エジプト・アラブ共和国
金属加工技術向上
事前調査団報告書

1999年4月

国 際 協 力 事 業 団

序　　文

エジプトでは慢性的な貿易赤字の解消を視野に入れ、国際競争力を高めるべく、特に自動車部品、一般機械などの産業開発を国家計画の最優先課題として重点を置き、同分野における外国資本、技術の導入を経済政策の大きな柱としてきました。そのうえで重要な位置を占めてくる部品産業のなかでも、金属加工、機械加工の製造業者は、基本的な技術並びに品質管理が欠落しており、その早急な改善が必要となります。

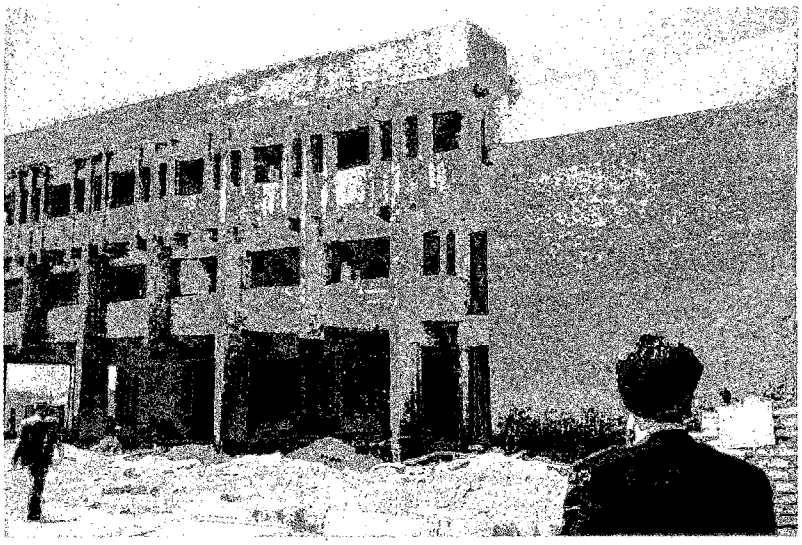
このような背景のもと、エジプト政府は、1998年８月、科学研究省中央冶金研究所（Central Metallurgical Research and Development Institute：CMRDI）の鋳造技術、金属加工、熱処理技術、評価試験に関する技術を強化することを目的とするプロジェクト方式技術協力を要請してきました。

本事前調査団は、エジプト政府から提出された協力内容について、エジプト側と詳細な協議を行い、プロジェクトの要請背景・実施体制の確認、要請各分野に関するニーズ及び要請内容の確認をし、より具体的、かつ実行可能性の高いプロジェクトの枠組み形成を行うことを目的に派遣されたものです。

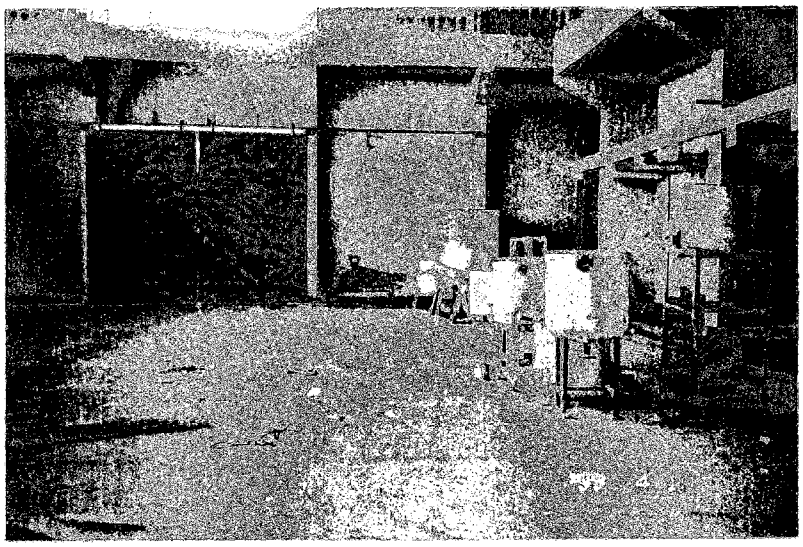
本報告書は、調査団の現地における調査結果及び協議事項を取りまとめたものです。ここに、本調査団の派遣に御協力いただいた日本、エジプト両国の関係各位に対し深甚の謝意を表するとともに、あわせて今後の御支援をお願いする次第です。

1999年４月

国際協力事業団
理事　安本　皓信



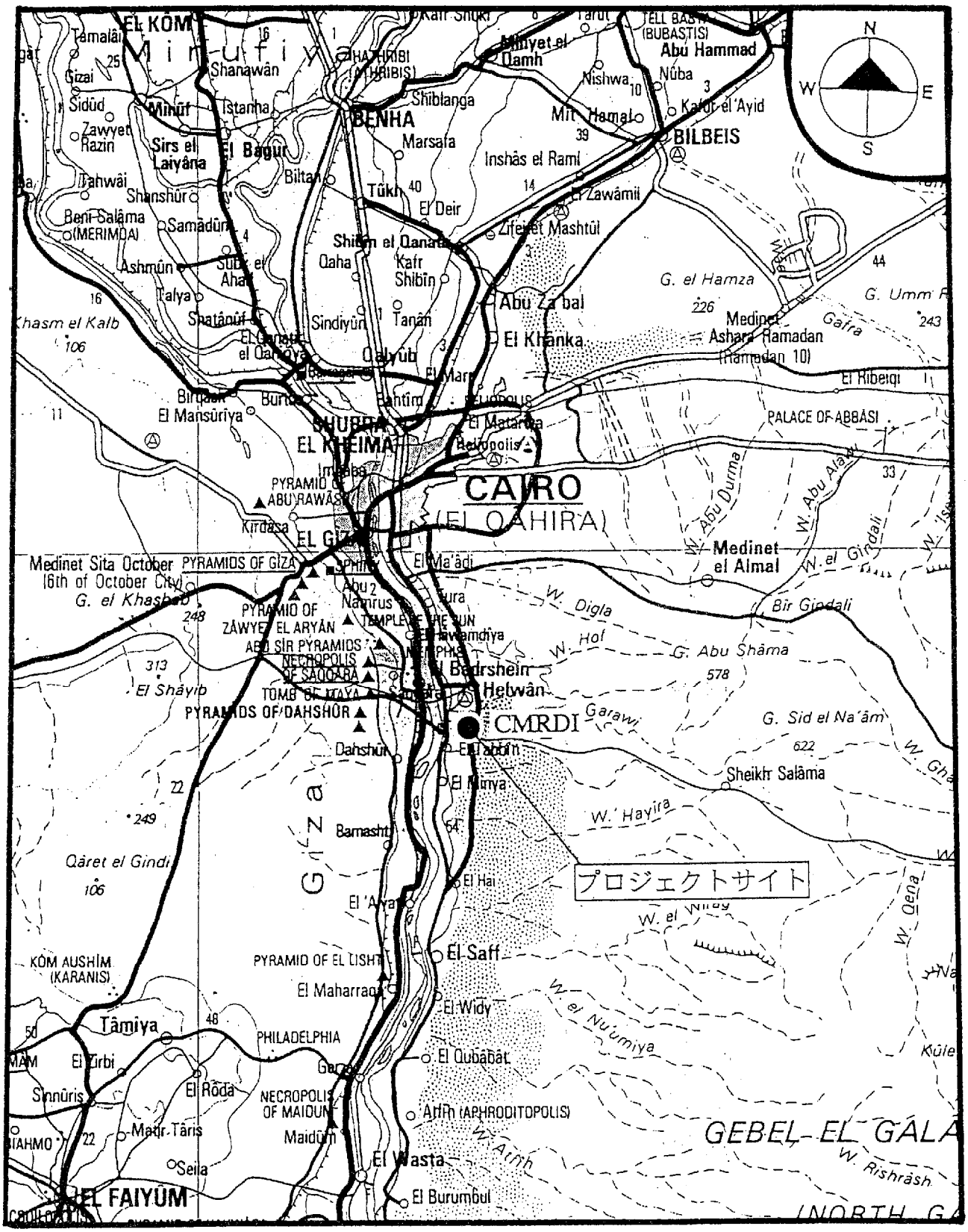
プロジェクト・サイト（増設工事部分）



プロジェクト・サイト（鋳造関連）

CMRDI正面玄関にて

プロジェクト・サイト位置図



目　　次

第１章　事前調査団派遣の経緯

１－１　要請の経緯と目的

エジプトでは、慢性的な貿易赤字の解消をも視野に入れ、輸出産業への投資促進策がとられており、公的企業の段階的な民営化による産業の活性化も進められているが、多くの企業はこれまでの保護政策下で十分な国際競争力を身につけていない。また、産業を支えるうえで重要な、中小企業を中心とした自動車部品、一般機械などの産業開発は、国家計画の最優先課題となっているが、基本的な技術並びに品質管理が欠落しており、産業の競争力強化を阻害する要因となっていることから、その早急な改善が急務となっている。

このような状況下、同国政府は、1998年８月、我が国に対し、鉱石評価・資源選鉱、冶金、金属加工、溶接の４部門に管理部門を加え約500人の人員（うち約30%が研究員）を擁し、同国における金属学の研究開発及び中小企業を中心とした民間への技術サービスにおいて中核的な存在である科学研究省中央冶金研究所（Central Metallurgical Research and Development Institute : CMRDI）の鋳造、金属加工、熱処理、評価試験に関する技術を強化することを目的とするプロジェクト方式技術協力を要請した。

上記を受け、今次事前調査では、日本におけるODAを取り巻く最近の情勢及び予算事情、プロジェクト方式技術協力スキームを先方に説明したうえで、プロジェクトの要請背景・実施体制の確認、要請各分野に関するニーズ及び要請内容の確認、エジプト側の技術レベルの把握及び問題分析等を行った。更に、これを踏まえ、技術移転分野・項目の絞り込み及び具体的協力形態・内容、また可能であれば日本、エジプト双方の投入計画（案）の検討を行ったうえで、これらについての確認・合意事項をミニッツに取りまとめ、署名・交換した。

１－２　主要調査項目

(1) 日本におけるODAを取り巻く最近の情勢、予算の説明

(2) プロジェクト方式技術協力の現行スキームの説明（PDM、評価５項目の説明を含む）

(3) プロジェクトの背景・実施体制の確認

　ア　エジプトの国家政策、経済動向との整合性

　イ　当該セクターの現況

　ウ　ターゲット・グループ

　エ　所管官庁・実施機関の組織、予算、人員

　オ　新建屋の建設状況

(4) 実施済み各案件に関する評価

(5) 下記要請各分野に関するニーズ及び内容の確認、技術レベルの把握及び問題分析、技術

移転分野・項目の絞り込み

ア　鋳造技術＝ロストワックス､ダイカスト(砂型鋳造については、機材のみの要請か要確認)

イ　金属加工＝機械加工、レーザー加工

ウ　熱処理技術＝高周波焼入れ、化学焼入れ、オーステンパー

エ　評価試験＝疲労試験、クリープ試験

(6)（可能であれば）具体的協力形態・内容、日本、エジプト双方の投入計画（案）の検討

１－３　調査団の構成

氏　名	分　野	所　　属
石田　幸男	団長・総括	国際協力事業団鉱工業開発協力部計画・投融資課課長代理
藤田　実	技術協力計画	通商産業省基礎産業局鉄鋼課技術振興室技術係長
吉田　千里	鋳造技術	神鋼リサーチ㈱東京調査研究部担当部長
樺澤　眞事	金属加工	日本鋼管㈱総合材料技術研究所福山材料研究センター主幹研究員
勝又　晋	協力企画	国際協力事業団鉱工業開発協力部鉱工業開発協力第一課職員

１－４　調査日程

日順	月日(曜日)	調　　査　　内　　容
1	４月９日(金)	移動（JL411成田→アムステルダム、KL553アムステルダム→カイロ）
2	10日(土)	午前：CMRDI表敬、サイト視察、プロ技スキーム説明 ミニプロ専門家との打合せ
3	11日(日)	午前：JICA事務所、JETROとの打合せ、日本大使館表敬 午後：エジプト外務省表敬
4	12日(月)	エジプト祝日（春薫祭）
5	13日(火)	CMRDIとの協議、カウンターパート候補者インタビュー
6	14日(水)	CMRDIとの協議、関連工場見学、カウンターパート候補者インタビュー
7	15日(木)	午前：関連工場見学 午後：エジプト輸出振興センター打合せ
8	16日(金)	団内打合せ
9	17日(土)	CMRDIとの協議
10	18日(日)	ミニッツ最終案確認
11	19日(月)	午前：ミニッツ署名 午後：日本大使館報告、JICA事務所報告
12	20日(火)	移動（AF503カイロ→パリ、AF276パリ→成田）
13	21日(水)	成田着

１－５　主要面談者

〈日本側〉

(1) 在エジプト日本大使館

山下善太郎	一等書記官

(2) 日本貿易振興会カイロ・センター

野口勝明	所長

(3) ミニプロ「薄板加工」専門家

青井久幸	JICA専門家
上村順三	JICA専門家
福本　紀	JICA専門家

(4) JICAエジプト事務所

竹内喜久男	所長
不破雅実	次長
佐藤　仁	所員
Mahmoud Abd El Halim	Development Projects Coordinator

〈エジプト側〉

(1) 外務省

Ms. Nagla El-Hussainy	Deputy Assistant Minister for International Cultural Relations

(2) 工業省

Mr. Soliman Reda	Minister
Mr. Hamdy Sanad	Vice Minister
Dr. Eid Hasan	Deputy Chairman of General Organization for Industrialization

(3) 中央冶金研究所

Prof. Adel Nofal	President
Prof. Dr. Eng. Bahaa Zaghloul	Head of Welding Research Department

第２章　協議結果

調査項目	エジプト側要請内容､現状及び問題点等	対処方針	協議結果
Ⅰ．日本におけるODAを取り巻く最近の情勢、予算の動向		・日本におけるODAを取り巻く最近の情勢、予算等について説明するとともに、必要に応じ意見交換を行い、ミニッツに記載する。	・フィージブルで自立発展性のあるプロジェクトを形成する必要がある旨を含め、左記を説明し、ミニッツに記載した。
		・また、我が国側より広報の重要性についても伝え、理解を得る。	・左記を説明し、理解を得た。先方も広報に積極的であり､今次調査団の来訪が新聞に掲載されたほか、テレビの生放送(国営チャンネル１の「おはようエジプト」）のなかでCMRDI、及びCMRDIとJICAの関係を紹介するコーナーがアレンジされ、CMRDI所長、本調査団長ほかが出演した。
Ⅱ．プロジェクト方式技術協力の現行スキームの説明	・今次協力の実施機関となる予定のCMRDIに対しては、我が国からの協力として個別専門家派遣、専門家チーム派遣、第三国研修等が実施されているが、プロジェクト方式技術協力が実施されたことは過去にない。	・プロジェクト方式技術協力の現行スキームについて説明し､理解を得る。	・左記について、特にプロ技の３つの柱のうち「専門家派遣」によるカウンターパートへの技術移転が中心である旨説明し、理解を得、ミニッツに記載した。
		・特に、案件の計画、実施、モニタリング、評価の一連の過程を管理するためにPDMを導入し、また、評価５項目を用いて評価することを説明し、理解を得、ミニッツに記載する。	・左記を説明し、ミニッツに記載した。

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Ⅲ. プロジェクトの背景 1　国家開発政策、経済動向等との整合性	・1997年７月より、第４次５カ年計画がスタートしている。主要目標(抜粋)は以下のとおり。 (1) 年間GDP成長率6.9%の達成 (2) 民間投資額を目標総投資額の65～75%、国内総生産の90%以上に拡大 (3) 民間セクター生産を年率10%で拡大 更に、1997年から2017年までの長期開発戦略「エジプトと20世紀」が実施されている。主要目標(抜粋)は以下のとおり。 (1) １人当たりGNPを4,100ドルに(現行1,250ドル) (2) 産業育成・生産及び輸出拡大 (3) 貿易の拡大	・左記各計画等の国家開発計画と要請されたプロジェクトとの整合性を確認し、必要に応じミニッツに記載する。	・左記のほか、1997年から2017年までの20年計画である「エジプトと20世紀」において、「産業開発に最も重要な政策」のひとつとして、「中小企業を育成し、大企業への納入先としての位置づけを確立し、相互補完関係を形成するように支援する」とある。その旨確認し、ミニッツに記載した。
	・エジプト経済、産業等に関する主要な動向は以下のとおり。 (1) 1996年以降のガンズーリ内閣下、民営化政策を加速している。しかし、非効率な公営企業をいまだ多数抱えている。民間従業員の１人当たりの生産額は国有企業の1/3といわれている。民間セクターのGDP構成比は61.3%(1992年度)から66.4%(1997年度)へ増加している。 (2) 失業率は1996/97年度はエジプト政府推計で8.8%、2001/02年度目標は4.9%となっている。	・左記の最新動向について確認し、必要に応じミニッツに記載する。	・左記の最新動向については、第３章を参照。
2　当該セクターの現況	・製造業、金属関連産業、中小企業の現況に関する主要情報については以下のとおり。 (1) 輸出のうち製造業の占める割合は26.5%。うち繊維製品が12.3%、金属・機械が6.4%、食品が3.1%、化学製品が2.4% (いずれも1997年)。 (2) 自動車の組立台数が1991年の２万台弱から1997年には７万台弱へと増加。ほとんどが国内市場で販売。1996年にはGM/いすゞ、現代、NASCO、スズキの４社で組立シェアの88%を占めている。日系ではほかに三菱、日産が生産を開始している。 （以下はCMRDIに対する事前質問表への回答より）	・左記現況について確認し、必要に応じミニッツに記載する。また、工場見学等により、当該セクターの技術的なニーズ、レベルについて把握し、必要に応じミニッツに記載する。	・下記４社について工場見学を行った。 (1) NASCO社（国営自動車メーカー) (2) General Metals Co.社（ダイカストメーカー) (3) ABB Arab社（スイッチ盤等をレーザーマシンを用いて製作しているメーカー) (4) El Naser Casting Co.(ダクタイル、ねず

調査項目	エジプト側要請内容、現状及び問題点等	対処方針	協議結果
	(3) 公営企業では、機材、技術とも比較的古く、後れている。 (4) 1970年代以降に創設された民間企業の設備は比較的新しい。 (5) 民間企業のほとんどは輸出産業であることから、製品の品質の維持や技術の更新等に関して、継続的な支援が必要である。 (6) また、自社の試験設備がないことから、製品の試験・評価についても支援が必要である。		み鋳鉄等のメーカー） ・当該セクターの現況等については、第３章に記述のとおり。
Ⅳ. プロジェクトの実施体制の確認			
(1) 所管官庁	・所管官庁は、国務(科学研究)省（Ministry of State for Scientific Research）とされている。	・左記について確認し、ミニッツに記載する。所管官庁と実施機関間の指揮命令系統、予算承認・配分等に関する関係について確認する。	・国務(科学研究)大臣は、内閣においてCMRDIを代表する立場を有している。ただし、本大臣は、傘下に省としての組織は有していない。 他方、CMRDIは、予算を大蔵省へ直接要求することが可能であること等、独立性が高い組織といえる。
(2) 実施機関	・実施機関は、中央冶金研究所(Central Metallurgical Research and Development Institute：CMRDI)とされている。	・左記について確認し、ミニッツに記載する。	・左記を確認した。
	・CMRDIは、1985年に、エジプトAcademy of Scientific Research and Technology、エジプト産業界、UNESCOにより設立された。	・左記について確認し、必要に応じミニッツに記載する。	・CMRDIは、1985年に、エジプトAcademy of Scientific Research and Technology、エジプト産業界、UNIDOにより設立された旨を確認し、ミニッツに記載した。 なお、CMRDIの機能は、1985年以前はエジプトNational Research Centerが有しており、CMRDIは同Centerより1985年に分離独立の形で設立される

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			と同時に、現在のサイトに移転したとのこと。
ア　活動概要	・CMRDIは、工業試験所として産業界への新規技術の紹介、各企業を訪問しての技術指導を行い、パイロットプラント(２カ所の化学工場)への技術サポートを行っている。10年間に250件の受託契約による技術支援を実施しているほか、研修コース20件を定期的に開催している。	・左記について、以下の各項目に沿って現状を確認し、ミニッツに記載する。 (ｱ) 対象とする技術分野 (ｲ) ターゲットとしている産業 (ｳ) 活動形態(技術支援、研修コース、セミナー、試作品製作、研究開発、技術認定等)ごとの活動	(ｱ) 金属にかかる、鉱石評価・資源選鉱、鋳造、金属加工、溶接、試験等の技術分野について幅広く対象としている。 (ｲ) 広く産業界全体を対象としている。 (ｳ) 左記各分野について、広く活動している。
イ　組織としての開発計画	・CMRDI DEVELOPMENT PLAN(1997-2001)が実施されている。	・左記内容・実施状況について確認し、必要に応じミニッツに記載する。	・左記が実施中であることを確認し、ミニッツに記載した。
ウ　組織	・以下の４部門で構成されている。 溶接研究(Welding Research) 鉱石評価・資源選鉱(Ore Evaluation & Mineral Beneficiation) 冶金(Extractive Metallurgy) 金属加工(Metal Working & Forming) なお、上記CMRDI DEVELOPMENT PLANによれば、組織の改編が予定されている。	・組織改編の状況も含め、左記について確認し、ミニッツに記載する。	・現在の組織は、左記の４部門に加え、管理部門（Administration）を含めると５部門で構成されている旨確認し、ミニッツに記載した。 ・エジプト側より、向こう半年間に、より直接的に産業界のニーズに応えるために組織の改編を行う予定である旨説明があった。 具体的な新組織については、まったく未定とのことで確認できなかった。

