	303.4	283.4	302.0	289.8

Source: ANSDK

Annex VI

ANSDK - Natural Gas and Fuel Oil[19] Prices
$/million BThU

	Fuel Oil	Natural Gas
1986	1.60	
1987	2.23	
1988	1.66	2.44
1989	2.16	2.71
1990	2.52	2.55
1991	1.97	2.10
1992	1.98	1.93
1993	1.85	1.81
1994	1.86	1.77

Source: Platt's Oilgram, and ANSDK
Natural gas prices are those actually paid by ANSDK

[19] Prices are FOB Mediterranean Post (Italy) for 1 percent sulphur fuel oil.

Annex VII

ANSDK - Costs of Major Inputs, Consumables and Utilities

	1988	1989	1990	1991	1992	1993	1994
Raw Material Imports							
Pellet/Ore $/ton	34.3	37.1	40.4	41.3	43.9	34.1	34.7
Hot Briquetted Iron $/ton	-	-	135.7	135.6	126.1	115.0	139.0
Scrap $/ton imported	-	-	135.7	136.8	129.3	132.9	145.0
Scrap $/ton local	64.0	83.0	95.0	101.0	106.0	125.0	133.0
Ferro Manganese $/ton	411.7	477.4	601.8	561.4	579.5	484.5	427.8
Consumables							
Electrode $/ton	2,049	1,914	2,045	1,943	2,262	2,565	2,788
Refractories $/ton	354	458	500	518	607	610	531
Utilities							
Electricity ¢/kwh	1.37	1.31	1.26	1.42	1.98	2.02	2.03
Natural Gas $/million BTU	2.44	2.71	2.55	2.10	1.93	1.81	1.77

Source: ANSDK

Annex VIII

Reinforcing Bar Price Series
MUV used as deflator

	EC Rebar Exports Actual Metal Bulletin Average FOB		Japanese Rebar Exports Bank Commodities Division Series FOB		EC Rebar Exports SAR Projection FOB		Recent Prices of Imported Rebar into Egypt CIF
	Current $/ton	In 1982 dollars	Current $/ton	In 1982 dollars	Current $/ton	In 1982 dollars	Current $/ton
1972	105	260					
1973	200	426					
1974	311	544					
1975	207	326					
1976	227	352					
1977	192	272					
1978	234	288					
1979	319	346					
1980	311	307	331				
1981	255	251	313				
1982	218	218	242	242	218	218	
1983	186	193	222	227			
1984	196	205	225	234			
1985	200	208	225	234			
1986	236	208	220	193			
1987	254	204	202	162	365	330	
1988	313	234	262	196	465	330	283
1989	322	242	342	257	495	330	302
1990	293	209	364	259	525	330	292
1991	277	193	367	259	550	330	268
1992	264	176	307	205	575	330	245
1993	271	180	349	232	600	330	245
1994	278	178	322	207	625	330	240

Sources: Metal Bulletin: Market Outlook for Major Energy Products, Metals and Minerals and Minerals, The World Bank, July 1994; ANSDK

ANSDK Annual Production and Sales

1000s tons

	Production	Domestic Sales	Exports	Total Sales	Egyptian Market for Rebars	Share of ANSDK in Domestic Market
1986	47	21	-	21	2108	1%
1987	425	384	-	384	2116	18%
1988	825	781	49	830	1798	43%
1989	932	827	94	921	1793	46%
1990	970	875	88	963	1891	46%
1991	1000	942	59	1001	1860	51%
1992	1035	819	265	1084	1634	50%
1993	1102	875	250	1125	1945	45%
1994	1101*	799	335	1134	2050	39%

*Excludes 31,000 tons of billets rolled at another facility.
Source: ANSDK

Imported, Domestic and Export Prices of Rebar

	Brussels export price $/ton	Average price of imported rebars declared at Egyptian Customs $/ton	Price accepted by Egyptian Customs $/ton	Average cost of imported rebars into Egypt £E/ton	ANSDK Average Selling Price £E/ton		ANSDK Average Selling Price $/ton	
					Domestic	Export	Domestic	Export
1988	285	283	283	785	635	662	278	290
1989	322	302	302	907	823	760	346	319
1990	293	292	292	930	900	853	339	322
1991	277	268	268	1070	1053	970	319	294
1992	264	255	255	1105	1039	887	312	266
1993	271	245	260*	1080	1131	949	338	283
1994	278	240	290*	1124	1129	919	334	272