調査項目	エジプト側要請内容、現状及び問題点等	対処方針	協議結果
	・また、産官学の関係者で構成された理事会(Board of Directors)が存在している。	・理事会の機能・役割等について確認し、必要に応じミニッツに記載する。	・以下を確認し、ミニッツに記載した。 理事会は、年間４回定期的に開催されるほか、必要に応じ不定期にも開催され、人事等については理事会の承認事項となっている。ただし、予算要求については、理事会の承認を経ず、CMRDIから大蔵省に直接行うことができる。 理事会メンバーの任期は４年間であり、現理事の任期は2001年６月までとなっている。次期については、民間からの登用を増やす予定とのこと。 理事会メンバーは以下のとおり。 (カッコ内は人数) (ｱ) 議長=CMRDI所長(1) (ｲ) 副議長(1) (ｳ) CMRDIの４部長(4) (ｴ) holding company社長(5) (ｵ) 大学教授(1) (ｶ) 特別な経験の持ち主(2)
エ　人員	・CMRDIの人員は約420名であり、そのうち、研究員(Reasearcher)が約140名、テクニシャン(Technician)が約130名である。 ・なお、職員の職階については、以下のとおりとされている。 (ｱ) Professor (ｲ) Doctor (ｳ) Researcher (ｴ) Specialist (ｵ) Engineer (ｶ) Technician	・今後の人員計画も含め、左記について確認し、ミニッツに記載する。 ・左記の役割分担について確認し、必要に応じミニッツに記載する。	・人員については増加傾向にあり、現在は507名が在籍している旨確認し、ミニッツに記載した。 ・職員の職種は、大きく分けると以下のとおりとなる旨確認し、ミニッツに記載した。各職種ごとの職階につ

調査項目	エジプト側要請内容、現状及び問題点等	対処方針	協議結果
	(ｷ) Worker (ｸ) Administration Staff (ｹ) Labor		いては、ミニッツのAnnex 6を参照。また、人員については、1998年11月現在。 (ｱ) Research Staff（140名）大卒者が中心で、CMRDI在籍中に修士、博士号を取得することにより、職階が昇格する。 (ｲ) Technical Staff（227名）工業高校、職業訓練校、大学等の卒業者で構成される。 (ｳ) Supporting Staff（137名） （ほかに大学に留学中の職員３名）
オ　予算・収入	・政府からの予算配分は年間450万エジプト・ポンド(LE)(約1.8億円、1LE=約40円)。	・左記について、内訳も含めた現状、及び今後の見込みを確認し、ミニッツに記載する。	・1997/98年度の政府からの予算配分実績は約722万LE（約2.9億円）。
	・自己収入は年間350万LE(約1.4億円)。1996年までの10年間の自己収入の内訳については、以下（次ページの表）のとおりとなっている。	・左記について、内訳も含めた現状、及び今後の見込みを確認し、ミニッツに記載する。特に、左記（次ページの表）の「xii) Capability Strengthening of CMRDI」の内訳について確認する。	・1997/98年度の自己収入は357万LE（約1.43億円）。 内訳については以下のとおり。 (単位千LE) 分　類　金額　比率(%) (ｱ) Contractural Projects　1,647　46.06 (ｲ) Consultations　127　3.55 (ｳ) Technical services　811　22.68 (ｴ) Training　49　1.37 (ｵ) International Agreements　480　13.42 (ｶ) Grants　412　11.52 (ｷ) Donations　50　1.40 合計　3,576　100.00 上記自己収入は、1996/97年度比約24%増となっている。上記の(ｵ)(ｶ)が外国援助機関からの援助による収入（経費は除く）と

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	(単位千LE) Category of Activities 収入 % i) Introduction of new technologies to the Egyptian industry 2,150 6.48 ii) Production of new products as important substitutes 3,100 9.35 iii) Development of product or production process 2,275 6.86 iv) Maximization of indigenous raw material exploitation 2,908 8.77 v) Development of new alloys 250 0.75 vi) Environmental protection 678 2.04 vii) Development of small and medium enterprises SME's 680 2.05 viii) Failure analysis and trouble shooting 322 0.97 ix) Technicial services and consultations 788 2.38 x) Nondestructive testing and third party inspection 830 2.50 xi) Training 1,783 5.38 xii) Capability strengthening of CMRDI 17,400 52.47 TOTAL 33,164 100.00		なっており、左記の「xii) Capability Strengthening of CMRDI」にあたる。上記1997/98年度は、自己収入全体の約25%であり、左記に比べ、比率は減少している。
カ　サイト	・CMRDIは、ヘルワン市(カイロ市から約40km)に所在している。	・左記について確認し、ミニッツに記載する。	・左記のとおり確認し、ミニッツに記載した。
(3) 責任者 ア　総括責任者 (Project Director)	・本プロジェクトにおける総括責任者については、まだ特に定められていない。	・左記について、位置づけ・役割も踏まえたうえで、具体的な総括責任者名について確認し、ミニッツに記載する。	・CMRDI所長を総括責任者とする旨確認し、ミニッツに記載した。
イ　実施責任者 (Project Manager)	・本プロジェクトにおける実施責任者については、まだ特に定められていない。	・左記について、位置づけ・役割も踏まえたうえで、具体的な実施責任者名について確認し、ミニッツに記載する。	・CMRDI溶接研究部長を実施責任者とする旨確認し、ミニッツに記載した。なお、現在の副所長の定年退職(1999年内予定)に伴い、溶接研究部長が副所長に昇格する予定であり、同昇格のあとは、副所長を実施責任者とする旨確認した。

調査項目	エジプト側要請内容、現状及び問題点等	対処方針	協議結果
Ⅴ．実施機関に対する他の国際協力等 1　我が国との協力	・我が国からJICAを通じたCMRDIへの協力としては、主要なものとして、これまで以下が実施されている。 (1) 専門家チーム派遣・溶接技術 (1991.11～1994.11) (2) 個別専門家・非破壊検査技術 (1994.9～1997.9) (3) 個別専門家・溶接技術 (1996.4～1998.4) (4) 専門家チーム派遣･薄板金属加工における総合品質管理技術の導入 (1997.4～2000.4)　(実施中) (5) 第三国研修・溶接技術 (1989～1998)	・左記内容、協力分野の現状及びCMRDIへの定着状況等について確認し、必要に応じミニッツに記載する。	・我が国からの協力としては、左記のJICAを通じた協力のほかに、1997年に、科学技術庁金属材料研究所との間で共同研究協力に係る討議議事録が署名交換されている旨確認し、ミニッツに記載した。なお、エジプト側より、本プロジェクトの国内委員会への金属材料研究所からの委員の配置について検討依頼があったため、持ち帰り検討することとした。
2　他国の援助機関、国際機関等との協力	・主要な他国からの援助については以下のとおり。 (1)　既存の実験鋳造工場(experimental foundry shop)がオランダ(TNO)の協力により設立されている。 (2)　小型ロストワックス精密鋳造設備が米国USAIDにより贈与されている。 なお、CMRDIでは、ほかにもいくつかの他国の援助機関(カナダ等)、及び国際機関との協力が実施されている。 また、KOICA(韓国)による技術協力に対しての要請も検討されているといわれている。	・要請分野における、左記を含むCMRDIにおける国際協力(今後、計画・検討されているものも含む)の内容、本プロジェクトとの関係・役割分担等について確認し、必要に応じミニッツに記載する。	・左記のオランダ（TNO、砂型鋳造・金属切断の研究開発）及びアメリカ（USAID、複数分野に関する研究）のほか､カナダ(CIDA、中小企業に係る実地調査）、韓国（KOICA、中小企業運営に関する研修)との協力が実施済みまたは実施中である旨を確認し､ミニッツに記載した。なお、左記のKOICAによる技術協力に対する要請は現在検討されていないとのこと。
Ⅵ．プロジェクト内容 1　案件名称	・金属工学技術開発プロジェクト(Development of Metallurgical Engineering Technologies) なお、本プロジェクトについては、1997年９～10月の中近東産業基盤育成基礎調査団において、「現在実施され	・左記名称について確認する。場合によっては、より協力内容に合致した名称について協議する。上記につい	

調査項目	エジプト側要請内容、現状及び問題点等	対処方針	協議結果
	ている様々な企業への技術支援活動の中で企業ニーズの高い分野を抽出し、協力内容の絞り込みを行うことができれば、プロ技とし取り組むことは十分可能であると考えられる」と記されている。 また、要請書については、非公式な要請書が1996年８月付で提出されたあと、内容が改訂され、エジプト外務省から在エジプト日本大使館宛口上書(1998.8.12付)により正式要請書が接到している。	て合意のうえ、ミニッツに記載する。	・より協力内容に合致した案件名称として、協議の結果、以下の名称とすることとし、ミニッツに記載した。 (和) エジプト・アラブ共和国金属加工技術向上プロジェクト (英) Project on Upgrading of Metal Processing Technology in the Arab Republic of Egypt
2　要請の背景、ターゲット・グループ	・要請の背景について、要請書では以下のとおり記載されている。 「地元企業の競争力を高めるという責務を維持するため、CMRDIは金属工学、金属加工分野の能力向上を図っている。そのために、当該分野における更なる技術の向上と鋳造工場、金属加工工場、熱処理設備、評価試験設備等の更新が必要である」 また、要請書からは、中小企業をターゲット・グループとするプロジェクトの実施を希望しているように見受けられる。 事前質問表の回答では、要請の背景・詳細、ターゲット・グループ等について、更に以下のとおり記載されている。 (1) 特にエジプトのengineering companyと成長著しい自動車産業に対しては、新しい製品と技術を紹介する需要が大きい。 (2) 繊維産業も少量生産で生産に特別な技術を要する部品を用いることから、支援が必要である。 (3) CMRDIの位置づけから、エジプトまた中東域内をリードする新しい技術、例えばレーザー技術やCNC切断技術を習得し、紹介する必要がある。金属セクターのみならず、石油化学、エンジニアリング、建設、エ	・要請の背景、ターゲット・グループについて確認し、ミニッツに記載する。	・エジプトの産業政策の中心は、輸出振興、公営企業の民営化、輸入代替であり、そのためには部品産業等の中小企業の強化が必要であるとし、これら中小企業をターゲット・グループと位置づけることとし、ミニッツに記載した。

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	ネルギーセクターについても技術を提供する必要がある。 (4) ロストワックスの技術移転の対象となる材質については、アルミニウム、鋼、超合金が含まれる(特定のターゲット産業は想定されていない)。 (5) ダイカストは、高圧ダイカストが対象となるものと思われる。 (6) オーステンパーについては、ダクタイルが対象となるものと思われる。 (7) 評価試験(performance evaluation)については、よい試験所を通じた中小企業への支援が非常に重要と思われる。 (8) 特に自動車産業は、国際水準に見合った高品質なスペアパーツの入手に関するニーズが高い。分野としては、特に、アルミダイカスト、金属切断・形刷り、熱処理、粉末冶金に対するニーズが高い。 (9) ダイカストについては、エジプトで、３公営企業と４民間企業が存在している。ダイカスト製品のマーケットは、更に拡大すると見込まれる。 (10)レーザー技術に関しては、中小企業が金属切断、溶接、表面焼入れ(surface hardening)のために実用化しようとしている。既にCMRDIでは、職員に対しこの技術をトレーニングしていると同時に、カイロ大学(Cairo University)更に日本を含む外国の研究所との協力のもと、研究活動を開始している。CNC切断技術についても同様である。 (11)エジプトにおいて数社が既存の製品に対する必要性から熱処理を実施している。しかし、多くの企業は新製品にこの技術を適用できず、また熱処理した製品に対する試験技術も有していない。CMRDIは、この分野に対する技術協力について多数の要望を受けている。しかし、CMRDIの既存設備は大変安い設備であり、試験所規模であることから、これを対応するのに十分でない。（注：原文のまま） (12)評価試験に関しては、中小企業のニーズが高い疲労試験やクリープ試験に関して、CMRDIが重要な役割を		

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	担う必要がある。特にCMRDIの職員がこれらの試験を実施するための設備は重要である。 (13)特殊合金の真空誘導溶解、金型製作技術、溶接、総合品質管理(TQC)については、要請を取り下げたわけではなく、また、現在実施中のミニプロでも対応しているが、更なる支援を得たいと考えている。		
3　技術レベル	・要請された分野に関するCMRDIの技術レベルについては、特に情報がない。	・可能な範囲で、カウンターパート候補者へのインタビュー、カウンターパートの実技状況の把握、機材の稼働・維持管理状況の確認等を実施し、これらを通じカウンターパートの技術レベルについて把握する。	・カウンターパート候補者（一部）に対してのインタビュー、企業訪問、及びCMRDIでの機材の稼働、維持管理状況の確認等を通じ、カウンターパートのレベル把握を行った。 把握した技術レベルの内容については、第３章を参照。
4　技術移転の方法	・質問表の回答では、技術移転の方法として以下があげられている。 (1)　必要な書籍等の供与を通じたCMRDIの図書館への支援 (2) 日本人専門家を通じたCMRDIスタッフへのトレーニング (3) 日本のモデル企業での職員のトレーニング (4) CMRDI及びエジプト企業におけるOJT (5) CMRDIの職員による、エジプト企業における諸問題の解決や、新製品の開発に対する支援 (6) CMRDIでの必要な機材や設備の供与	・プロ技スキームでは、原則として、専門家からカウンターパートへの技術移転を核に、それを補完するための研修員受入、機材供与が実施されることを説明し、理解を得、ミニッツに記載する。 ・更に、座学、実技、企業でのOJT等の技術移転の方法について意見交換を行い、結果を可能であればミニッツに記載する。	・左記を説明し、理解を得、ミニッツに記載した。ただし、先方は、多岐にわたる機材の更新を通じたCMRDIの機能強化に対して関心が高いため、今後の調査団等でも改めて説明する必要がある。 ・技術移転の方法としては、座学、実技、ＯＪＴ（カウンターパートの本来業務を兼ねた技術移転）をとることとした。また、エジプト側より、OJTを含めると、週５日を技術移転にあてることが可能である旨の発言があった。以上をミニッツに記載した。なお、Researcherクラスのカウンタ

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			ーパート候補の一部は、研究中心で実技には疎い職員もいる模様だったが、Project Managerより、本プロジェクトではすべてのカウンターパートに実技を行う旨の言質を取り付けている。
5　プロジェクトの基本計画	・要請書では、「プロジェクトの主要目的」として以下が記載されている。「CMRDI職員の技術潜在力を向上させ、エジプトの中小企業が製品の質を高め、また企業への新しい技術の紹介を含む、必要なサービスを提供することを目的とする」	・案として以下を我が国側より提案し、協議のうえ、日本、エジプト双方で確認したものを今次調査団時点のプロジェクトの基本計画(案)としてミニッツに記載する。	・以下のとおり確認し、ミニッツに記載した。
(1) 上位目標		エジプト中小企業の(協力対象分野の)製品製造のための技術能力が向上する。	エジプトの金属加工分野の中小企業の製品製造のための技術能力が向上する。
(2) プロジェクト目標		CMRDIの(協力対象分野における)エジプトの中小企業へのサービスの質が向上する。	CMRDIの金属加工分野における中小企業への技術サービスの質が向上する。
(3) 成果		0　運営体制が強化される。 1　資機材が整備・維持管理される。 2　カウンターパートの(協力対象分野に関する)技術力が改善される。 (以下3～5は協力内容によって変更あり) 3　(協力対象分野の)試作品製作サービスが改善(実施)される。	0　運営体制が強化される。 1　資機材が整備・維持管理される。 2　カウンターパートの金属加工分野における技術力が改善される。 3　金属加工分野におけるCMRDIによる中小企業への研修サービスが計画的に実施される。 4　金属加工分野

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		4 (移転された要素技術にかかる) 研修コースが改善(開催)される。 5 エジプト中小企業に対する技術支援サービスが改善(実施)される。	におけるCMRDIによる中小企業への技術支援が計画的に実施される。
(4) 活動		「成果を達成するための活動を実施する」として確認し、ミニッツに記載する。	左記のとおり確認し、ミニッツに記載した。
6 技術移転分野・項目	・要請書では、要請分野・項目に関連して以下が記載されている。 (1) 鋳造技術 中小鋳造企業向けの鋳造技術(ダイカスト・ロストワックス)を移転する。付加価値の高い鋳造技術の移転により、中小企業が輸出を促進できるようにする。ダイカスト機は新規導入の必要がある。ロストワックス設備は既存のものあり。砂型設備については、約10年前に導入されたものであり、更新が必要。 (2) 金属加工 金属、溶接、切断、表面処理のための、既存CNC旋盤、フライス盤を用いた機械加工、及びレーザー加工技術を移転する。パイロット・レーザーユニットの導入により、エジプト国内産業に対しては新しい技術であるレーザー加工技術の移転を行う。同時に、既存のCNC turning machine及びvertical machining centreの更新を行う。 (3) 熱処理技術 熱処理設備を更新し、高周波焼入れ、化学焼入れ、オーステンパー等が実施できるようにする。 (4) 評価試験 疲労試験、クリープ試験等は、産業界にとってニーズの高いものであり、機材の導入が必要である。 なお、非公式な情報では、先方の上記分野に関する優先順位は(1)、(2)、(3)、(4)の順であるとのこと。	・技術移転の効率性及び成果測定の観点から、協力の範囲と内容の絞り込みが必要であることを説明する。 可能であれば、各技術移転分野間の技術的なつながり、専門家のリクルートの可能性も勘案しながら、本プロジェクトで対象とする技術移転分野・項目(案)について協議し、本件協力の妥当な範囲と内容を検討する。継続検討の必要な事項については、持ち帰り検討事項とする。 以上について、ミニッツに記載する。 なお、本項目の協議に際しては、上記「Ⅰ. 日本のODAの現状」及び「Ⅱ. プロ技スキーム」をエジプト側が理解することが前提であり、また、上記Ⅲ. によるプロジェクト	・左記を説明のうえ、専門家のリクルート、予算の制約、ニーズ、レベル等を短期調査において詳細に調査するため、変更があり得るとしたうえで、以下の技術移転分野を確認し、ミニッツに記載した。 ア 鋳造 (ｱ) アルミダイカスト (ｲ) 特殊鋳型 (シェルモールド、コールドボックス、ホットボックス) イ 熱処理と材質 (ｱ) ダクタイル鋳鉄のオーステンパー (ｲ) 表面硬化 (浸炭、窒化) (ｳ) 溶接継手の疲労試験 ウ レーザー切断 また、上記各分野における技術移転項目をミニッツのAnnex 11として確

調査項目	エジプト側要請内容、現状及び問題点等	対処方針	協議結果
		の背景、さらに上記VI. 2、3に示した要請の背景、ターゲット・グループ、先方の実施体制、技術レベル等に関する確認をベースとする。	認し、添付した。 なお、上記ア「(ｱ)アルミダイカスト」の技術移転項目のひとつである金型について、今次調査では、知識の提供のみを技術移転項目としたものの、エジプト側より、できるだけ広い範囲にわたって技術移転を実施してほしい旨の強い要望があったため、聞き置き、我が国側において短期調査までに検討することとし、ミニッツに記載した。
		他方、以下の技術移転要請分野については、下記の理由により、実施が困難であることを説明し、ミニッツに記載する。	左記については、下記のとおり協議・説明した。
		ア　ロストワックス 多くの段階の工程からなる分野であり、技術移転には多くの技術者、技能者を必要とすることから、専門家のリクルートが困難である。	ア　ロストワックス エジプト側から、実施について強い要望があったが、我が国側から、機材予算の制約、専門家のリクルートの困難さ、エジプト産業におけるニーズの相対的な低さから協力範囲に含めない旨説明し、ミニッツに記載した。 なお、エジプト側より、今後、他のドナーによる援助の要請を

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			検討する旨の発言があった。
		イ　レーザー加工 切断以外の分野については、先進国でも最近実用化した技術であることから、技術移転は困難である。 なお、仮に技術移転を実施する場合でも、当該分野の機材は、ほこり、水質等に細心の注意を要することから、エジプト側投入により施設・設備を整備のうえ、維持管理することが必要である。	イ　レーザー加工 レーザー切断のみを技術移転分野とし、ミニッツに記載した。なお、当該分野の機材については維持管理について細心の注意が必要であることをエジプト側に説明し、安定した水の供給や二重ドアを有するクリーンルームが必要となる旨を説明し、ミニッツに記載した。短期調査までに、これらエジプト側で準備すべき事項の詳細について我が国側から連絡することとした。
		ウ　クリープ試験 ひとつの試験が完了するまでに10年単位の時間を要するため、実施が困難である。仮に実施する場合も、情報提供のみとする。	ウ　クリープ試験 我が国側より、左記のとおり説明したところ、エジプトから、タンク等の残り寿命を図るためのクリープ試験であり、1,000時間程度の試験でよいので技術移転をしてほしい旨の説明を受けた。 しかし、我が国側より、再度、ターゲット・グループのプライオリティーが比較的低いと思われること、また、カウンターパートが本件に関する

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			知識を既にかなり有していることから、今次協力範囲から除外する旨説明し、ミニッツに記載した。 エ　その他 (ｱ) 熱サイクル試験（グリーブル試験) 1996年に作成された要請書では要請されていたものの、1998年８月に接到した最新要請書には含まれていなかった分野。今次協議において、先方から実施について強い要望があった。 我が国側は、予算の制約、並びに本分野がCMRDI内での研究開発として行われるものであり、中小企業をターゲットにしたものではないことから、本プロジェクトの協力範囲から除外する旨説明した。 エジプト側はなおも本件に対して強い要望を示し、場合によっては別途要請レターをJICAエジプト事務所に提出する旨コメントした。 以上をミニッツに記載した。 (ｲ) 溶接・非破壊検査 エジプト側より、CMRDIにおいて、既に自立発

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			展的に活動が可能という説明があり、今次協力範囲からは除外することとし、その旨ミニッツに記載した。
7　協力期間	・要請書では、協力期間は５年間となっている。	・技術移転の定着を図る期間を含め協力期間を定めることを説明し、理解を得、ミニッツに記載する。 具体的な協力期間については、短期調査以降に協議のうえ決定することとし、ミニッツに記載する。	・左記について説明し、理解を得たのち、技術移転分野（案）について確認したうえで、協力期間を４年間として暫定的に合意し、ミニッツに記載した。 なお、エジプト側からは、場合によっては協力期間を３年間とするよう検討してほしいとの発言があったので、聞き置き、短期調査の際に協議する技術移転内容に応じて再度適正な協力期間について協議することとし、併せてミニッツに記載した。
Ⅶ. 投入 (1) 日本側投入	（要請書では以下のとおり）		
ア　専門家派遣	・長期専門家　３名(チーフ・アドバイザー、業務調整員、レーザー技術) 短期専門家　５名(ダイカスト、精密鋳造、破壊現象、砂型鋳造、CNC機械加工) CMRDIのカウンターパートがエジプト産業に技術を移転できるようになるための支援を専門家が行う	・協力期間を通じた長期専門家投入量の目安についてエジプト側に伝える。	・左記について、以下の分野で長期専門家を派遣することを確認し、ミニッツに記載した。 (ｱ) チーフ・アドバイザー (ｲ) 業務調整員 (ｳ) 鋳造 (ｴ) 熱処理と材質 (ｵ) レーザー切断
		・短期専門家は必要に応じ派遣することとし、ミニッツに記載する。	・左記のとおり説明し、ミニッツに記載した。

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イ　研修員受入	・協力期間を通じ、10名から15名程度受入れ。 分野＝ダイカスト、ロストワックス、溶接におけるレーザー技術、砂型造形、熱処理、試験材料、切断及び表面処理	・年間最大３名程度の受入れとなることとし、ミニッツに記載する。	・左記のとおり説明し、ミニッツに記載した。 また、R/D署名後早期に、総括責任者及び実施責任者の研修員としての受入れを検討する旨我が国側より説明し、ミニッツに記載した。
ウ　機材供与	・主な機材供与(金額)として以下があげられている。 レーザー機械　(US$　900,000) 熱処理炉　(US$　200,000) 砂型造型設備　(US$　150,000) CNC(追加コントロールユニット) (US$　150,000) 疲労試験機械　(US$　250,000) ダイカスト設備　(US$　200,000) クリープ試験機械　(US$　150,000) 上記計　US$ 2,000,000	・技術移転のツールとしての機材供与の位置づけをエジプト側に説明するとともに、協力期間を通じた機材供与費の目安についてエジプト側に伝える。 可能であれば、技術移転で必要となる機材のリストについて確認し、ミニッツに記載する。	・左記をエジプト側に説明したうえで、技術移転で必要となる機材のリストについて、Annex12としてミニッツに添付した。
(2)エジプト側投入 ア　人員	・質問表の回答では、カウンターパートの候補者として以下があげられている。 部長以上　２名 レーザー技術(Laser Tech.)　１名 熱処理(Heat Treatment)　１名 板金加工(Sheet Metal Forming) １名 鋳造技術(Casting Technology) １名 材料特性(Mat.Characterization) ２名 精密鋳造(Precision Casting) １名 金属形削り(Metal Shaping)　１名	・左記について確認し、各カウンターパートの職階等も含めた人員配置の具体的な予定、本来業務との時間配分等について聴取し、結果をミニッツに記載する。	・以下のとおり確認し、ミニッツに記載した。 各技術移転分野ごとのカウンターパート候補については、以下のとおり。 部長以上　２名 ダイカスト　４名 特殊鋳型　３名 熱処理　５名 材質　５名 レーザー切断　３名 （合計　22名) なお、部長以上を除いた20名中17名が研究スタッフ、３名が技術スタッフとなっている。 また22名中博士取

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			得者が９名、修士取得者が７名、学士取得者が６名となっている。
		・サポーティング・スタッフの配置も必要となる旨説明し、理解を得、ミニッツに記載する。	・サポーティング・スタッフについては、約10名を配置する用意がある旨、エジプト側より聴取した。
イ　施設・設備	・現在CMRDIサイトの拡張工事中であり、一部の技術移転は拡張後の新建屋で実施される予定とされている。	・拡張工事の状況、今後の準備スケジュール等について確認し、結果をミニッツに記載する。	・既存ワークショップの一部を使用する旨確認した。また、これに隣接した、建設中で1999年６月末完成予定の棟をレーザー切断や疲労試験に使用する旨確認し、併せてAnnex15としてミニッツに添付した。なお、完工後の状況を写真を含めて我が国側へ報告するようにエジプト側に依頼し、ミニッツに記載した。 更に、特にダイカストマシンやレーザーマシン等については、エジプト側の措置として、分電版の設置、水の供給、クリーンルームの設置が必要となる旨確認し、ミニッツに記載した。 なお、エジプト側は、プロジェクト・サイトの詳細な準備事項について、短期調査の派遣までに日本側から連絡するよう依頼した。
ウ　機材	・CMRDIは、要請関連分野において、機	・左記内容につい	・機材の状況を確認

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	材リスト(稼働、メンテナンス状況を含む)を我が国側に提出している。	て、プロジェクトでの使用の可否を可能な限り確認し、ミニッツに記載する。	したうえで、ミニッツのAnnex17として、CMRDI保有機材のリストを添付した。
Ⅷ. その他 1　R/D(Record of Discussions、討議議事録)		・R/Dのサンプルに基づき内容を説明し、ミニッツに添付する。	・左記を説明のうえ、ミニッツに添付した。
2　今後のスケジュール／暫定実施計画(TSI)	・1999年度予算で短期調査、実施協議調査を実施する予定となっている。	・左記について説明する。また、協力期間はR/Dで合意された日から開始するが、協力期間開始日については、機材供与に要する日程等も勘案して設定する旨説明する。 以上について必要に応じミニッツに記載する。	・左記のとおり説明したうえ、ミニッツのAnnex19のとおり、暫定実施計画(TSI)を確認し、ミニッツに記載した。協力期間開始は、仮に2000年７月とした。
3　他の試験所との役割分担		・他の同様の試験所の存在の有無を確認するとともに、存在する場合には当該試験所との役割分担について確認し、ミニッツに記載する。	・CMRDIと同じヘルワン市に所在する工業省傘下のテビン冶金研究所（Tebbin Institute for Metallurgical Studies）が類似の研究所としてあげられるが、現在は省エネルギーや汚染対策に関する企業関係者のトレーニングを中心として活動しており、CMRDIと重複する活動は行われていない旨の説明をエジプト側から受け、ミニッツに記載した。
4　業界、学会との連携		・案件の性格上、また広報の観点からも、業界、学会との連携が重要となる旨を伝え、ミニッツに記載する。	・エジプト鋳造者協会（Egyptial Foundrymen Association）等、本案件の技術移転分野に関連した業

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		また、可能であれば、業界団体、学会等の具体的な活動、及び本プロジェクトとの連携内容について意見交換を行い、必要に応じミニッツに記載する。	界団体の一部は、設立に際してCMRDIが支援している。また、エジプト標準化機構(Egyptian Organization of Standardization)との関連も深い。
5　専門家の生活環境		・専門家の生活環境、治安状況等について確認する。	・特段の支障は認められなかった。
IX. 貿易研修センタープロジェクト	・1997年度新規案件として要請があったが、1997年９～10月に中近東産業基盤育成基礎調査団で「前提条件となる貿易研修センターの建物の建設費は既に予算化されているとの説明であったが、建設スケジュール、新規人員の採用計画が未定であり、直ちに新規案件とするには時期尚早と思われる」とされ、1998年度案件としては不採択となった。 しかし、上記の点について、貿易供給省派遣の個別専門家を通じ引き続きエジプト側と検討を進めたところ、1998年12月、貿易研修センターの建物、組織・人員計画、技術移転の対象についての進展がみられた旨我が国大使館、JICAエジプト事務所に連絡があり、1999年１月に非公式に新要請書が提出された。 現在、３月末をめどとして更なる改訂要請書が準備されている。 (４月２日現在、上記改訂要請書は未接到)	・本年１月の要請内容をもとに、国内支援体制を検討中。現時点では新規協力を前提とはせず、新組織の体制、建物の建設スケジュール、新規人員の採用計画及び貿易研修の具体的な要請分野と技術移転内容等について聴取のうえ、確認する。	・（第３章参照）

第３章　調査団所見

３－１　調査団総合所見

今回のエジプト滞在期間のうち、同国の祝日が２日間も含まれるという極めてスケジューリングの難しい日程ではあったが、実施機関であるCMRDIの所長ほか関係者がイスラム新年の祝日にも本件調査団の協議に積極的に加わるなど、エジプト側の本件プロジェクト協力への意気込みが感じられた調査であった。

従来より個別専門家派遣やミニプロ等でJICAスキームを熟知している実施機関ではあるが、プロジェクト方式技術協力については、初めての取り組みということもあり、調査団からのプロジェクト方式技術協力の仕組みやPDM手法についての説明には十分な時間を費やし、先方の理解を得ることができた。またODA大綱やODA予算の現状についても併せて説明し、妥当性や継続性のあるプロジェクト形成の必要性の認識を促し、先方の理解を得ることができた。

今回の協議は全体を通じほぼ順調に行われたが、プロジェクト協力分野の絞り込みで、若干双方の認識の違いが現れ、ややハードな討論を行う場面もあった。それは実施機関がアフリカ地域及び中近東地域で随一の金属工学分野の研究機関であることから、外部からのあらゆる照会事項やコンサルテーションにすべて対応する必要がある、それらに対し決して「ノー」と言えない立場にある、という責任感の表れから、あれもこれも協力してほしいという絞り込み分野に一貫性のない要求があったためであり、調査団としても根気よく説明はしたが、先方の理解は必ずしも得られたわけではなく、今後とも理解を求めていく必要がある。

いずれにしても、本件実施機関であるCMRDIは従来より研修員受入、専門家派遣、第三国研修と日本とのつき合いが長く、所長はじめ日本シンパが大多数を占め、日本の文化風習を学び、昨年まで在京エジプト大使館参事官だった溶接研究部長をはじめとして、他のカウンターパートの一部も日本語が堪能といった環境は、エジプトをはじめ中近東・アフリカ地域でも優良実施機関のひとつとして位置づけられ、安定した自己収入を得ていることをも踏まえると、移転された技術は確実に近隣諸国へも移転できる機能を持ち合わせており、我が国側としても現在のCMRDIとの関係を維持拡大していく必要があるものと思料される。

CMRDIは科学研究大臣直轄の研究機関ではあるが、中小企業育成の観点から工業省とも強い関連があることもあり、滞在中、調査団は工業大臣を表敬訪問する機会をもった。その際、我が国協力の概要について説明し、理解を求めたところ、先方としても協力を惜しまない旨発言があったことは、今後の本件プロジェクトにとって有益となると思料される。

また、今回の調査期間中、エジプトテレビの要望により、４月17日のイスラム正月に朝の人気番組「おはようエジプト」の生番組に調査団員（石田、勝又）が出演し、JICA事業の説明や本件プロジェクトの紹介が可能となり、広報の面からもエジプト国民に本件協力をアピールできたこ

とは、極めて有意義であったと思料される。

最後に、今回の事前調査結果を踏まえ、今後短期調査そして実施協議と案件実施に向けて作業が進むこととなるが、今後の調査にあたり特記事項及び留意事項を以下に述べることにより、調査団の総合所見と致したい。

(1) 機材現地調達

機材の現地調達について、JICAエジプト事務所より同国に優良商社や代理店が少なく機材の納期が遅れたり、前払い金を要求するが銀行保証の取り付けが困難であったりなど、従来より大変苦慮した経験をもっているため、原則機材現地調達は行わない旨説明を受けた。また現在CMRDI派遣の専門家からも、機材検収時のトラブルや納期の遅延等も考慮すれば、多少時間がかかっても可能な限り本邦調達をすべしとのアドバイスも受けた。他方、CMRDI側は機材の維持管理や安価で購入が可能との理由から、機材の現地調達を強く要望している。また、日本からの機材は電圧が異なるため、別途トランスを購入する必要があり、トラブルの原因となった過去の経験からもCMRDI側は機材の現地調達を要望している。調査団はCMRDI側に我が国側の事情を説明したが、CMRDIには機材調達部門もあり、ノウハウはJICAエジプト事務所よりもっているので、協力して現地調達を行いたい旨申し出ており、また、エジプトにサービス拠点を有しているヨーロッパなどのメーカーに関してはメンテナンス面の優位性があるものと認められるので、JICAエジプト事務所と十分協議しつつ、機材調達の方法を検討する必要がある。

(2) 金属材料研究所との関連

CMRDIの説明によれば、筑波にある金属材料研究所(National Research Institute for Metals)と1997年に共同研究協力に係る討議議事録を署名交換し、現在共同研究協力を実施中の由。先方より同研究所からの専門家派遣の可能性について照会があったが、本件国内支援機関が日本鉄鋼連盟であることを説明のうえ、可能性はあるが現在のところ同研究所からの専門家派遣は考えていない、また、その場合であっても本件プロジェクトとの違いを明確にしたうえで派遣することとなる旨説明し、理解を求めた。今後の準備作業において同様の要望が予想されるので留意しておく必要がある。

(3) 専門家のリクルート

CMRDIは中近東・アフリカ地域で唯一の金属工学分野の研究機関ということもあり、スタッフのプライドは極めて高く、派遣専門家は先方のプライドを尊重しつつ技術移転を図っていく必要がある。特に専門家の資質については、先方よりグレーヘア（すなわち、年配で経験豊富である意味と思われる）の専門家を派遣してほしい旨要望があった。グレーヘアの専門家は、

専門分野は当然のこととして、長い経験から全体を把握しつつものごとを考えることができ、CMRDIにとっても大きなメリットとなり得ると考えているようである。CMRDI側は、日本人派遣専門家の技術移転がもたらす成果に対して高い期待をもっており、本件プロジェクトの成功のカギはすべて専門家の資質にかかっているといっても過言ではない。カウンターパートの多くが修士・博士号を有していることをも踏まえ、我が国側専門家のリクルートについては、最大限上記を留意しつつ人選する必要がある。

参考までに、CMRDI側は今までに派遣され帰国した専門家のなかで特に、田中甚吉専門家（元NKK）、河野六郎専門家（新日鉄関連会社）、山崎利一専門家（NKKテクノス）については大変高く評価しており、それらのなかからチーフ・アドバイザーが派遣されることを期待している旨の発言もあったので申し添える。

(4) 短期調査の派遣時期

短期調査の派遣時期については、CMRDI側は可能な限り早い時期を希望し、前広に時期を通知していただければいつの時期でも受入れ可能との発言があった。現在ミニプロにて派遣中の３名の専門家の支援は不可欠と思料されるので、引き続き支援をお願いしつつ、我が国側の派遣準備状況に応じ、可能な限り早期（８月ごろ）に派遣することが適当と思料される。なお、今年のラマダンは12月中旬から１月中旬までとなり、特に１月中旬にはラマダン明け休日となるため、実施協議調査派遣については１月中旬を避けるほうが望ましい。

(5) 機材供与

今回調査団の示した機材リストについては、CMRDI側が考えていた予算規模の約半分程度となったこともあり、CMRDI側の落胆は極めて大きいような印象を受けた。調査団より対象分野を絞り込み技術移転を主眼に機材の選定を行ったものであり、妥当なものである旨再三再四説明したものの、必ずしも先方の満足を得られるには至らなかったと思料される。今後短期調査時の機材の仕様のつめで、１ランク上の機材を求めてくる可能性があるので、なぜそれが必要なのか必要でないのか、その理由を十分説明できるよう理論武装しておく必要がある。

(6) 協力期間及び開始時期

機材購送が順調に行われ、適格な専門家が派遣されるならば、最短３年間で技術移転が完了すると想定されるが、移転した技術の定着促進や予想されない問題の発生等を考慮するならば、協力期間は４年間が妥当と思料される。また先方は、今回プロジェクトの対象にならなかった金型分野、粉末冶金分野、新素材分野への次期フェーズでの協力を要望していることも併せて留意しておく必要がある。

プロジェクトの開始時期については、機材が現地に到着する２～３カ月程度前からの専門家派遣が妥当とされるので、それらを考慮しつつプロジェクト開始時期を決定する必要がある。

(7) 熱サイクル試験（Gleeble Test）

本分野の協力については、CMRDI側の説明によれば当初の要請書には含まれていたものの、何らかの手違いがあり、最終プロポーザルから落ちてしまった由。本分野は全体にかかわる極めて重要な分野でもあり、本件プロジェクトに含めてほしい旨強い要望があったが、調査団よりプロポーザルから落ちていたとしても、その後のクエスチョネアでも何ら回答がなかった分野でもあること、機材がなくてもプロジェクト実施に影響がないこと、供与機材の金額が大きくなり、想定予算をはるかに超えてしまうことなどを理由に、本分野の機材供与は困難である旨回答した。しかしながら、先方の本件熱サイクル試験に対する要望は極めて強く、今後、再度JICA事務所を通じ要望してくる可能性があるため、場合によっては本分野に関する我が国側の対応ぶりを再検討する必要がある。

(8) CMRDIの新組織体制

CMRDI側の説明によれば、現行４つに分かれている部門にそれぞれ重複する分野が多々あるので、より効率的効果的に研究所を運営していくために、今年の秋をめどに新組織体制を構築中とのこと。本件プロジェクトにどのような影響があるか、現在のところ不明であるが、その動向については留意しておく必要がある。

(9) 実施責任者（プロジェクト・マネージャー）

本件プロジェクトでは、CMRDIのPresidentがProject Director、Project Managerは現在のHead of Welding Researchとなる。本件プロジェクトではWeldingは含まれていないが、現在のVice Presidentが今秋定年退職となり、後任としてHead of Welding Researchが就任予定であるため、現行ではHead of Welding Researchとしているので念のため申し添えることとする。

(10)カウンターパートの配置

CMRDIの職員の雇用形態は終身雇用に近く、現在も定着率が非常が高いとの先方説明から、カウンターパートが技術習得後民間へジョブホップする可能性はほとんどなく、その面では、効率的効果的な技術移転が行われ、技術が定着すると思われる。また専門家１名に対し、最低２名以上のカウンターパートを配置することにより、カウンターパート不在となることがない、より効率的な技術移転が行われると思われる。

(11)近隣諸国への技術移転の波及

今次調査では、エジプト国内・実施機関の現状を把握することを通じた具体的協力形態・内容に関する検討を目的としたため、プロジェクト内容の近隣諸国への波及については、協議項目としなかった。しかし、先方から近隣諸国への技術の普及に関して強い意思表示があったことも踏まえ、短期調査の協議項目として、近隣諸国への技術の普及の可能性、方法、内容等について検討する必要があるものと思料する。