* Deemed CIF price for import duty calculation.
Source: Metal Bulletin; ANSDK

Alexandria National Iron and Steel Company
Profit and Loss Account

Egyptian £ million

	1987	1988	1989	1990	1991	1992	1993	1994	1995
Revenue									
Net Sales	11.9	538.9	757.9	867.2	1,065.0	1,196.7	1,329.0	1,314.4	1,530.9
Other Income	1.3	10.7	17.8	9.5	9.6	4.9	6.1	6.1	2.8
Total	121.2	549.6	775.7	876.7	1,074.6	1,201.6	1,335.1	1,308.3	1,523.1
Costs									
Cost of Sales	105.4	389.4	489.1	641.1	761.9	911.0	926.5	1,030.7	1,220.6
Sales & Distribution Expenses	1.4	3.4	4.1	4.8	4.6	28.3	29.2	25.7	28.7
Total	106.8	392.8	493.2	645.9	766.5	939.3	955.7	1056.4	1,249.2
Gross Profit/(Loss)	14.4	156.8	282.5	230.8	308.1	262.3	379.4	251.9	273.9
Other Costs									
General & Administration Expenses	4.8	11.9	15.5	17.5	22.1	24.1	27.9	33.3	41.5
Financing Charges	25.4	98.4	108.9	96.6	146.9	142.2	89.8	86.4	76.9
Provisions	-	2.0	53.6	(11.1)	11.9	(7.7)	39.3	2.0	21.6
Board Remunerations	.1	0.3	.4	.6	.6	.8	.9	1.3	1.3
Currency Exchange Loss	5.3	4.8	8.6	26.9	18.9	(5.9)	13.4	.5	1.3
Deferred Expenditure	11.5	35.1	35.5	40.4	43.3	41.6	96.0	13.7	10.8
Total	47.1	152.5	222.4	170.3	243.7	195.1	267.3	137.2	153.4
Net Profit/(Loss)	(32.8)	4.2	60.1	60.5	64.4	67.3	112.0	114.7	120.5

Source: ANSDK

Alexandria National Iron and Steel Company
Balance Sheet

Egyptian £ million

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Assets											
Current Assets	91.4	83.1	67.0	86.0	252.0	521.83	578.5	674.5	811.2	696.2	673.8
Cash	90.2	81.6	48.1	12.0	74.7	233.6	207.0	140.2	189.5	117.0	50.2
Accounts Receivable	1.1	1.5	5.9	8.3	10.4	14.6	31.2	17.4	46.1	58.9	84.9
Inventory			13.1	65.7	166.9	273.6	340.3	516.8	575.6	520.3	538.6
Fixed Assets	1.5	2.9	55.1	607.6	1,302.2	1,274.5	1,177.7	1,230.9	1,352.1	1,251.7	1,143.5
Other Assets	54.9	142.9	405.1	229.0	228.2	255.5	221.7	218.8	211.9	164.2	163.7
Project in Progress	51.1	135.4	382.2	135.5	1.6	0.9	0.5	0.9	12.2	22.2	43.4
Investments/Long-Term Receivables	0.1	0.4	0.8	1.5	3.6	5.1	6.6	12.1	22.0	21.1	20.5
Long-term Loan Exchange Difference & prior expenditure	3.7	7.1	22.1	82.0	223.0	249.5	214.6	205.8	177.7	120.9	100.8
Total Assets	147.8	228.9	527.3	912.6	1,782.3	2,051.8	1,978.0	2,124.2	2,375.2	2,112.1	1,980.9
Liabilities											
Current Liabilities	13.5	33.4	59.4	101.5	3,009.9	321.6	196.0	208.2	273.1	292.8	304.2
Banks	-	-	-	50.1	36.6	258.5	258.9	259.5	329.1	206.7	26.9
Long-Term Debts	9.7	45.5	268.9	529.3	1,220.9	1,238.7	1,154.5	1,245.6	1,385.7	1,197.1	1,115.3
Provisions				1.0	14.2	28.1	103.5	106.2	41.7	28.8	78.1
Net Shareholder's Equity	124.7	150.0	199.0	230.7	200.7	204.9	265.0	304.7	345.7	386.8	456.4
Shareholder's Equity	119.2	136.7	179.1	229.3	233.5	233.5	233.5	233.5	233.5	233.5	233.5
Profit & Loss/Reserves	5.4	13.3	19.9	1.4	-32.8	-28.6	31.5	71.2	112.2	153.3	222.9
Total Liabilities	147.8	228.9	527.3	912.6	1,782.3	2,051.8	1,978.0	2,124.2	2,375.2	2,112.1	1,980.9
Memo: Dividends								20.9	23.0	25.9	42.6