３－２　技術移転の内容

３－２－１　移転項目分野

技術移転分野・項目については、エジプト側との協議のうえ、下記のとおり確認した。なお、下記分野・項目については、短期調査において、我が国側の専門家のアベイラビリティー及び予算の制約、ターゲット・グループ、CMRDIのニーズ及びレベル、更にカウンターパートのレベルを詳細に調査したうえで精査することとし、変更もあり得るとして我が国側より申し入れ、エジプト側の理解を得た（以上、ミニッツの16ページ及びAnnex11を参照）。

なお、要請があったものの、今次協力の範囲外となった技術移転分野については、３－２－３を参照。

技術移転分野・項目（１／２）

技術移転大分野 小分野 大項目 小項目	
和　文	英　文
Ⅰ．鋳造	Casting
１　アルミニウムダイカスト	Aluminum High Pressure Die Casting
(1) ダイカストの知識	Knowledge of Die Casting
ア．ダイカスト機	Die Casting Machine
イ．金型	Die
ウ．合金と溶解	Alloys and Melting
エ．鋳造理論	Theory of Casting
オ．ダイカスト作業方法	Methodology of Die Casting
カ．製品の検査	Inspection of Products
(2) ダイカスト作業の実技	Practice of Die Casting
ア．製品の品質	Properties of Products
イ．合金の溶解	Melting of Alloys
ウ．ダイカスト作業	Methodology of Die Casting
エ．金型作業	Methodology of Metallic Mold
オ．製品の検査	Inspection of Products
カ．製品の品質	Properties of Products
(3) ダイカスト機の管理と点検	Maintenance and Checking of Die Casting Machine
(4) 金型の管理と点検	Maintenance and Checking of Metallic Mold
２　特殊鋳型（ケミカルボンディドサンド）	Chemically Bonded Sand Molding
(1) 特殊鋳型の知識	Knowledge of Chemically Bonded Sand Molding
(2) 特殊鋳型（シェルモールド）の 実技	Practice of Chemically Bonded Sand Molding(Shell Molding)
(3) 特殊鋳型（コールドボックス）の実技	Practice of Chemically Bonded Sand Molding(Cold Box)
(4) 特殊鋳型（ホットボックス）の 実技	Practice of Chemically Bonded Sand Molding(Hot Box)

技術移転分野・項目（２／２）

技術移転大分野 小分野 大項目 小項目	
和　文	英　文
Ⅱ　熱処理と機械的性質	Heat Treatment and Mechanical Properties
1　ダクタイル鋳鉄のオーステンパー	Austempering of Ductile Cast Iron
(1) オーステンパーの知識	Knowledge of Austempering
ア．熱処理	Heat Treatment
イ．オーステンパーの理論	Theory of Austempering
ウ．オーステンパーの設備	Equipment of Austempering
エ．ミクロ組織	Micro Structure
オ．熱処理と機械的性質	Heat Treatment and Mechanical Properties
(2) オーステンパーの実技	Practice of Austempering
ア．オーステンパー作業	Methodology of Austempering
イ．材質試験と検査	Material Testing and Inspection
(3) 設備の管理と点検	Maintenance and Checking
2　表面硬化（浸炭・窒化）	Surface Hardening (Carburizing and Nitriding)
(1) 基礎的理論	Basic Theory
ア．浸炭と窒化の基礎	Basic of Carburizing and Nitriding
イ．浸炭と窒化用鋼	Steels for Carburizing and Nitriding
ウ．組織と特性	Microstructures and Properties
(2) 浸炭処理炉	Carburizing Furnace
(3) 窒化処理炉	Nitriding Furnace
(4) ソルトバス作業方法	Methodology by Salt Bath
ア．塩の構造と温度の制御	Control of Salt Composition and Temperature
イ．反応の制御	Control of Reaction
(5) 検査方法	Inspection Method
(6) 表面硬化の実技	Practice of Surface Hardening
ア．歯車の浸炭	Carburizing of Gear
イ．歯車の窒化	Nitriding of Gear
3　溶接部疲労評価	Fatigue Evaluation of Welded Joint
(1) 疲労理論	Theory of Fatigue
(2) 疲労試験作業	Practice of Fatigue Test
(3) 疲労破壊部調査	Investigation of Fatigue Fractured Surface
(4) 溶接部疲労ノウハウとしてのデータベース作成	Making of Database as Fatigue Know-how on Welded Joint
Ⅲ．レーザー切断	Laser Cutting
(1) レーザー加工の知識	Knowledge of laser Processing
ア．レーザーの性質	Characteristics of Laser
イ．炭酸ガスレーザー発振器	CO2 Laser Oscillator
ウ．YAGレーザー発振器	Nd-YAG Laser Oscillator
エ．加工用光学系機器	Optical Devices of Laser Processing
オ．安全衛生管理	Safety and Health
(2) 切断への応用	Application of Laser for Cutting
ア．熱切断の原理	Principle of Thermal Cutting
イ．ステンレス鋼と非鉄金属の切断	Cutting of Stainless Steels and Non-Ferrous Metals
ウ．炭素鋼切断	Cutting of Carbon Steels
(3) 切断の実技	Practice of Laser Cutting
ア．切断準備作業	Preparation for Cutting
イ．切断条件適正化作業	Optimization of Cutting Condition
ウ．切断品質管理	Quality Control for Cutting
(4) レーザー設備の保守	Practice of Maintenance and Repair of Laser Facility
(5) 切断ノウハウデータベース作成	Making of Database as Cutting Know-how

３－２－２　プロジェクト使用機材

調査団は、日本側より供与するいかなる機材もプロジェクトにおける技術移転を実現するためのツールであることを説明し、エジプト側の同意を得た。これを考慮しながらプロジェクトの実施に必要な機材のリストを以下のとおり作成した（以上、ミニッツのAttached Document 8(3)及びAnnex12を参照）。

なお、下記リストのうちの疲労試験に関連して、材質の基礎特性を評価する引張試験機については、CMRDIの現有機材での対応も検討することとした。また、仮に日本側より供与する場合でも、エジプト側がCMRDIでの実施を希望している高熱試験用の付属品は今次技術移転の範囲外であることから、エジプト側の負担で調達する旨確認した。

技術移転分野	主要機材名称		仕様（概要）	備考	調達国
	和　文	英　文			
Ⅰダイカスト High Pressure Die Casting	脱ガス装置	Degassing		P	日
	保持炉	Holding Furnace		P	日
	ダイカスト機	Die Casting Machine	型締め力 135t	P	日
	金型	Dies	2組（350本x2）	P	日
	金型加熱器	Die Mold Heater		P	日
	鋳仕上げ装置	Finishing Device		P	日
	ホイスト	Hoist		P	日
Ⅱ特殊鋳型 Chemically Bonded Sand	中周波誘導溶解炉	Medium Frequency Induc. Furnace		U	
	造型機	Molding Machine		U	
	シェルモールド	Shell Molding		U	
	CO2プロセス	CO2 Process		U	
	コールドボックス・ホットボックス	Cold Box, Hot Box		P	日
Ⅲオーステンパー Austempering of Ductile Cast Iron	電気炉	Electric Furnace		P	日
	ソルトバス	Salt Bath		P	日
Ⅳ表面硬化 Surface Hardening	ソルトバス	Salt Bath		P	日
	光学顕微鏡	Optical Metal Microscope		U	
	走査型電顕	SEM		U	
	マイクロビッカース硬さ計	Micro Vickers Hardness Tester		U	
Ⅴ疲労試験 Fatigue Evaluation	平面曲げ疲労試験機	Out of Plane Bending Fatigue Testing Machine	1.5kgf-m / 2 台	P	日
	動ひずみ測定器	Dynamic Strain Meter	＊4CH	P	日
	Ｘ－Ｔレコーダー	X-T Recorder	＊デジタル処理型	P	日
	光学顕微鏡	Optical Metal Microscope		U	
	走査型電顕	SEM		U	
	工具顕微鏡	Tool Microscope		U	
	輪郭形状測定器	Contour Measuring Instrument		P	日
	引張試験機	Tensile Testing Machine	50t	P (*1)	日／エ
Ⅵレーザー切断 Laser Cutting	レーザー切断機	Laser Cutting Machine	0.5-1.0kw, Nd-YAG/X-Y Table	P (*2)	日
	放射温度計	Infra-red Thermometer	Point Measuring	P	日
	X-Tレコーダー	X-T Recorder	デジタル処理型	P (*3)	日
	35mmカメラ	Still Camera	シャッター速度1/8000秒	P	エ
	輪郭形状測定器	Contour Measuring Instrument		P (*3)	日
	マルチ電圧計	Multi Voltage Meter		P	エ
Ⅶその他 Others	車両	Vehicle	Mini-bus style	P (*4)	日

（注）仕様欄・備考欄のうち、＊印がついた項目については、帰国後に検討して加えたもので、エジプト側との協議、検討は短期調査の際に行う予定である。
*1　日本側による機材供与は予算面に関し、日本側が検討する。高熱試験用の付属品はエジプト側が調達する。
*2　この機材の仕様は予算の制約などから日本側が検討する。
*3　同一機材を別の分野でも共用する予定。
*4　この機材の日本側による供与については用途を確認のうえ、検討する。
備考欄　U:CMRDIでの現有機材でプロジェクトでの仕様可。
　　P:CMRDIに存在せず、新規調達が必要。
調達国欄　日：日本側から供与する機材。
　　エ：エジプト側で調達する機材。

３－２－３　技術移転分野及び項目の変更の内容と理由

次の各分野または供与機材については、要請書内、または本事前調査の協議中に先方から要請があったものの、以下の理由で、今次協力の範囲からは除外し、または先方の要請した機材からスペック・ダウンした。ただし、短期調査でエジプト側のニーズやレベル等についてより詳細に調査したうえで、下記の内容に変更があり得るものとした。

(1) ロストワックス

本分野については、CMRDIが米国USAIDにより供与された関連機材を一部保有していることもあり、エジプト側から実施について強い希望があったが、以下の理由で技術移転の対象外とし、関連機材の供与も実施しないこととした。

ア　多くの段階の工程からなる分野であり、技術移転には多くの技術者、技能者を必要とすることから、専門家のリクルートが困難。

イ　エジプトにおいて、アルミダイカストやダクタイル鋳鉄は生産が増加しつつあるのに対し、ロストワックスは、非常に新しい技術であり、ロストワックス工場も極めて少ない（CMRDIによれば１社のみとのこと）。

なお、エジプト側は、今次協議で本分野の協力範囲からの除外が合意されたあと、他の援助機関に協力を要請する旨を非公式に表明している。

(2) CNC加工技術及びCNC追加制御ユニット

本分野についても下記の理由で今次協力の範囲外とし、供与対象機材としても除外することを確認した。

ア　要請書では、移転要望技術の名称として、CNC加工技術とあるのみであった。今次調査において、CMRDIの現状を確認したところ、ソフト面のみならず、ハード面からみても加工技術に不足はなく、既存設備(CNC旋盤、CNCミーリング)も順調に機能している。要望設備の内容については、協議の際に我が国側から説明を求めたものの、先方の説明は得られなかった。以上から、要望技術と要望設備ともにニーズがはっきりしない。

イ　鋳造難削材の加工のノウハウには不足がみられるが、知識上の問題であり、必要なら短期専門家派遣、または研修員受入で対応できる。

(3) 疲労試験機

この供与機材については下記理由により、要請書でエジプト側が想定していたと思われる機材よりも安価な平面曲げ疲労試験機を供与する。

ア　エジプト側が移転を希望している技術は疲労損傷解析である。これには既存の光学顕

微鏡と走査型電子顕微鏡（SEM）で対応可能である。

イ　知識の習得には、上記ア以外にラボ破壊サンプルの観察経験が有益である。

ウ　現在、CMRDIは回転曲げ疲労試験機を保有しているが、素材評価に限定される。

このため、上記イの観察経験には溶接継手まで評価対象を拡大できる機材が必要である。

エ　上記ウで必要となる機材としては、軸引張型疲労試験機が理想的であるが、スタートレベルでは、平面曲げ疲労試験機が妥当である。特に、自動車板金部品においては、日本でも80%のデータが平面曲げ疲労試験機で評価される。

(4) クリープ試験（クリープ試験機）

この機材については下記のような理由で今次協力の範囲外とし、関連機材の供与についても実施しないことを確認した。

ア　移転要望技術が明確ではない。エジプト側からのヒアリングによると、要望している機材は材料選択のために使用する機材である。材料選択試験は、与えられた性能仕様に対して合否を判定するのみの作業であり、知識の習得が重要な分野ではない。また、この材料選択試験は、試験をCMRDIへ委託する企業への技術移転効果も小さい。

イ　同試験に関連する産業は、通常は石油化学、電力等の大企業である。産業に用いる機材への補修部品を製作する企業は中小企業であるが、一般的には同試験が中小企業を対象とした技術移転とはなりにくい。

(5) 表面硬化（高周波焼入れ、浸炭、窒化、オーステンパー）（熱処理関連機材）

注：要請書では、化学焼入れ（chemical hardening）という呼称が用いられていたが、本プロジェクトではより国際的な呼称として、浸炭（carburization）及び窒化（nitriding）を用いることとした。

本分野に関しては下記のような理由から、浸炭、窒化を技術移転範囲とし、機材については大気加熱炉とソルトバスを供与することとした。また、高周波焼入れは技術移転範囲から除外することとした。

ア　要請された移転技術としては、鋳物のオーステンパー、浸炭、窒化、高周波表面焼入れなどがあげられているが、要望機材として記載されている大型炉はこれらの技術に対応しない。

イ　各技術に対応する機材は以下のとおり。

オーステンパー：大気加熱炉＋ソルトバス

浸炭、窒化：ソルトバス、または雰囲気調整炉

高周波表面焼入れ：高周波加熱装置

ウ　移転技術の集中化と供与機材の効率化を図るため、技術移転範囲はオーステンパー、浸炭、窒化とし、よって大気加熱炉とソルトバスを供与する。

(6) レーザー加工（レーザー加工機）

エジプト側の本分野に関する移転要望技術は、溶接、切断、表面焼入れであったが、協議の結果、技術移転分野としては、切断以外は先進国でも最近実用化した技術であり、他方切断については、近年エジプト、またCMRDIでのニーズが高まっていることから、レーザー切断のみを実施することとする。

一方、エジプト側が要請書上で想定していた供与機材は、3000Wクラスの炭酸ガスレーザー切断加工機（実加工用）で、価格が比較的高価なうえ、切断以外には使用できない。上述のとおり、今次調査ではレーザー切断のみを技術移転分野としたため、当面当該機材に切断以外の用途はないものと思われる。しかし、本プロジェクト協力期間終了後を含め、将来的にCMRDIで溶接、表面焼入れを実施する際、当該機材を汎用的に使用することを念頭に置くと、上記の要請機材よりも汎用性の高いものを供与するのが望ましい。また、先方がYAG（yttrium aluminum-garnet）を将来のレーザーの本命として理解している点も勘案する必要がある。

以上より、当該機材を、研究設備として加工の基礎を習得する装置として位置づけ、価格も比較的安価だが汎用性のある小型（500W～1000W）のYAGレーザーを供与することとする。

３－３　訪問先の現状

３－３－１　CMRDIの現状（設備、技術レベル）

(1) 研究所としての役割

エジプトの企業では、大企業といえども試験設備が不足しており、設備主導の開発・試験については、設備を保有するCMRDIへの委託を期待している。一方、運営経費として、自己収入をあげる必要があることから、CMRDIは受託研究・試験を積極的に受け入れている。

(2) 研究と企業サポート

研究活動と企業サポート活動の比率（企業サポート活動の全活動に占める比率）は、カウンターパート候補者インタビューでは20～70%と回答されたが、印象では70%程度と推測される。両活動の違いはほとんど認識されていないようである。これは同研究所の自己

収入重視という基本体制によるところが大きいものと感じられる。

(3) 技術レベル

企業から必要とされる技術は一言で言うと現在エジプトにない技術であり、これは国際的には必ずしも最先端のものではない。したがって、同研究所の活動の多くは、保有設備でデータ、製品を製作すること、及び海外で既知の技術をトレースし、実施することにある。

(4) 研究意識

職員の階層構造に関しては、特に研究者の場合、学士、修士、博士の学歴間で待遇が歴然と区別されている。単純な実力主義ではない。このため、前二者は上位資格（学位）の取得を動機として、ある程度の研究を欲している。

しかし、研究の意味合いは、多くのデータ、彼らにとっての新しいデータを取得することであり、カウンターパート候補者も、本音としてはそのために新しい機材を欲している部分もあるといえる。

限られた時間でカウンターパートへのインタビューを実施したが、どのような技術に取り組みたいとの意思はみられた反面、既存技術に対する新規性、自己のアイデアなどの独創性の主張はみられなかった。

(5) 国内産業育成との対応

CMRDIの研究レベルは、以上のように必ずしも十分ではないが、現在のエジプトの国内企業の期待にはマッチングしている。CMRDIが自己収入を得ている受託サービスも、双方の利害が一致することを考えるなら、確実に技術が産業界に普及している。現在のエジプト産業の技術向上に役立っていることは間違いない。

(6) CMRDIの設備状況

溶接機、鋳造設備、熱処理設備等の金属加工設備は比較的多数保有している。特に、熱処理炉は、研究所としては大きなものがそろっている。これらには外国援助機関からの供与等による機材と自己資金で調達した機材の両方がある。

ただし、比較的新しい設備であっても、非稼働の設備も目立つ。理由は種々である。例としては以下のとおり。

ア　ロストワックス機材

CMRDI幹部によると前後設備がないため使えない（ただし、CMRDI担当者によれば故障

している）。

イ　溶接予熱装置

過大電圧投入により制御器が故障している。

ウ　プラズマ溶接機

担当者がいないため使えない。

いずれにしても、機材を常に使える状態で待機させておくような保守体制については意識が欠如している。

加工設備の充実度に比較して、いわゆる計測装置の不足が目立つ。温度測定装置、電圧測定装置、記録装置など、加工装置に比べ安価ではあるが基礎的研究装置であるものが少なく、またあまり使用されていない。

(7) CMRDIの設備

金属加工(鋳造)研究部関連

溶解炉	中周波誘導溶解炉	(鉄用)350キロ (鉄用)120キロ (非鉄用)銅合金で80キロ、アルミ合金で30キロ ＊１電源３炉方式
	中周波誘導溶解炉	(鉄用)10キロ
	キュポラ	使用できない。本プロジェクトでは使用しない
	エレクトロスラグ	使用できない。本プロジェクトでは使用しない
	真空溶解炉	使用できない。本プロジェクトでは使用しない
造型機	ジョルトスクイズ 砂の混練機	２機 ２機
特殊鋳型	CO2プロセス シェルモールド一式	１機 １機
精密鋳造	ロストワックス	ワックス射出・コーディング装置がある 脱ろう装置・焼成炉・ワックス溶解炉などがない
砂試験		一式そろっている
分　析	発光分析 蛍光Ｘ線	
顕微鏡	光学顕微鏡	

必要設備

アルミダイカスト	ダイカスト機 溶解保持炉 脱ガス炉 その他
特殊鋳型	コールドボックス ホットボックス
オーステンパー	電気炉 ソルトバス

溶接研究部関連

熱処理	電気炉 ソルトバス	最高加熱温度1000℃ 温度領域300～600℃ ＊電気炉とソルトバスでオーステンパーを行うには制御が不十分である
測定記録装置	光学顕微鏡	×400(撮影装置なし) ×800，×1000
	実体顕微鏡	撮影装置なし
	走査型電子顕微鏡	JSM20
	マイクロビッカース硬さ計	圧痕寸法読み取り内部目盛り
	X-T 記録器	旧式、動作不良
	35㎜カメラ	シャッター速度1/1000ｓ

必要装置

疲労	平面曲げ疲労試験機
レーザー	レーザー切断機
測定記録装置	動ひずみ測定器 輪郭形状測定器 赤外放射温度計 X-T 記録器 35㎜カメラ

３－３－２　カウンターパート候補者面接結果

今次調査で、カウンターパート候補者として22名があげられているが、そのうち８名に対してインタビューを行った。

カウンターパート候補者面接結果(1)

役　職	Researcher	Researcher	Researcher	Assistant Researcher
氏　名	Abdul.Monem.El.Batahgi	Mohamad.Hanafi	Mohamad.Mosallam	Khald.Hafez
生年月日	1955.4.2	1961.9.13	1960.3.27	1967.12.30
年　齢	45	37	39	31
学　士	1978 カイロ大金属工学	カイロ大金属工学	1983　スエズカナル大	1991　スエズカナル大 金属工学
修　士	1983 カイロ大金属工学	カイロ大機械工学	1992　スエズカナル大	1997　スエズカナル大 溶接工学「継手品質に対する局部低水素系溶接棒の成分の影響」
博　士	1990　東工大金属工学科 (菊池、松尾教授) 「クリープ変形による高温材料の劣化」	1998 大阪大接合科学研奈賀教授「真空技術 (ろう付け)」	1998　東工大金属工学 「Ni-Al-Nb，Ni-Fe-Nbの状態図」	
現業務	・高張力鋼板の低温割れ性 ・ステンレス鋼板、ＱＴ鋼板、アルミのレーザー溶接性の比較 ・エジプトへのレーザー技術導入ナショプロ(1997-2002)	・表面硬化(浸炭、窒化) ・Mn鋼、工具鋼の熱処理 ・現ミニプロデザインGrリーダー	・摩擦圧接（装置なし、旋盤で代替）	・溶接の現場的問題のサポート ・近隣への溶接技術トレーニング ・溶接材料の研究 ・２相ステンレスの継手品質(組織、靭性) ・発電設備に関する対応
研究/企業支援	50/50%	20-30/80-70%	70/30%	?
保有技術	溶接(レーザー、ＴＩＧ、MIG)	熱処理、溶接	溶接(アーク溶接)	溶接
今後の期待	・1994年よりレーザー研究開始(装置なし)	・オーステンパー(ダクタイル鋳鉄) ・テンパリング ・マルテンパー ・高周波焼入れ ・浸炭	自動車部品の摩擦圧接	・クリープ性能での材料選択（試験機６台希望) ・靭性評価（疲労ノッチ入れ装置希望) ・グリーブル希望
日本での 研修経験	・1985(９カ月) JICA溶接技術コース ・～1990　東工大 ・1994(4.5カ月)AOTS海外研修者協会名古屋大(沓名助教授)	・1993～1998　大阪大	・1992　日軽金研究所 (アルミ溶接) ・1994～1998　東工大	・1994(６カ月) JICA溶接技術コース
日本以外での 研修経験			1989　ポーランド造船所	
語学力 英語	良	良	良	良
語学力 日本語	比較的良	比較的良	中	少
PJ担当テーマ	Laser Cutting	Heat Treatment	Mechanical Properties	Heat Treatment
評　価	既に活動しており、技術移転は比較的やりやすい。	技術のマッチングはよいので、実践面の知識を付与したい。	疲労の知識は少ないが、溶接の経験が豊富であり、技術移転により技術範囲拡大が期待できる。	これまで溶接主体の業務であり、組織制御の観点に立てば、熱処理も共通。技術の拡大が期待できる。

カウンターパート候補者面接結果(2)

役　職	Assistant Researcher	Assistant Researcher	Assistant Researcher	Assistant Researcher
氏　名	Hamed.Abdel.Aleem	Mahamad.Tobbaa	Nader El-Baguri	Hassan Ahmed
生年月日	1968.1.28	1967.3.21	1971.5.5	1965.9.6
年　齢	31	32	26	33
学　士	1991　スエズカナル大 金属工学	1990　スエズカナル大 機械工学	1993　スエズカナル大 金属工学	1992　スエズカナル大 金属工学
修　士	1997　スエズカナル大 溶接工学「継手性能に対する溶接条件の影響」	1997　イリノイ大 機械工学「ハードアロイ(高Cr鋳鉄)の切削」	1999　スエズカナル大 「ステンレスの急冷凝固」	
博　士				
現業務	・溶接材料選定 ・溶接適正手順 ・溶接前後工程のトラブルシューティング（化学､肥料､ボイラー等)	・切断の工場問題のサポート ・切削の研修コース ・中小企業指導	・ダイカスト ・ＱＣ ・耐摩耗材料 ・鋳造研修コース	・砂型鋳造 ・ＱＣ
研究/企業支援	60/40%	40/60%	50/50%	30/70%
保有技術	溶接	切削	鋳造	鋳造、シェルモールドを勉強中
今後の期待	・石油反応器のＨＡＺ品質 ・グリーブル試験機によるシミュレーション	要望設備 ・CAD/CAM ・ユニバーサル円筒研削盤 ・ワイヤカッティング ・放射温度計 ・切削FEMシミュレーター		
日本での研修経験	・1994(６カ月) JICA溶接技術コース	・1994(６カ月) JICAハイテク切削技術	・1995年５月から ４カ月JICA研修コース 「鋼と応用」に参加	なし
日本以外での研修経験		1992～1997 イリノイ大	なし	なし
語学力 英語	良	良	良	少々
語学力 日本語	少	中	少	なし
PJ担当テーマ	Mechanical Properties	Laser Cutting	diecast	砂型鋳造(特殊鋳型)
評　価	疲労の知識は少ないが、溶接の経験が豊富であり、技術移転により技術範囲拡大が期待できる。	機械加工の専門家であり、熱加工は未経験。逆に切断機能面からレーザーの特長を理解しやすいと考えられる。	ダイカストの経験はかなりある。	砂型鋳造の知識はある。

３－３－３　企業の技術レベル

今回訪問視察したのは４社であった。エジプト側のアレンジによる企業訪問であり、比較的従業員数の多い会社が多く、限られた時間のなかでの訪問であったことから、エジプトの関連セクターの企業のレベルの客観的な把握とは必ずしもならないが、訪問した企業の印象は以下のとおりである。なお訪問した４社の企業訪問結果は次項３－３－４にまとめている。

(1) 企業形態の影響

見学した４社はすべて大企業である。しかし、公営の２社と完全民営の２社とではまったく状況が異なる。公営企業では設備、作業者の配置、作業管理に秩序がみられなかった。エジプト企業には雇用の維持の義務があるようだが、特に公営企業の従業員はそれに安住しているようにも見受けられる。

(2) 設　備

いずれの企業においても、基本的な設備は輸入品である。視察先が機械産業であるせいか、ヨーロッパ（特にドイツ）製の設備が多いようである。日本製もあるがわずかである。

例えばNASCOのような公営企業では、デジタル表示の備わった設備はほとんどない。すなわち、古い設備といえる。自動制御はもとより、工作機械の位置制御もすべてアナログである。精密部品の場合、職人的技能がない限り精度管理は極めて難しい。

一方、ABBのような民営企業では、設備は近代化され、自動制御機が大量に設置されている。

(3) 作業者の技量

公営企業では、例えば比較的単純な形状のプレスにおいても面ひずみが大きい。ボール盤作業では外から芯振れが見える。作業者は指示された作業を行うのみで、装置が正しく機能しているかどうかの確認は責任外といった感があり、品質の概念がないのではと思わせる部分もあった。ただし、少なくともエンジン、ミッションのような難部品でも立派に機能する製品は作っており、部署間のばらつきがあるようである。

一方、民営企業では作業、品質は正しく管理されている。しかし、トラブルに関してはすべて、海外親会社の指示を仰ぐ体制であり、自らのノウハウ、開発能力は不足している。ただ、個別製品において、内製化率及び国内部品調達率を徐々に増加させており、現在、成長中と感じられる。

(4) 技術と市場品質との関係

製品の市場は基本的にエジプト国内である。純国産車（トラック）では国内部品調達比率が70%に達するのに対し、海外と提携して製造している車（乗用車）では40%程度である。後者の国内生産品はガラス、樹脂部品であり、金属部品はほとんどない。海外（投資企業）からの刺激がない限り、国内市場からはまだ高い品質が求められていない状態であり、技術レベルもそれに対応し、高いものとはいえなかったが、近年の市場経済化で、ようやく品質向上に関心が高まってきた状況である。

(5) 中小企業の状態の推測

良好な経済成長率、急速なモータリゼーションなど、現在エジプト産業は高度成長期にあるといえる。一方、生産技術、品質レベルはまだ低い。したがって、輸入代替のみでも多くのビジネスチャンスがあるはずであり、新たな企業が生まれ育つ土壌はある。今後の産業発展のためには技術と経営の両面における近代化が必要であろう。

一方、既存の中小企業はさまざまある。カイロからCMRDIの所在地であるヘルワン市に向かう際、同市の手前には数キロにわたり零細の自動車修理工場が並び、修理待ちの自動車が多数並んでいる。古くとも貴重とされる自動車をぎりぎりまで使い切るような低い経済水準では、多くの場合、市場品質ニーズも低く、近代技術を必要としない。

中小企業の技術を平均的に向上させるには困難な面があり、ターゲット・グループとしては、技術取得に積極的な新規民営企業が中心となろう。

３－３－４　企業訪問結果

企業名称	El Nasr Automotive Manufacturing Co.(NASCO)	ABB Arab Contractors for Electrical Industries	General Metals	El-Nasr Casting
面接者	Mohamed Fouad El-Sayed	Ashraf Mohamed	M.Cruel El Dein	Mohamed Osman
職　名	Director of Press Sector	Chemist Electrical Porceelain Production MGR		General Manager
所在地	Wadi-Hot-Helwan-Cairo	10th Ramadan City Industrial Zone (B1)	CMRDI近傍	アレキサンドリア
資　本	公営	民営(独ABB＋埃Arab Contractors)	公営	公営だが、民間銀行から投資
従業員数	7,000人	1,000人		700人(カイロ工場との合計では2,000人)
製　品	トラック、バス、トラクター、乗用車(FIAT　Tempra)、自動車部品	変電配電機器(電力遮断機)、売上げ 300 million LE	アルミと亜鉛ダイカスト製品、アルミ圧延材、銅、鉛も製造	鋳鉄バルブ、鋳鉄管(曲がり管)、鋳鉄管(カイロ工場)の継手
設　備			ダイカスト13台(800t～5t)	生砂と自硬性の２ライン
生産量			アルミダイカスト50t/月	ダクタイルを4.5万トン/年
市　場	自動車工業、自動車部品工業(国内自動車メーカーへ部品供給)	電力機器工業	モーターケースなど電気製品、ガスレンジなど日用品が主	バルブと水道管
CMRDIとの関係	鋳造、溶接、熱処理等全面的に技術相談	不明	CMRDIが技術指導(Dr.M.A.Walyが指導)	CMRDIが技術指導(Dr.A.Nofalが指導)
技術的特徴	・トラック、バス：国内品70%使用。エンジンも内製。・乗用車：国内品30%使用。・エジプト唯一の総合自動車工場。	・遮断機本体は平均50%を内製、50%を輸入し、筐体を内製して組み立て。・筐体板金穴あけの５%にレーザー使用。	ダイカストと重力鋳造	ダクタイルの製造
技術的問題点	・乗用車プレス部品100%輸入(=国際品質プレスできない)。・アーク溶接ほとんど手溶接棒。・スポット溶接／乗用車良←→トラック劣悪	・レーザーの例：設備運転上のトラブルについてはすべてドイツ本社より指示を受ける。設備稼働体制は十分である。	手動でダイカストに注湯	あまり問題なし
技術移転への要望	・トラックキャビンパネル用タレットパンチ(日本製)１台：レーザーへの変更希望。	・金型(樹脂射出用)輸入が主で一部内製。内製比率拡大希望。		
QC体制	エンジン等基幹部品の製品検査はある。品質向上運動のQCなし。	ISO9001を既に保有。	５Ｓなど不十分	
工場の状況と所感	・設備古く、手動機がほとんど(確認できたＮＣ機はタレパン１台とギヤ切削１台のみ)。 ・既存設備では品質向上には作業者技量の向上必要。 ・工作機械では人員配置にアンバランスあり。 ・安全管理、環境に改善必要。 ・輸出競争力の獲得は困難，輸入品代替の部品（特に金属部品）の増加が現在の課題。 ・公営企業としての労働の確保の役割と、国際競争力の両立は難しいようである。	・板金機械、工作機械、樹脂射出成形機など設備はほとんどが輸入最新設備。工場環境も欧米レベルにある。・人員の配置も無駄がなく、近代的大工場として機能している。・技術面はすべて本社(独)の指示によるものである。・設計、保守等、自立技術が今後の目標と思われる。・また、一部金型は内製しているが、基本的には輸入である。金型技術も必要であろう。	整理整頓されていない。エジプトでは最大のダイカスト工場であるが、近代的工場ではない。	整理整頓が行き届いている。エジプトで最大の鋳鉄工場のひとつ。エジプトのダクタイルの70%を生産。
プロジェクトテーマとの関係	・熱処理：表面焼入れ実施の高品質化、レーザー切断の導入などでCMRDIの技術指導を必要とする。	・レーザー稼働事例としての確認項目：使用設備は独Trump社製(型式600L，2200W，CO2LASER)／冷却水は蒸留水を購入し循環使用／ハムシーン時に事前保守はしないが、事後では塵埃清掃／ハードのオーバーホールは６カ月に１回メーカーにより実施(時間稼働率10%程度)／O2、N2、He、CO2準備(国内調達)	アルミダイカストの技術レベル向上のためにCMRDIの技術指導を必要としている。	砂型鋳造全般及びケミカルボンディドサンドの技術向上のためにCMRDIの技術指導を必要としている。

資　　料

1 ミニッツ

MINUTES OF DISCUSSIONS
ON
THE JAPANESE PROJECT-TYPE TECHNICAL COOPERATION
FOR
THE PROJECT ON UPGRADING OF
METAL PROCESSING TECHNOLOGY
IN
THE ARAB REPUBLIC OF EGYPT

The Japanese Preliminary Study Team (hereinafter referred to as "the Team") organized by Japan International Cooperation Agency (hereinafter referred to as "JICA") and headed by Mr. Yukio Ishida, Deputy Director, Planning and Financial Cooperation Division, Mining & Industrial Development Cooperation Department, JICA, visited the Arab Republic of Egypt from April 10 to April 20, 1999 for the purpose of clarifying the background, concept, and scope of the project proposal made by the authorities concerned of the Government of the Arab Republic of Egypt (hereinafter referred to as "the Egyptian side") and studying the feasibility of the Japanese Project-Type Technical Cooperation for the Project on Development of Metal Processing Technology in the Arab Republic of Egypt (hereinafter referred to as "the Project).

During its stay in the Arab Republic of Egypt, the Team exchanged views and had a series of discussions with the authorities concerned of the Government of the Arab Republic of Egypt.

As a result of the discussions, both sides came to reach a common understanding concerning the matters referred to in the document attached hereto.

Cairo, April 19, 1999

Yukio Ishida
Leader
Preliminary Study Team
Japan International
Cooperation Agency
Japan

Adel Nofal
President
Central Metallurgical Research
and Development Institute
Arab Republic of Egypt

ATTACHED DOCUMENT

1 Present Situation of Japan's ODA

The Team explained the present situation of Japan's ODA, that is, harshness of its budget and thus it is necessary for the Government of Japan, through JICA to formulate a furthermore feasible and sustainable project and the Egyptian side understood it.

2 Present Situation of Project-type Technical Cooperation

The Team explained the present situation of Project-type Technical Cooperation as follows:

(1) Conceptual Model for Project-type Technical Cooperation

Conceptual Model for Project-type Technical Cooperation is as shown in Annex 1.

(2) Introduction of Project Cycle Management

Project planning and concept clarification method entitled Project Cycle Management (hereinafter referred to as "PCM") has been introduced to every Project-type Technical Cooperation project to monitor and evaluate the level of the achievement and enhance the communication for its smooth implementation.

Since its introduction, a worksheet called Project Design Matrix (hereinafter referred to as "PDM") has been required to prepare for every project to realize the said PCM. The PDM is a tool, to view a project based on an assumption, designed to analyze a multi-level chain of cause-to-effect, input to output, output to project purpose, project purpose to overall goal. Because the PDM explicitly showing the interrelation among the chain elements, (input, output, project purpose and overall goal) can be used as a tool to evaluate whether or not the goals have been obtained either

during or after the project, it is now also being used as a framework for evaluation.

PDM is a tool for management-by-objective. The matrix table of PDM should thus have been created in the design stage of a project, not at the stage of evaluation.

As a result, every project is now required to be formulated as output-oriented, while the project before the introduction of PCM, in many cases, tended to be formulated as input-oriented.

In other words, there is no doubt that "Dispatch of experts", "Training counterpart personnel in Japan" and "Provision of machinery and equipment" are still main three (3) components of the Project-type Technical Cooperation, however, more stress is now put on the output from the transfer of technology to the counterpart personnel (hereinafter referred to as "the C/P") from Japanese experts, while the rest, that is, "Training C/P in Japan" and "Provision of machinery and equipment" are the supplement for the smooth implementation of technology transfer from the experts to the C/P.

(3) Introduction of Five (5) Basic Evaluation Components

In parallel with the introduction of PDM, JICA has been improving its evaluation mainly because to disseminate any valuable lessons obtained to better meet development needs in the future, partially because to cope with the criticism against the effectiveness and efficiency of the Japan's ODA from Japanese taxpayers.

In this connection, the Team explained five (5) Basic Evaluation Components as shown in Annex 2.

(4) Localization of the Management of the Project

Because of the harshness of the Japan's ODA budget, the Team explained the Egyptian side and the latter agreed that it would be difficult for the Japanese side to dispatch a

study team every year once the Project is commenced and that to implement, monitor and evaluate the Project, in other words, management of the Project should be localized, taken the initiative by the Joint Coordinating Committee for the Project.

(5) Definition of terminology

The Team clarified the Egyptian side the definitions of respective terminologies as follows:

a Extension and Follow up

In case that both the Japanese side and the recipient side agreed to extend the original cooperation period, if the scope of the project is no change from those of the original cooperation period, such extension is to be called as extension, while the scope is squeezed, it is called as follow-up.

In this context, there is no interruption as time-wise between the original cooperation and the said two (2) extension.

b Aftercare Program

The Aftercare program is a scheme to extend supplemental cooperation within the scope of the original cooperation, generally speaking, two (2) or three (3) years after the completion of the original cooperation, to enhance and reactivate the outputs of the original cooperation.

In view of budget, only one (1) or two (2) projects are eligible for this program annually, thus not all projects can enjoy this program.

3 Facts collected/confirmed during the Study

(1) Facts collected by factory visit

a NASCO(NASR Automotive Manufacturing Corporation = an automobile company)

NASCO is a national automobile company which is established in 1960 and licensed from FIAT and some other foreign companies.

As for the components of the products of the company, 65% to 70% of bus and track 40 to 43 % of passenger's car of such components are procured locally, some of which are procured from local companies such as cast iron, aluminum and forging.

Their product of buses are 4,000 unit/year and track is also 1,000 unit/year

Now a training course and monitoring for laser cutting and welding are prepared and being conducted by Central Metallurgical Research and Development Institute (hereinafter referred to as "CMRDI") to be conducted to NASCO and other companies.

In the beginning of 1999, CMRDI, NASCO and other companies have formed Laser Technology Study Group.

b General Metals Co. (a die casting company)

General Metals Co. is a company who produces aluminum casting products like die casting, gravity casting and aluminum rolling products. Copper, zinc and lead alloy are also produced.

There exist three (3) to four (4) high pressure die casting companies and one (1) gravity casting company in Egypt.

General Metals Co. has thirteen (13) die casting machines. Automatic pouring system are not installed. The products often have a lot of fettling.

c ABB Arab (a laser company)

ABB Arab is a joint-venture company with Egyptian and foreign capital who produce electricity products like switch board steel panel and steel box with utilizing ten (10) punching machine. They are using cutting

technology by laser. They are taking care of the laser machine with distilled water and cleaning it from dust. They said machine was maintained by a German manufacturer, once in six (6) months. Its operation rate is 35%.

d El Nasr Castings Co.(a Ferrous metal company)

El Nasr Castings Co. is a company producing ductile cast iron and gray cast iron. The production of ductile cast iron is 45,000 tons/year. It is 70% of total production in Egypt. They have their own in-house training courses.

(2) Budget and measures for the research and development activities by the Egyptian Government

The Egyptian side explained that the Egyptian Government put emphasis on research and development. From 1997 to 2001, national budget for research and development is nine (9) billion Egyptian Pound (hereinafter referred to as "LE"), which is three (3) times as much as that of the last five years.

The Egyptian side also explained that Prime minister's office set the research and development committee called "Ministerial Supreme Committee for Technological Development of Egypt" and president of CMRDI is a member of the committee.

(3) National policy concerned with the sector related to the Metal Processing Technologies

The twenty (20) year plan of Egypt, that is, "Egypt in the 21st Century - Vision 2017" says as one of the important packages of policies in industrial development is "Encourage small and medium-size industries and support their role as originators of finished products or as feeders or complementary to large-size industries."

(4) Demarcation of the large, medium, small and micro enterprises in Egypt

In connection with the demarcation of the above-mentioned size of companies, the Egyptian side explained to the Team as follows:

Before, when it was socialist regime in Egypt, almost all the industry was government-owned company, and input of man-power was intentionally made to the particular government-owned company, so most companies have quite large number of employees. Nowadays, many companies are being privatized, but it is difficult to define small and medium scale enterprises uniformly, because the number of employees of such government-owned companies is quite large compared with some private companies even though the amount of products are being the same, since it is forbidden to fire employees in the Egyptian law.

Even in such condition, early retirement are being encouraged as a new system, from fifty (50) years old or even at the age of forties (40s).

As far as Small and medium scale enterprises (SMEs) in case of the Project concerned, the definition seems to be the industries whose production is relatively limited.

4 Ministry/Agency concerned with the Metal Processing Technology

(1) Minister of State for Scientific Research

In Egyptian cabinet, the Minister of State for Scientific Research acts as the representative of research institute including CMRDI. President of CMRDI reports its activities to the Minister periodically, but the president has the autonomy to run the institute.