Source: ANSDK

Foreign Exchange Savings

	Import Price $/ton	Foreign Exchange Outflow Including Financial Charges $/ton	Savings $/ton	Total Production Thousand tons	Total Foreign Exchange Savings $ million
1988	283	131	152	825	125
1989	302	149	153	938	143
1990	292	169	123	977	120
1991	268	184	84	1000	84
1992	255	158	97	1035	100
1993	260	158	102	1102	112
1994	290	141	149	1132	168
				Total	852

Annex XIV

ANSDK Project Costs at Prevailing Exchange Rates (US$ million)

	Appraisal Estimate			Actual		
	Foreign	Local	Total	Foreign	Local	Total
Site Preparation	-	13.2	13.2	0.0	28.1	28.1
Direct Reduction	79.3	-	79.3	76.6	1.5	78.1
Steel Making Plant	99.0	-	99.0	126.4	5.6	132.0
Bar Rolling Mill	39.2	-	39.2	33.3	2.3	35.6
Rod Rolling Mill	47.2	-	47.2	44.4	1.9	46.3
Lime Calcining	6.9	-	6.9	7.3	0.2	7.5
Substation	20.0	-	20.0	17.3	0.8	18.1
Transportation Equipment	8.7	-	8.7	11.9	1.5	13.4
Utilities 9.3	-	19.3	19.3	16.5	1.1	17.6
Analysis and Inspection	1.7	-	1.7	4.7	0.3	5.0
Maintenance Shop	3.2	-	3.2	6.3	0.8	7.1
Civil and Building Works	77.7	52.1	129.8	80.0	25.4	105.4
Steel Structure	1.5	4.3	5.8	24.5	6.8	31.3
Installation[a]	43.9	20.4	64.3	-	-	-
Temporary Facilities	-	0.5	0.5	0.1	0.4	0.5
Inland Transportation[a]	-	4.5	4.5	-	-	-
Other[b]	0.9	1.7	1.5	1.5	2.5	4.0
Engineering and Training[c]	33.4	1.7	35.1	-	-	-
Subtotal	462.6	117.7	579.4	450.8	79.2	530.0
Preproduction Expense[d]	14.7	9.3	24.0	138.6	14.1	152.7
Contingency[a]	30.7	7.8	38.5	-	-	-
Working Capital	42.7	18.1	60.8	42.8	21.1	63.9
Subtotal	88.1	35.2	123.3	181.4	35.2	216.6
Project Cost	569.9	132.8	702.7	632.2	114.4	746.6
Housing Fund	5.0	-	5.0	-	1.6	1.6
Interest During Construction and front-end fee	49.7	-	49.7	45.6	-	45.6
Other Provisions[a]	42.6	-	42.6	7.1	-	7.1
Subtotal	97.3	-	97.3	52.7	1.6	54.3
Total Project Cost	667.2	132.8	800.0	684.9	116.0	800.9
Exchange Loss on Debt	-	-	-	151.8	-	151.8
Total	-	-	-	836.7	116.0	952.7

[a] These items are buried in other packages in "Actual".

[b] Includes $1.1 mln for construction progress.

[c] In actual, engineering and training cost is included in analysis and inspection and elsewhere.

[d] Includes working capital and contains an exchange loss component.