Under Minister of State for Scientific Research, presidents of twelve (12) national research institutes which

are shown in Annex 3 represent the Supreme Council for Research Centers and Institutes.

(2) Central Metallurgical Research and Development Institute (CMRDI)

a Function

The Egyptian side explained the main function of CMRDI as follows:

1 Capability building of staff and facilities

2 Support to Egyptian Industry through R&D projects, consultation, technical services and training)

b Development Plan of CMRDI

The Egyptian side introduced "CENTRAL METALLURGICAL RESEARCH AND DEVELOPMENT INSTITUTE (CMRDI) DEVELOPMENT PLAN (1997-2001)" which is now being implemented.

The Egyptian side added that in case of endorsement of such plan, approval of board of directors of CMRDI is needed, and the report to Minister of State for Scientific Research should be made.

c Board of Directors of CMRDI

Members of the Board of Directors of CMRDI are as shown in Annex 4.

It is held periodically four (4) times a year, and also held when necessity arises. In Board of Directors' meeting, the activities are reported for approval including personnel matters.

On the other hand, budgetary matters are directly requested from CMRDI to Ministry of Finance.

Terms of service of the members of the Board of Directors are four (4) years, and those of the current members are from July 1997 to June 2001. Membership of board members are to be modified to involve more members from private sectors.

d Organization of CMRDI

The Egyptian side explained that CMRDI was founded by the joint assistance of Academy of Scientific Research and Technology, Egyptian industry and UNIDO in 1985.

Present organization chart of CMRDI and the number of staff in each department is shown in Annex 5.

Restructuring of organization of CMRDI would be made in half a year from now considering the needs of private sector. The new organization is in planning stage, and thus, there exists no draft plan yet.

New organization has to be approved by the Government of Egypt after the approval of the Board of Directors.

e Personnel (including the demarcation of staff by the categories)

Number of staff as of April 1999 in CMRDI by categories is shown in Annex 6.

Regarding the category of staff of CMRDI, the Egyptian side explained as follows:

(a) Research staff

New staff who belong to this category is university graduate, and he/she will be promoted to Research Officer and Researcher according to his/her acquisition of M.Sc and Ph.D from universities. Researcher submits his/her publications after the first five (5) years of his service and in case if they are worthy, he/she will be promoted to Associate Professor. Associate Professor also submit his/her publications after the first five (5) years of his/her service and in case if they are worthy as well as his/her contribution to industries, he will be promoted to Professor.

(b) Technical staff

New staff who belongs to this category is graduate of technical high school, vocational training center and university. He/she will be promoted according to system of normal governmental employees' system.

Concerning the personnel system of CMRDI, the Egyptian side explained as follows:

- Retirement Age

  Life-time employment is assured in Egypt. Retirement age is sixty (60) years old except for professorship. However, professor may continue to be in institute without occupying any post.

- Job hopping of Staff

  Job hopping of staff is very rare. For example, only one (1) staff left CMRDI to private sector in fifteen (15) years.

- Salary of staff

  The Egyptian side informed that basic salary is approximately LE 250 for Research Assistant, LE 170 ~180 for Engineer and LE 120 for Technicians. A part of income of CMRDI through Contractual work will come to be bonus to staff according to their contribution, which is approximately amount to as much as two (2) to four (4) times of basic salary of staff. Bonus will amount to approximately 20% of the income of CMRDI in the Contractual Works. For reference, 30% of the income will be used for the facilities and equipment procurement at CMRDI, and 10% paid to the Government and the rest is being used for the other activities of CMRDI. Also for reference, the salary of engineers in private companies in Egypt is approximately LE 600, and LE 1000 for salesmen.

- Social Welfare for staff

Staff of CMRDI can enjoy the assistance of the government in purchasing their housing through good condition loan.

Health insurance is also granted.

f Budget of CMRDI by categories

The Egyptian side explained the budget of CMRDI by categories as shown in Annex 7a.

In connection with the budget, the Egyptian side explained as follows:

- The Egyptian fiscal year begins in July and ends in June.
- The budget which is not utilized in a fiscal year cannot be carried over to the next fiscal year.
- Pay-back of income to the government is approximately 15%. In case of lack of budget, they can utilize that 15%.
- Request of the budget for the next fiscal year to the Government is usually done in October and the actual allocation for the next fiscal year is noticed in April.

g Income of CMRDI

The income of CMRDI in Egyptian Fiscal Year (hereinafter referred to as "EFY") 1996/97 and 1997/98 are shown in Annex 7a.

The Egyptian side explained the contents of CMRDI's category of income as follows:

(a) Contractual Project

The activities based on contract with clients of CMRDI, whose duration are mostly three (3) months to two (2) years

(b) Consultation

Advising or supervising on-demand basis for the clients

(c) Technical Services

Services whose result would be in the style of qualification and testing report, etc.

(d) International Agreements

Income through international assistance by the contract basis. Expenses for costs of activities paid from international agencies to CMRDI such as those of third country group training course of JICA are not regarded as income.

(e) Grants

Financial support for CMRDI's activities without contract.

(f) Donations

Incomes donated from companies or organizations in Egypt.

h Expenditure of CMRDI

The expenditure of CMRDI in the last five (5) years is shown in Annex 7b.

i Important services from CMRDI to industries

(a) Training

Training courses for company staff, engineers and technicians. List of training courses conducted by CMRDI is shown in Annex 8.

(b) Technical support

To solve the problems of the company by testing, analyzing the defected materials and etc. in CMRDI and in companies with contract basis.

(c) Consulting

To give necessary ideas to companies for the problems in adhoc basis.

(d) Introduction of new product and/or process

To introduce a new product and/or a new process to the company.

(e) Prototype services

To manufacture trial prototype upon request from companies.

j Demarcation with the other related institute

In connection with the demarcation with the other institute, the Egyptian side stated that Tebbin Institute for Metallurgical Studies under Ministry of Industry is in charge of mainly energy serving and pollution control to train relatively elder employees from the companies whose salary is paid from those companies. It gives diploma after one (1) or two (2) years course.

k Relation with the related industries and academic societies

The Egyptian side explained that Egyptian Foundrymen Association, Egyptian New Materials Association and Egyptian Corrosion Society were founded in cooperation with CMRDI. On the other hand, Federation of Automotive Feeding Industry has been established in 1999.

The Egyptian side also explained that National Accreditation Body is also to be founded in cooperation with CMRDI, and in relation with Egyptian Organization of Standardization. Especially in committees of Egyptian Organization of Standardization related to the fields of metallurgy, the chairman is nominated from staff of CMRDI.

The Egyptian side further explained that approximately one third (1/3) of Professors of CMRDI are part time lecturer in universities. Joint researches of CMRDI and universities are often conducted usually upon request from universities.

5 Administration of the Project

Chairman of CMRDI, as the Project Director, will bear overall responsibility for the administration and implementation of the Project.

Head of Welding Research Department of CMRDI, as the Project Manager, will be responsible for the managerial and technical matters of the Project.

The tentative organization chart for the administration of the Project is shown in Annex 9.

6 Other international cooperation to CMRDI

(1) From Japan

Aside from cooperation with JICA, the Egyptian side stated that the agreement for Scientific and Technological Cooperation between National Research Institute for Metals (hereinafter referred to as "NRIM") Tsukuba-Japan and CMRDI has been formulated in August 1997. Activities of the said agreement is as follows:

a Joint research activities

b Exchange of invitations to scholars for lectures, seminars and participation in conferences

c Exchange of information in fields of interest to both parties

In line with the above, the Egyptian side commented that when the supporting committee in Japan for the Project is formulated, it is appreciated, if a personnel from NRIM could become a member of the committee. The Team took note of it, and commented that they appreciate the coordination of the international cooperation by different schemes from Japan to CMRDI. Although it is important to recognize that the nature of the Project is different between the Project and the cooperation of NRIM, the best mixture of the two (2) schemes will be considered.

(2) From countries other than Japan

The Egyptian side explained the major foreign cooperation to CMRDI and it is shown in Annex 10.

7 The Project

(1) Name of the Project

Both sides confirmed that the name of the Project is "Project on Upgrading of Metal Processing Technology in the Arab Republic of Egypt."

(2) Background of the Project/Target group

Both sides agreed that in the light of the national policy of Egypt related to the industry sector, that is, promotion of export, privatization of public companies, and substitute of import products, the reinforcement of small and medium industries such as feeder industries will be essential for the development of the country. Therefore small and medium scale industries in Egypt are the target group of the Project.

(3) Site of the Project

Site of the Project is as follows:

Address: P.O.Box 87, El-Tebbeen, Helwan, Cairo, Arab Republic of Egypt

Tel.: 20-2-5010640, 5010094

Fax.: 20-2-5010639, 5011185

Person to Contact: Prof. Adel Nofal (President)

(4) Technical capability of CMRDI

The Team commented that in general, the knowledge of the staff of CMRDI are relatively in high level, however, research and development activities which require certain measurement equipment facilities and equipment are relatively not sufficient due to lack of facilities.

(5) Methodology of technology transfer

The Egyptian side commented and the Team agreed that in principle, younger Research staff and technical staff in CMRDI will be allocated as C/P of the Project.

The Egyptian side further commented that allocation of C/P for technology transfer from the Japanese experts of five (5) days a week would be possible. The technology transfer from the Japanese experts to the C/P are in the style of lecture, hands-on training and On-the-job training (OJT).

(6) Master Plan of the Project

Both sides discussed and finalized the tentative Master Plan of the Project as follows:

a Overall Goal

Technical capability for production of small and medium scale enterprises of metal processing fields in Egypt will be upgraded.

b Project Purpose

Quality of technical services for small and medium scale enterprises in metal processing fields extended by CMRDI will be upgraded.

c Outputs

0 Project operation unit will be enhanced.

1 Machinery and equipment will be provided, installed, operated and maintained properly.

2 Technical capability of the counterpart personnel in the metal processing fields will be upgraded.

3 Training services for small and medium scale enterprises in metal processing fields by CMRDI will be implemented systematically.

4 Technical assistance for small and medium scale enterprises in metal processing fields by CMRDI will be implemented systematically.

d Activities

Necessary activities to achieve the above-mentioned outputs will be conducted. The details of the activities will be discussed at the dispatch of the Supplementary Study Team

(7) Fields, sub-fields and items of technology transfer

Both sides agreed that the technology transfer to C/P of CMRDI will be conducted in the following fields and sub-fields in the light of the Team's study of the needs of the target group and CMRDI. The tentative fields, sub-fields and items of technology transfer in the Project are shown in Annex 11.

The Team commented and the Egyptian side understood that these fields, sub-fields and items need to be carefully examined by the Supplementary Study Team in the light of the availability of experts and the limitation of budget as well as the detailed study on the needs and level of target group and CMRDI and the level of C/P in CMRDI, thus are subject to change:

a Casting
   (a) Aluminum high pressure die casting
   (b) Chemically bonded sand molding (Shell molding, Cold box and Hot box)

b Heat Treatment and Mechanical Properties
   (a) Austempering of ductile cast iron
   (b) Surface hardening (carburization, nitriding)
   (c) Fatigue evaluation of welded joint

c Laser Cutting

In relation to the following sub-fields, both sides discussed as follows:

a Aluminum high pressure die casting

In the above mentioned sub-field, the Egyptian side strongly requested to include the items of technology transfer related to dies. The Team took note of it and study to what extent it can be included in the scope of the Project by the dispatch of the Supplementary Study Team.

b Precision casting (lost wax process)

The Egyptian side strongly requested to include the above mentioned sub-field to be included in the Project, but the Team explained and the Egyptian side agreed that due to the limit of the budget for the machinery and equipment, the relatively low availability of the expert as well as relatively low dissemination to the Egyptian industries, it will be excluded from the scope of the Project.

c Gleeble testing

The Egyptian side strongly requested to include the above mentioned sub-field to be included in the Project although it is declined in the latest proposal of the Project. The Team explained that it will be excluded from the scope of the Project because of the following reasons:

(a) There is a limit of the budget for the provision of machinery and equipment, and the cost for the machinery and equipment in this sub-field are relatively high.

(b) The purpose of the Project is to upgrade the quality of technical services for small and medium scale enterprises of metal processing fields extended by CMRDI, but the nature of this sub-field seems to be mainly for internal research and development of CMRDI.

The Egyptian side took note of the comment of the Team, but they explained that they may submit a proposal for this particular sub-field to be included in the Project through the JICA Egypt Office.

d Creep testing (material selection testing with the duration of approximately 1,000 hours)

The Egyptian side requested to include the above sub-field to be included in the Project, but the Team explained that it will be excluded from the scope of the Project because the priority of this sub-field is relatively low in the light of the needs of the target group, and the knowledge of CMRDI staff seems to be already enough capability to conduct activities related to this sub-field.

e Welding and Non-destructive Testing

The Egyptian side explained that the activities related to the above-mentioned fields are sustainably conducted by CMRDI, so it can be excluded from the scope of the Project

(8) Duration of the Japanese Technical Cooperation for the Project

Both sides tentatively agreed that the duration of cooperation is four (4) years from the date to be stipulated in the Record of Discussions considering duration needed for the technology transfer to the C/P as well as the said technology to adopted by CMRDI.

In connection with this, the Egyptian side commented that to achieve the Project Purpose as soon as possible, it is appreciated if it is studied to make the duration of cooperation for three (3) years. The Team took note of it and commented that the appropriate terms of cooperation will be discussed and set upon the visit of the Supplementary

Study Team according to the detailed study on the contents of the Project.

8 Measures to be taken by the Japanese side

The Team explained to the Egyptian side and the latter understood that the contents of the following measures to be taken by the Japanese side are subject to change according to the budget allocation and the availability of experts, etc.

(1) Dispatch of experts

The Team explained and the Egyptian side agreed that the following long-term experts would be dispatched in compliance with the fields as stipulated in Article 7.

a Chief Advisor
b Project Coordinator
c Casting
d Heat Treatment and Material Properties
e Laser Cutting

Both sides agreed that short-term experts will be dispatched as necessity arises

(2) Training of Egyptian Counterpart Personnel in Japan

The Team explained to the Egyptian side and the latter understood that maximum three (3) Egyptian C/P will be accepted in Japan annually. The duration, timing and contents of the training in Japan will be examined carefully by the Japanese experts and the Egyptian side.

The Team further explained that acceptance of the Project Director and the Project Manager in Japan will be considered in the earlier stage of the Project.

(3) Provision of Machinery and Equipment

The Team explained to the Egyptian side and the latter agreed that any machinery and equipment provided by the Japanese side should be regarded as only a tool and material

to accomplish the technology transfer for the Project.

Taking the above principle into consideration, both sides worked out the tentative list of the machinery and equipment necessary for the implementation of the Project as shown in Annex 12.

9 Measures to be taken by the Egyptian side

a Allocation budget for the Project

The Egyptian side explained that the allocation plan of budget for the Project is shown in Annex 13.

b Allocation of counterpart personnel (C/P)

The Egyptian side commented that they will allocate minimum two (2) C/P for one (1) field for efficient technology transfer in the Project.

The list of candidate C/P in the Project is shown in Annex 14.

c Facility and utility (new Project site)

The layout of the proposed Project site is shown in Annex 15.

The Egyptian side explained that the new building , some part of which is to be used as the Project site is now under construction and is to be completed by June 30, 1999, including the utilities. The Egyptian side further commented that the said new building is to be utilized by the Project with the top priority. The Team requested the Egyptian side to report the completed condition of the building to Japan with photographs.

The construction period of the building adjacent to the above portion of the building will start from July 1999 to June 30, 2000. The construction schedule of the building to be completed in June 30, 1999 is shown in Annex 16.

In addition to the above, the Team explained and the

Egyptian side agreed that the following preparations for the Project site are to be needed by the arrival of the machinery and equipment provided under the Project:

(a) Installation of switch boards for electrical supply
(b) Water supply for die casting machine and laser cutting machine
(c) Facilitating cleanroom with double door and air-condition for laser cutting machine

In line with the above, the Egyptian side requested the Team that the detailed condition of the preparations of the Project site are to be informed from the Japanese side to the Egyptian side by the time of dispatch of Supplementary Study Team.

d Machinery and equipment

The main machinery and equipment existed in CMRDI are shown in Annex 17.

10 Sample of R/D

The Team explained the contents of Record of Discussions (hereinafter referred to as "R/D") whose sample is as shown in Annex 18.

11 Tentative Schedule of Implementation (TSI)

Both sides confirmed that the Tentative Schedule of Implementation as shown in Annex 19.

In this connection the Team explained and the Egyptian side understood that the commencement date will be stipulated in R/D, considering the certain duration for the procedure of the procurement of the machinery and equipment provided by the Japanese side under the scheme of the Project.

12 Joint Coordinating Committee

Both sides agreed that, for the effective and successful implementation of technical cooperation for the Project, a Joint Coordinating Committee will be established whose functions and

composition are described in Annex 20.

13 Joint Evaluation

The final evaluation of the Project will be conducted jointly by both sides through JICA approximately six (6) months before the termination of the cooperation period in order to examine the level of achievement of the objectives of the Project.

Other evaluations may be conducted as and when necessary during and after the cooperation period to better monitor the progress and sustainability of the objectives of the Project.

In this regard, the Team explained again the methodology of evaluation, especially five (5) basic evaluation components as shown in Annex 2.

14 Others

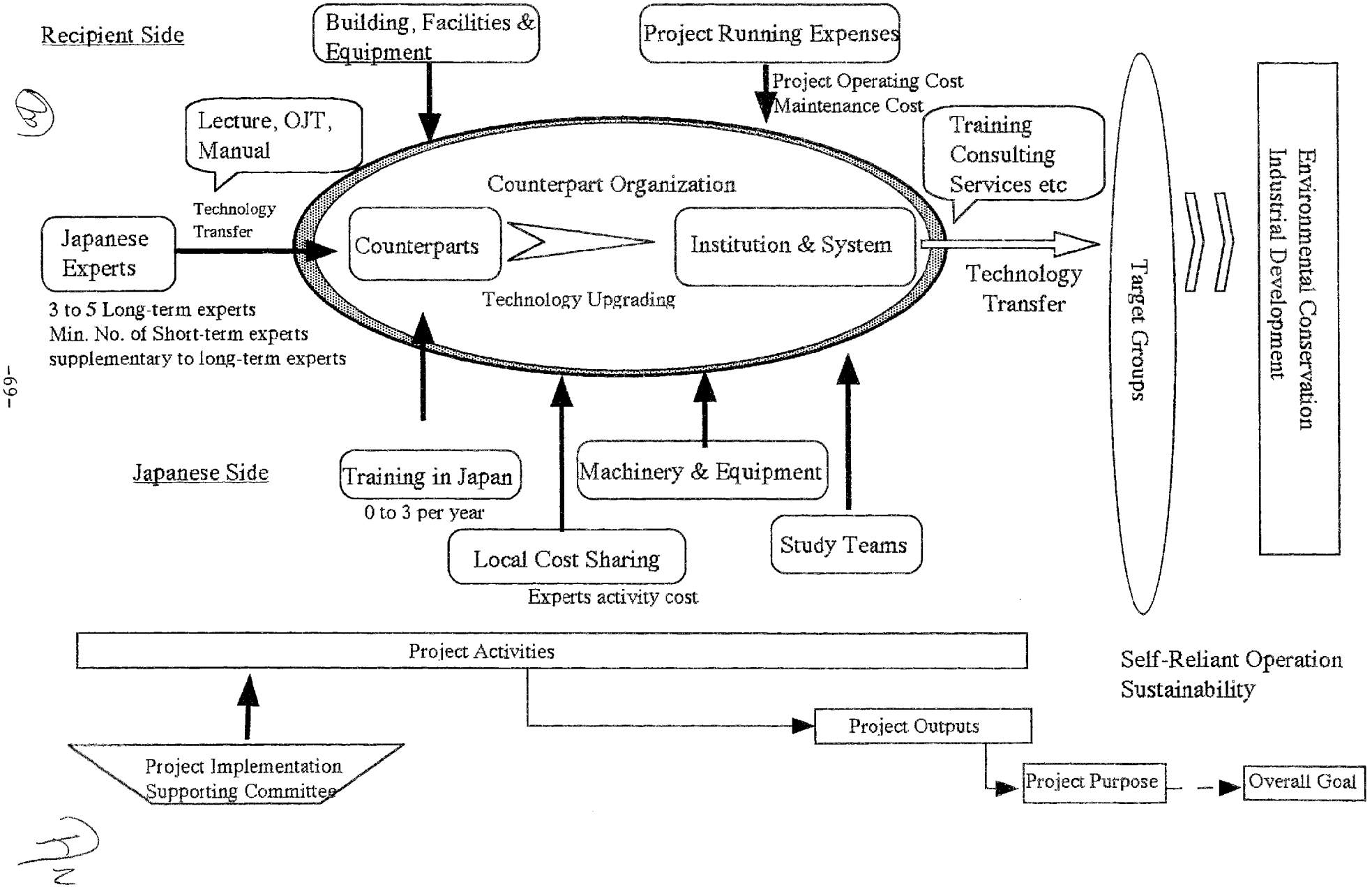
(1) Both sides agreed that common language used in any activities of the Project should be English.

(2) The Team requested to the Egyptian side and the latter agreed that when the Japanese experts for the Project are dispatched, the Egyptian side will make the best effort to facilitate the office space for the Japanese experts including furnishing the utilities such as air conditioner, the outside telephone line and LAN for them.

(3) The list of attendance to the Discussions are as shown in Annex 21.

List of Annexes

Annex 1 Conceptual Model for Project-type Technical Cooperation



Annex 2 Five Basic Evaluation Components

1 Five Basic Evaluation Components

The five (5) basic evaluation components defined by JICA as mentioned below are in line with those used for the evaluation works by DAC and other international assistance organization. Introduction of these components has enabled a consistent, well-balanced evaluation, which minimizes evaluator bias. Further, it allows us to share the results, knowledge and lessons with other aid organizations, since we are using common components and can discuss with them from the same viewpoints.

(1) Efficiency

Evaluate the method, procedure, term and cost of the project with a view to productivity.

(2) Effectiveness

Evaluate the results in comparison with the goals (or revised ones) defined at the initial or intermediate stage, and evaluate the attributes (factors and conditions) of the results.

(3) Impact

Evaluate the positive and negative effects of the project, extent of the effect and beneficiaries.

(4) Relevance

Preliminary evaluate whether the needs in the country have been correctly identified, and whether the design is consistent with the national and/or master plan.

(5) Sustainability

Evaluate the autonomy and sustainability of the project after the termination of cooperation, from the perspectives of operation, management, economy, finance and technology.

2 Relation between Five Basic Components and PDM

The following five (5) components are used for the evaluation and a selection of a project.

(1) Efficiency
(2) Effectiveness
(3) Impact
(4) Relevance
(5) Sustainability

These components are directly connected to the elements of PDM as shown in the Figure in the following page.

The component "Efficiency" is a measure to qualitatively and quantitatively compare all resource (input) to the results (output) of the project in order to evaluate the economic efficiency of conversion from input to output.

The parameter "Effectiveness" is a measure to evaluate whether the purpose has been achieved or not, or to evaluate how likely it is to be acheived. In other woeds, it is to evaluate how much the outputs contributed to the achievement of the purpose, or to evaluate whether or not the characteristics of the outputs were as expected.

The parameter "Impact" is a foreseeable or unforeseeable, and a favorable or adverse effect of the project upon society. To evaluate impact, both the goal and project purpose should be referred to in the beginning of the evaluation. Evaluation with this component could requires comprehensive surveys in many cases.

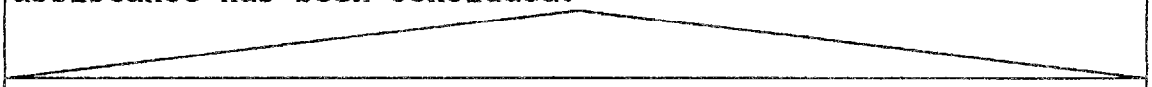
The parameter "Relevance" is to comprehensively evaluate whether or not the project meets the overall goals, politics of both the donor and recipient, local needs and given priority levels, in order to decide whether the project should be continued, reformulated or

terminated.
The component "Sustainability" is to comprehensively evaluate how long the favorable effect as a result of the project can continue after the project has been terminated. Evaluation with this component is required to decide how much the local resources should continue to be used for the project, and to evaluate how much the country receiving the assistance has been considering the project important. According to OECD (1989), "Sustainability" is a component to be used for the final test of the success of a development project.
All five components are essential for any of the projects or programs. The five components give necessary information to the decision maker so that he/she can decide how to approach the next step. Since each of the five components build on the elements of the intervention strategy, they also lay foundation for standardization in monitoring and information handling within and among organizations and agencies.
In practice, each of the five parameters should also contain project-specific information.

Five Components vs Goal Hierarchy

Evaluation Components

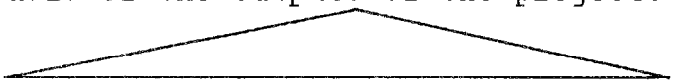
Sustainability:
Evaluate the extent to which the positive effects as a result of the project will still continue after external assistance has been concluded.



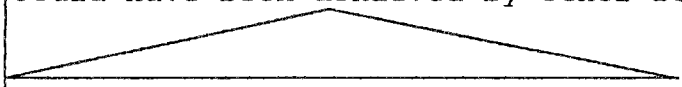
Relevance:
Evaluate the degree to which the project can still be justified in relation to the national and regional priority levels given to the theme.

Impact:
Foreseenable or unforeseenable, and favourable or adverse effect of the project upon the target groups and persons possibly affected by the project.

Effectiveness:
Evaluate the extent to which the purpose has been achieved or not, and whether the project purpose can be expected to happen on the basis of the outputs of the project.



Efficiency:
Evaluate how the results stand in relation to the efforts and resources, how economically the resources were converted to the outputs, and whether the same results could have been achieved by other better methods.



Inputs	Outputs	Project Purpose	Overall Goal

Goal Hierarchy

Annex 3 National Research Institute under Minister of State for Scientific Research

- Academy of Scientific Research and Technology
- Mubarak City for Scientific Research and Technological Applications
- National Research Center
- National Authority for Remote Sensing & Space Sciences
- Central Metallurgical Research and Development Institute
- Petroleum Research Institute
- Technical & Technological Consulting Studies Research Fund
- National Institute of Astronomy and Geophysics
- National Institute of Standards
- National Institute of Oceanography and Fisheries
- Theodre Belharz Research Institute
- Electronics Research Institute

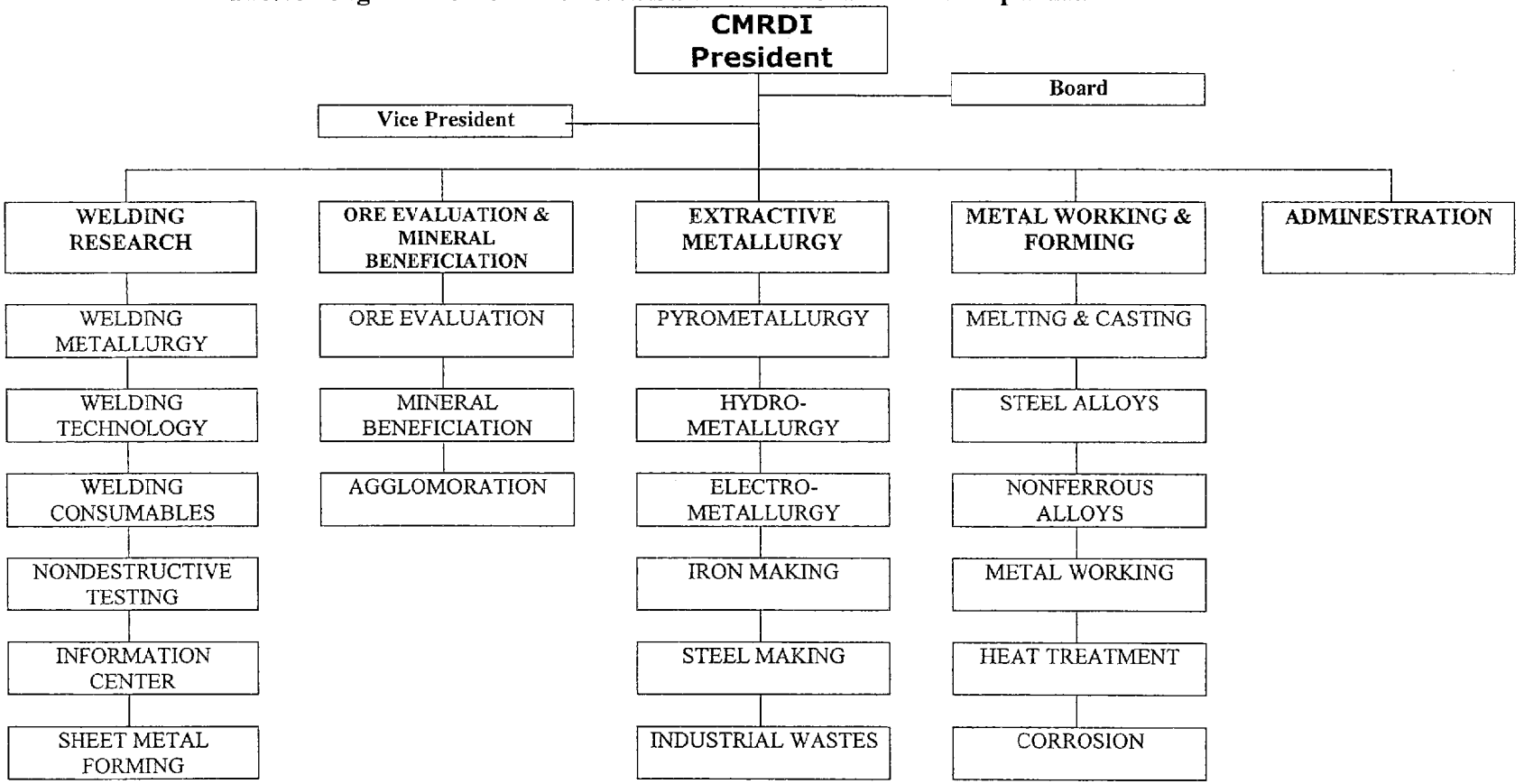
Annex 4 Members of Board of Directors of CMRDI

Chairman (1)
Vice chairman (1)
Head of department (4)
Chairman of big holding companies of the following fields (5):
- metallurgical
- mineralogical
- engineering (components of electronic, automotive)
- chemeical (fertilizer,etc)
- industry (nominated by the Minister)

University professor (1)
Personnel with special experience (2)

Annex 5

Present Organization Chart of CMRDI and No. of Staff in Each Department



Research Staff.	17	28	40	39	
Research Assistants	5	3	6	5	
Eng., Chem., Phys.	6	10	12	16	
Technicians	17	14	22	36	
Officers	3	7	11	13	
Labors	3	10	17	30	
Total	**51**	**72**	**108**	**139**	**137**

As of April 19, 1999

Annex 6 Number of Staff of CMRDI by categories

(As of November 1998)

Categories	Sub-categories	Numbers	Educational Background
Resarch Staff	Professor	22	Ph.D
	Associate Professor	19	Ph.D
	Researcher	24	Ph.D
	Research Officer	42	M.Sc
	Research Assistant	33	B.Sc
Sub-total		140	
Technical Staff	Engineer	13	B.Sc
	Chemist & Physist	21	B.Sc
	Physician	1	B.Sc
	Technicians	76	middle level education
	Artisans	42	lower level education
	Nonskilled Labor	74	
Sub-total		227	
Supporting Staff	Administration, Finance, Security, etc	137	
Staff Seconded to Univesities		3	
TOTAL		507	

Annex 7a

Total CMRDI Income

('000 L.E.)

	Fisc. Year 97/98			Fisc. Year 96/97			Item
	(B)/(A)	Estimated (A)	Actual (B)	(B)/(A)	Estimated (A)	Actual (B)	
Gov. Budget	102.71%	4,500	4,622	105.71%	3400	3,594	Salaries & Wages
	68.69%	1,600	1,099	80.60%	1500	1,209	Consumables, Maintenance,etc.
	75.00%	2,000	1,500	66.67%	1500	1,000	Equipment, Buildings, Furniture, etc.
	89.15%	8,100	7,221	90.67%	6,400	5,803	Total
Self Income	96.90%	1,700	1,647	107.66%	1600	1,722	Contractual Projects
	115.31%	110	127	114.80%	100	115	Consultations
	147.41%	550	811	108.73%	450	489	Technical Services
	49.01%	100	49	101.31%	400	405	Training
	107.07%	2,460	2,634		2,550	2,732	Sub-Total
			480				International Agreements
			412				Grants
			50				Donations
	145.36%	2,460	3,576	107.13%	2,550	2,732	Total
	102.24%	10,560	10,797	95.36%	8,950	8,535	Gross Total

Annex 7 b

Expenditure of CMRDI

in thoushand L.E.

	94/95	95/96	96/97	97/98	98/99
Salaries	3,004	3,657	4,323	5,284	5,853
Raw materials,spare parts, fuel	796	972	1,142	1,589	1,874
Buildings	600	450	550	1,700	2,100
Equipment	480	710	880	1,980	1,995
Furnature	4	30	50	100	100
Transport	20	15	28	116	11
	4,704	5,834	6,973	10,769	11,933

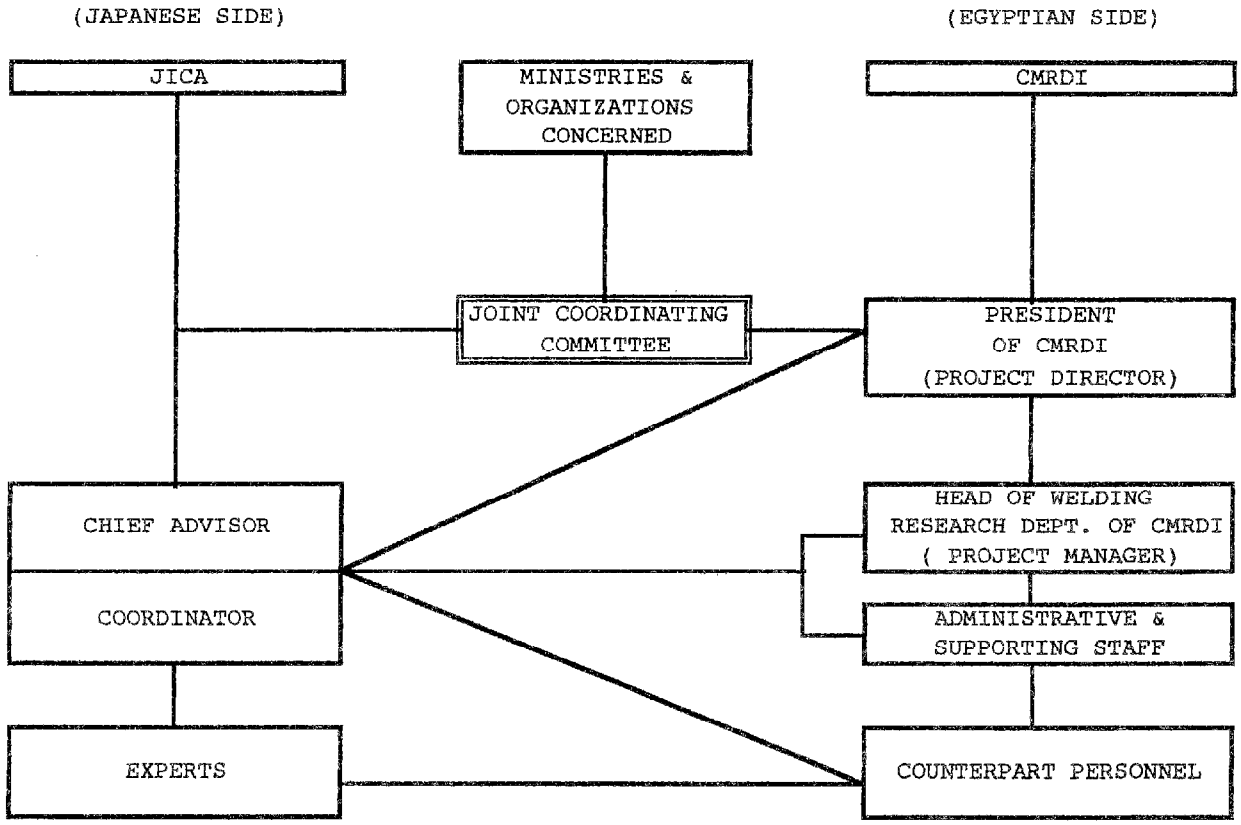
Annex 8 List of training courses conducted by CMRDI

Theme	Number of Participants
1 Mineral Processing	12
2 Pyrometallurgical Process for Extraction of Non-Ferrous Metal	4
3 Principles of Metallography	4
4 Non-Destructive Testing Techniques	34
5 Heat Treatment Technology of Metals and Alloys	28
6 Metal Working and Mechanical Testing	5
7 Welding Technology and Welding Metallurgy	57
8 Metallurgy of Cast Iron	5
9 Steel Casting	-
10 Recycling of Industrial Wastes	16
11 Steel Alloys	25
12 Steel Making and Ferroalloys Production	-
13 Metal Cutting Technology	40
14 Ore Evaluation Using Different Physical Tools and Methods	20
15 Principles of Hydro- and Electrometallurgy	15
16 Casting Design of Iron and Steel Castings	-
17 Continuous Casting of Carbon Steel	-
18 Roll Pass Design	2
19 Sintering	15
20 Welding of Carbon Steel	4
Total Number of Participants	286

List of organization of the Trainees

1 Egypt electric Power Authority
  (1) Mid-Delta Electric Power zone
  (2) South Upper Egypt Electric Power Zone
  (3) South Cairo Electric Power Zone
  (4) North Cairo Electric Power Zone
  (5) West Cairo Electric Power Zone
  (6) Shoubra Elkhima Electric Power Zone
2 Abu Qir Fertilizers and Chemical Industries Co.
3 El Nasr Fertilizers and Chemical Industries Co.
4 El Nasr Coke and Base Chemicals Co.
5 El Nasr Petroleum Co.
6 Assiut Petroleum Co.
7 Alexandria National Iron and Steel Co.
8 Egyptian Refractory Co.
9 Arab Organization for Industrialization
10 General Organization for Import and Export Control
11 Port Said Engineering Co.

Annex 9 The Tentative Organization Chart for the Administration of the Project



Annex 10 Major foreign cooperation other than from Japan to CMRDI

Foreing Organ	Field of Technology	Methodlology	Input			Duration
			Expert Dispatch	Equipment Provision	Trainee Acceptance	
TNO	Sand Casting	Reasearch & Development	○	○	○to CMRDI(Sudan) ○from CMRDI	86-94
TNO	Metal Cutting	Reasearch & Development	○	○	○to CMRDI(Sudan) ○from CMRDI	92-94
USAID	All field which was accepted by USAID fertilizer, ore beneficiation, casting,etc	Research	×	○	○	88-now
CIDA(IDRC)	SME's appraisal study	Field survey	×	×	○Second country training	93-now
GTZ	Metal Forming and New Matereial	Research	×	×	○	80's-now
KOICA	Small Scale Industry Management				○Group Training Course in Korea	93
UNIDO	(assistance for the establishment of CMRDI)					

Annex 11 Tentative field, sub-field and item of technology transfer in the Project

Field	Sub-Field	Items
I Casting		
	I-1 Aluminum High Pressure Die Casting	
		a Knowledge of Die Casting
			Die Casting Machine
			Dies
			Alloys and Melting
			Theory of Casting
			Methodology of Die Casting
			Inspection of Products
			Properties of Products
		b Practice of Die Casting
			Melting of Alloys
			Methodology of Die Casting
			Methodology of Metallic Mold
			Inspection of Products
			Properties of Products
		c Maintenance and Checking of Die Casting Machine
		d Maintenance and Checking of Metallic Mold
	I-2 Chemically Bonded Sand Molding	
		a Knowledge of Chemically Bonded Sand Molding
		b Practice of Chemically Bonded Sand Molding
			Melting of Alloys
			Molding
			Casting
			Finishing
			Inspection of Products
			Properties of Products
II Heat Treatment and Mechanical Properties		
	II-1 Austempering of Ductile Cast Iron	
		a Knowledge of Austempering
			Heat Treatment
			Theory of Austempering
			Equipment of Austempering
			Micro Structure
			Heat Treatment and Mechanical Properties
		b Practice of Austempering
			Methodology of Austempering
			Material Testing and Inspection
		c Maintenance and Checking

Field	Sub-Field	Items
II Heat Treatment and Mechanical Properties		
	II-2 Surface Hardening (Carburizing and Nitriding)	
		a Basic Theory
		Basic of Carburizing and Nitriding
		Steels for Carburizing and Nitriding
		Microstructures and Properties
		b Carburizing Furnace
		c Nitriding Furnace
		d Methodology by Salt bath
		Control of Salt Composition and Temperature
		Control of Reaction
		e Inspection Method
		f Practice of Surface Hardening
		Carburizing of Gear
		Nitriding of Gear
	II-3 Fatigue Evaluation of Welded Joint	
		a Theory of Fatigue
		b Practice of Fatigue Test
		c Investigation of Fatigue Fractured Surface
		d Making of Database as Fatigue Know-how on Welded Joint
III Laser Cutting		
		a Knowledge of Laser Processing
		Characteristics of Laser
		CO2 Laser Oscillator
		Nd-YAG Laser Oscillator
		Optical Devices of Laser Processing
		Safety and Health
		b Application of Laser for Cutting
		Principle of Thermal Cutting
		Cutting of Stainless Steels and Non-ferrous Metals
		Cutting of Carbon Steels
		c Practice of Laser Cutting
		Preparation for Cutting
		Optimization of Cutting Condition
		Quality Control for Cutting
		d Practice of Maintenance and Repair of Laser Facility
		e Making of Database as Cutting Know-how

Annex 12 Tentative List of Machinery and Equipment to be used in the Project

Field of Technology Transfer	Name of Machinery and Equipment	Specification	Notes	To be provided by
High Pressure Die Casting	Degassing		P	Japan
	Holding Furnace		P	Japan
	Die Casting Machine	Clamp Force 135ton	P	Japan
	Dies	2sets	P	Japan
	Die Mold Heater		P	Japan
	Finishing Device		P	Japan
	Hoist		P	Japan
Chemically Bonded Sand	High Frequency Induc. Furnace		U	
	Molding Machine		P	Japan
	Shell Molding Machine		U	
	CO2		U	
Austempering of Ductile Cast iron	Electric Furnace		P	Japan
	Salt Bath		P	Japan
Surface Hardening	Salt Bath		P	Japan
	Optical Metal Microscope		U	
	SEM		U	
	Micro Vickers Hardness Tester		U	
Fatigue Evaluation	Out of Plane Bending Fatigue Testing Machine	1.5kgf-m / 2 Sets	P	Japan
	Dynamic Strain Meter		P	Japan
	X-T Recorder		P	Japan
	Optical Metal Microscope		U	
	SEM		U	
	Tool Microscope		U	
	Contour Measuring Instrument		P	Japan
	Tensile Testing Machine	50T	P(*)	Japan / Egypt
Laser Cutting	Laser Cutting Machine	0.5-1kW Nd-YAG/X-Y Table	P(**)	Japan
	Infra-red Thermometer	Point Measuring	P	Japan
	X-T Recorder	Digital In/Out	P	Japan
	Still Camera	Shutter 1/8000s	P	Egypt
	Contour Measuring Instrument		P	Japan
	Multi Voltage Meter		P	Egypt
Others	Vehicle	Mini-bus style	P(***)	Japan

(Remarks)
(*) The provision of this machinery by the Japanese side is to be studied by the Japanese side in the light of budget. The accesssories for high temperature test will be procured by the Egyptian side.
(**) The specification of this machinery is to be studied by the Japanese side in the light of the availability of budget.
(***) The provision of this machinery by the Japanese side is to be considered according to the justification to utilize it.