Source: Project Audit Report (Report No. 9593)

ANSDK - Pollution Standards Envisaged In Design

Dust Control

Section	No.	Installed Place	Places to be dedusted	Type	Dust in Exhaust Gas
DR	1	Oxide Day Bins	Junction point of Belt Conveyor	Dry Cyclone + Wet Scrubber	100 micrograms per Nm^3
Plant	2	Product Screen	Junction point of Belt Conveyor	Dry Cyclone + Wet Scrubber	100 micrograms per Nm^3
Steel Making	3	Electric Arc Furnace	Furnace Roof	Combustion Chamber + Bag Filter	100 micrograms per Nm^3
Plant	4	Material Handling System	Conveyor Junction		100 micrograms per Nm^3
	5	Kiln Top	Kiln Top	Bag Filter	100 micrograms per Nm^3
	6	Raw Material Handling	Hopper	Bag Filer	100 micrograms per Nm^3
Lime	7	Product Handling	Hopper	Bag Filter	100 micrograms per Nm^3
Calcining	8	Product Handling	Conveyor Chute	Bag Filer	100 micrograms per Nm^3
Plant	9	Product Handling	Conveyor Chute	Bag Filer	100 micrograms per Nm^3
	10	Product Handling	Hopper	Bag Filter	100 micrograms per Nm^3
	11	Product Handling	Conveyor Chute	Bag Filer	100 micrograms per Nm^3

Effluent Water Control

pH	5.0 to 8.6
Biological Oxygen Demand (BOD)	below 120 micrograms per liter daily average (max. 160 microgramg per liter)
Chemical Oxygen Demand (COD)	below 120 micrograms per liter daily average (max. 160 micrograms per liter)
Suspended Solids	below 150 micrograms per liter daily average (max. 200 micrograms per liter)
Oil and Grease	below 30 micrograms per liter
Copper	below 3 micrograms per liter
Zinc	below 5 micrograms per liter
Soluble Iron	below 10 micrograms per liter

Source: ANSDK

ANSDK - Air Quality Analysis

Measurements in 1991

Microgram/Cubic Meter

	Dust	SO_2	NO_2	Iron	Lead	Manganese	Magnesium
Inside the Plant - Standard	1,800	60	200	15,000	14	200	1,500
Meltshop	1,756	35	67	944	2.01	4.3	16.7
DRP	2,129	-	10	-	-	-	-
Lime Calcining Plant	440	38	113	23	.37	2.0	15.2
Rolling Mills	203	-	-	72	.02	.46	9.0
Gate 2	281	18	45	101	.88	.29	6.0
Gate 5	788	31	127	128	1.34	2.81	21.0
Outside the Plant - Standard	230*	60	200	500	14	200	1,500
North East	136	-	-	4	.19	.05	17.7
South East	316	-	-	32	.35	2.32	18.1
North West	422	-	-	81	.69	1.46	13.5
South West	156	-	-	5	.16	.06	12.5
East	256	20	22	34	.03	.91	9.5

Measurements in 1995

Site Office	1,746	18	61				
Gate 3	249	22	61				
Gate 4	524	25	77				
Laboratories	655	20	53				
The Company's Camp	123	15	61				

*Taken for the upper limit of the standard for the City of Alexandria.
Source: ANSDK

ANSDK - Water Quality Analysis
Drainage Water

	National Standards	1990	1991	1992	1993	1994
pH	6-9	7.2	8.2	8.2	8.3	8.2
Total Alkalinity	ND	230	259	354	346	423
Calcium mg/liter	ND	57	120.8	142.4	169.2	131.1
Chlorine mg/liter	ND	234	196	245	258	212
Total Iron mg/liter	ND	8	6	3	3	4
Silicon Oxide (SIO_2) mg/liter	ND	8	7	4	10	13
Suspended Solid mg/liter	60[a]	30	44	49	46	55
Chemical Oxygen Demand (COD) mg/liter	100[a]	8	15	12	12	13
Biological Oxygen Demand (BOD) mg/liter	60[a]	4	11	8	8	9
Oil and Grease mg/liter	10[a]	1	1	1	1	3
Total Dissolved Solids mg/liter	2,000	757	772	1,102	1,187	1,332

Figures rounded

[a] Below initial design value.
ND - Not defined.
Source: ANSDK

Slag and Waste Material From 1986 to 07/1994 - tons per year

Material	86-87	1988	1989	1990	1991	1992	1993	1994	Total
Sludge (DRP)	9655	15106	17368	18786	19080	18137	13459	8332	119923
Sludge Cake	00	00	1952	3025	2441	1929	2879	1010	13236
Scale	2765	13016	16437	17770	13521	13608	16167	9788	103072
Limestone Fine	5648	6943	7299	6469	7063	6607	9823	6056	55908
Refractory Bricks	3875	7649	5811	7130	8767	7688	7986	3575	52481
DRI Dust	1332	2129	1810	3094	3082	3000	4300	2170	20917
Other Dust	9900	13863	11959	14105	16046	21481	22526	13509	123389
Total Waste	33175	58706	62636	70379	70000	72450	77140	44440	488926
Total Slag									1263856
Grand Total									1752782

Source: ANSDK

Annex XIX

ANSDK's Shareholding Structure

Shareholders	Old Holding as at 12/31/93	New Holding as at end January 1995	
	%	Shares	%
Public Sector			
Egyptian General Petroleum Corporation (EGPC)	14.06	640,180	9.15
National Bank of Egypt (NBE)	8.03	562,278	8.03
National Investment Bank (NIB)	11.04	773,344	11.04
Bank of Alexandria (BOA)	8.03	417,278	5.96
Bank Misr (BM)	8.03	562,278	8.03
Misr Insurance Company (MIC)	8.03	562,278	8.03
Egyptian Iron & Steel Company (Hadisolb)	6.03	227,360	3.25
Executive Organisation of Industrial and Mining Complexes (IMC)	6.03	274,360	3.92
National Metal Industries Company (NMI)	6.03	227,360	3.25
Delta Steel Mill Company (DSM)	6.03	227,360	3.25
Egyptian Copper Works Company (ECWC)	6.03	274,360	3.92
Sub Total Public Sector	87.47	4,748,436	67.83
Private Sector			
Japanese Consortium (JC)	10.04	702,949	10.04
IFC	2.59	350,000	5.00
Employee Fund	-	912,615	13.04
Investment Funds	-	286,000	4.09
Sub Total Private Sector	13.63	2,251,564	32.17
Grand Total	100.00	7,000,000	100.00

Annex XX

ERR Calculations in 1994 Prices

	Investment Cost £E million	Sales Thousand Tons	Economic Price £E	Total Revenue £E million	Costs £E million	Cash Flow £E million	Deflator Egyptian Producer Price Index	Benefit Stream
1984	3	-	-	-	-	(3)	.219	(14)
1985	53	-	-	-	-	(53)	.245	(216)
1986	570	-	-	-	-	(570)	.304	(1875)
1987	794	227[20]	731	166	5	(633)	.365	(1734)
1988	70	830	927	770	389	311	.428	727
1989	-	921	1029	948	527	421	.519	811
1990	-	963	1070	1031	650	381	.606	629
1991	-	1001	1189	1190	845	345	.725	476
1992	-	1084	1145	1242	951	291	.825	353
1993	-	1125	1183	1331	1003	328	.924	355
1994	-	1134	1213	1376	1047	329	1.000	329
1995	-	1130	1217	1375	1047	328	1.000	328
1996	-	1130	1221	1379	1047	332	1.000	332
1997	-	1130	1224	1384	1047	337	1.000	337
1998	-	1130	1228	1388	1047	341	1.000	341
1999	-	1130	1232	1392	1047	345	1.000	345
2000	-	1130	1235	1396	1047	349	1.000	349
2005	-	1130	1242	1403	1047	356	1.000	356
2010	-	1130	1248	1410	1047	363	1.000	363

ERR=10.5%

Assumptions for ERR Calculations

1. Sales will be maintained at the current level.
2. Rebar economic prices for the past + EC export prices + US$80 to cover freight, product, mix and size premia and unloading charges.
3. Future economic prices based on Bank forecast: 0.3 percent annual real increase until the year 2000; 0.1 percent annul real increase thereafter..
4. Deflator: Egyptian Producer Price Index.
5. Declines in financial charges balanced by the need for heavy repairs and maintenance to keep the current production level.

[20] The 1987 income statements runs from September 1, to the end of the year.

IMAGING

Report No: 15555 BGT
Type: IEE