Annex 13

Tentative Plan for Appropriation of Local Cost

(Unit: '000 EL)

	1999	2000	2001	2202	2003
Staff Expenses	450	495	544.5	599.95	658.5
Building and Facilities					
Machinery, Equipment and Materials Procuured by Cidesi	200	500	300	200	200
Maintenance and Operation of Machinery & Equipment	50	100	100	100	100
Utilities, Communications and Others	20	30	30	30	30
Domenstic Transportation Handling and Installation of Machinery and Equipment	30	50	40	30	30
Total	**750**	**1175**	**1014.5**	**959.95**	**1018.5**

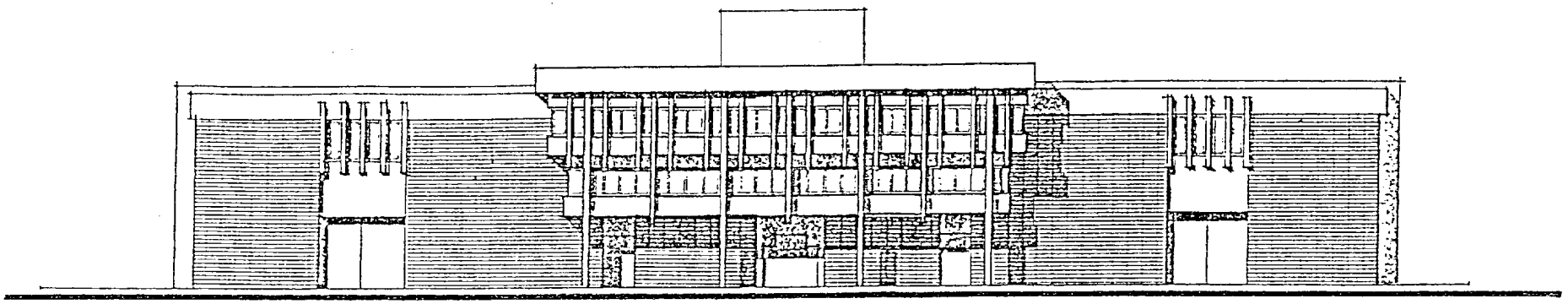
Annex 14 List of candidate C/P of the Project

Name	Sex	Age	Title / Department	Field of technology tranfer charge	Educational background
(Project Director)					
Prof. Adel Nofal	M	57	President		Dr.Eng
(Project Manager)					
Prof. Bahaa Zaghloul	M	54	Head of Welding Department		Dr.Eng
(Technical C/P)					
Mohamed Waly	M	43	CD(R)	Die Casting	Dr.Eng
Mohamed Ramadan	M	31	CD(R)	Die Casting	B.Sc
Nader El-Baguri	M	28	CD(R)	Die Casting	M.Sc
Iman Afifi	F	23	CD(R)	Die Casting	B.Sc
Iburahim Mustafa	M	23	CD(R)	Chemicaly Bonded Sand Molding	Dr.Eng
Hassan Ahmed	M	33	CD(T)	Chemicaly Bonded Sand Molding	M.Sc
Ramadan Soilman	M	32	CD(T)	Chemicaly Bonded Sand Molding	B.Sc
Alber Sadek	M	45	WRD(R)	Heat Treatment	Dr.Eng
Mohamad Hanafi	M	39	WRD(R)	Heat Treatment	Dr.Eng
Kahled Hafez	M	31	WRD(R)	Heat Treatment	M.Sc
Mohamed Murad	M		CD(R)	Heat Treatment	M.Sc
Shaimaa Mohamed	F	23	CD(R)	Heat Treatment	B.Sc
Mohamed Musallam	M	39	WRD(R)	Mechanical Properties	Dr.Eng
Khaled Ibrhim	M	40	CD(R)	Mechanical Properties	Dr.Eng
Hamed Abdel Halim	M	31	WRD(R)	Mechanical Properties	M.Sc
Nabil Zakhari	M	28	WRD(R)	Mechanical Properties	M.Sc
Osama Khedr	M	37	WRD(R)	Mechanical Properties	B.Sc
Abdul Monen El Batahgi	M	45	WRD(T)	Laser Cutting	Dr.Eng
Mahmoud Tobaa	M	32	CD(R)	Laser Cutting	M.Sc
Sherien El-Halawaty	F	23	WRD(R)	Laser Cutting	B.Sc

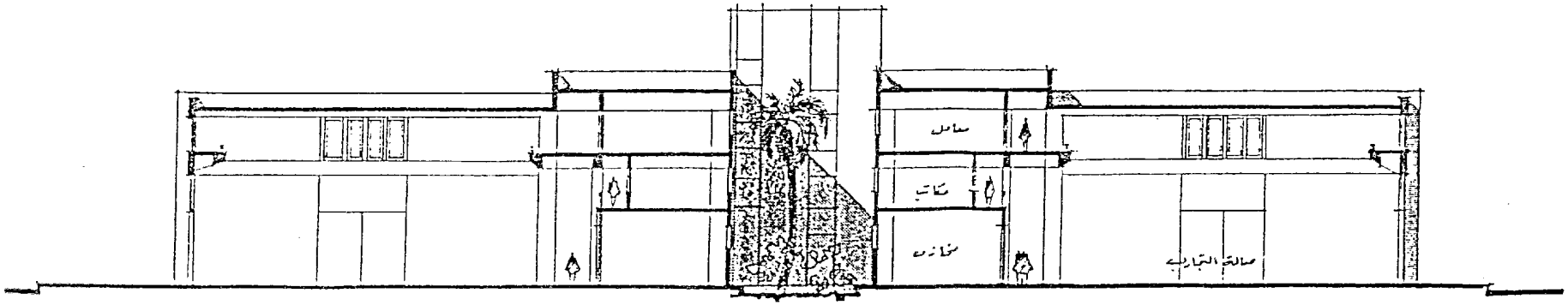
(Remarks)
WRD stands for Welding Research Department
CD stands for Casting Department
(R) stands for Research Staff
(T) stands for Technical Staff

Annex 15

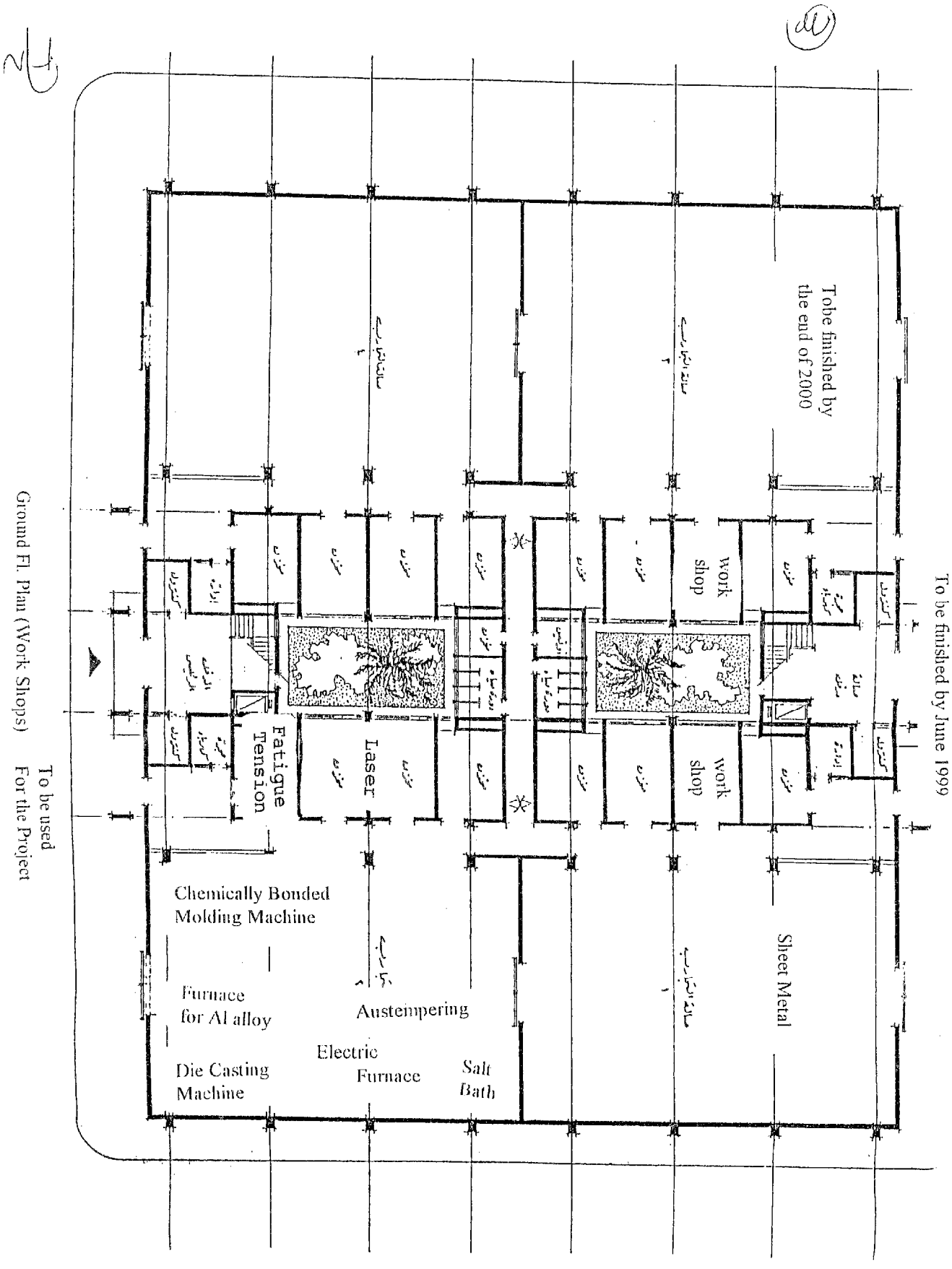
Layout of the Proposed Project Site



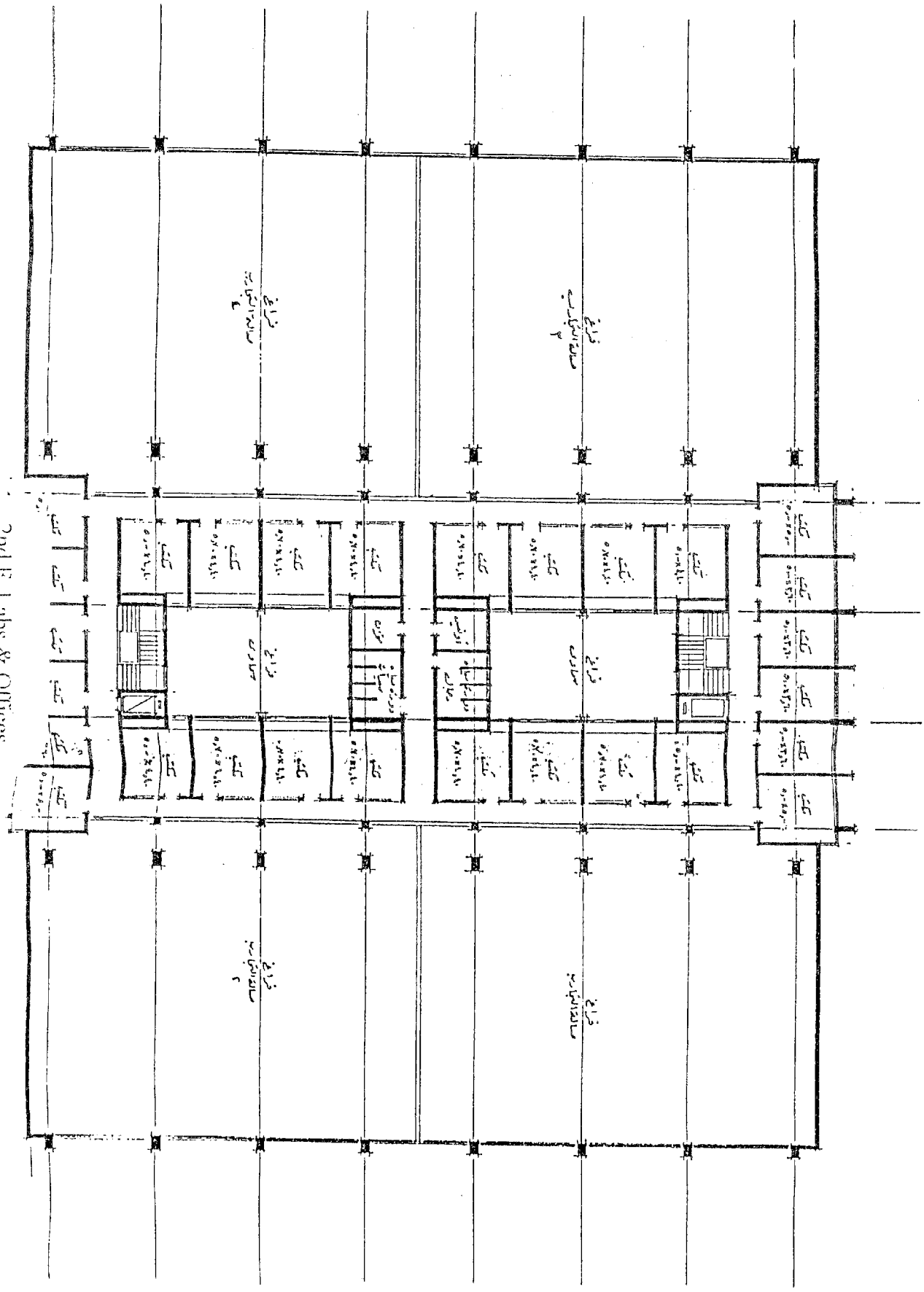
الواجهـــة الرئيسية ٢٠٠١



قطاع طولى ٢٠٠١



Ground Fl. Plan (Work Shops) To be used For the Project



2nd F. Labs & Offices

Annex 16

Time Schedule for Completionof the Construction of New CMRDI Pilot Plant Extension - Phase B

1. Expansion joints	18/4 - 22/4
2. Brick work - ground floor	18/4 - 22/4
3. Internal plastering - ground florr	18/4 - 4/5
4. Outside plastering - facade	18/4 - 6/5
5. Sanitary work - feeding & drainage	18/4 - 6/5
6. Painting	18/4 - 15/6
7. Painting of internal corridors	14/4 - 24/5
8. Electrical work	18/4 - 15/6
9. Marble and staircases	24/4 - 27/5
10. Ceramic and tiles flooring	2/5 - 20/5
11. Staircasses accessories	2/5 - 20/5
12. Outer pavements	8/5 - 22/5
13. Outer satritary work	8/5 - 31/5
14. Aluminum work	15/5 - 31/5
15. Sanitary accessories	1/6 - 15/6
16. Finishing and carpentary accessories	1/6 - 15/6

Annex 17 List of existing machine and equipment of CMRDI

No.	Field	Specification	Manufacturer	Manufacture Country	Provider (1*)	Installed Date	Operation (2*)	Maintenance (3*)	Availability (4)
1	Casting	Induction melting medium frequency furnace (100/120/350Kg)	BBC Brown Boven	Germany	C Royal Dutch	1988	A	A	A
2	Casting	Induction melting medium frequency furnace (10Kg)	Inductotherm		C UNDP	1988	A	A	A
3	Casting	Cupola melting furnace (ton/hr)	CMRDI	Egypt	A	1992	B	C	C
4	Casting	Electro-slag melting furnace (15Kg/hr)	Paton	Russia		1993	B		A
5	Molding	2 pairs of jolt squeeze molding machines international	Russia	Russia	C Royal Dutch	1988	A	C	A
6	Molding	2 pairs of jolt squeeze molding machines	GEMCO son-mold	Holland	C Royal Dutch	1988	A	B	A
7	Molding	2 sand mixer (8t/hr/Kg)	Maschinen-enfabrick Gustav Eirich	Germany	C	1988	A	A	A
8	Shell molding	Semi-automatic shell mold machine 300 pound sand tank & 15" x 20" pattern size plate	Df Dependable foundry equipment Co. Inc.	TULATIO OREGON	C	1995	C	C	A
9	Shell molding	Dependable shell mold bonding press	Df Dependable foundry equipment Co. Inc.	TULATIO OREGON	C	1995	C	C	A
10	Chemically bonded sand	CO2 Process	Trenton	UK	Royal Dutch	1988	A	A	A
11	Investment casting	Wax injector machine	Muller Phipps international	USA	C USA	1995	C	C	C
12	Investment casting	Fluidizing chamber	Muller Phipps international	USA	C	1995	C	C	C
13	Investment casting	Slurry mixers	Muller Phipps international	USA	C	1995	C	C	C

No.	Field	Specification	Manufacturer	Manufacture Country	Provider (1*)	Installed Date	Operation (2*)	Maintenance (3*)	Availability (4)
14	Investment casting	4 Mixers	CMRDI	Egypt	A	1995	C	C	C
15	Sand testing	Green compression strength	G.F(George Fisher)	USA	C UNDP	1987	A	A	A
16	Sand testing	Permeability	G.F(George Fisher)	USA	C UNDP	1987	A	A	A
17	Sand testing	Wet tensile strength	G.F(George Fisher)	USA	C UNDP	1987	A	A	A
18	Sand testing	Mixture (3Kg, 5Kg)	G.F(George Fisher)	USA	C UNDP	1987	A	A	A
19	Sand testing	Speedy moisture tester	G.F(George Fisher)	USA	C UNDP	1987	A	A	A
20	Sand testing	Thermal expansion	G.F(George Fisher)	USA	C UNDP	1987	A	B	A
21	Sand testing	Seave analysis instrument	G.F(George Fisher)	USA	C UNDP	1987	A	A	A
22	Sand testing	Sand testing furnace	G.F(George Fisher)	USA	C UNDP	1987	A	A	A
23	Sand testing	Drier	G.F(George Fisher)	USA	C UNDP	1987	A	A	A
24	Sand testing	Green compression strength	Sinto kogio LTD	JICA	B	1987	A	B	A
25	Quality control	Chemical analysis apparatus 4-base (Fe-Cu-Al-Ni)	A.R.L	Swiss	A	1987	A	A	A
26	Quality control	Chemical analysis apparatus 3-base (Fe-Cu-Al)	Spectra	Germany	A	1995	A	A	A
27	Quality control	Optical microscope	PME Olympus	Japan	A	1986	A	A	A
28	Quality control	Scanning microscope (SEM)	JOEL	England	A	1996	A	A	A
29	Quality control	Tribometer for measuring the wear resistance of castings		Holand	(C) TNO	1988	A	A	A
30	Heat Treatment	Electrical resistance furnace ϕ1.5*2m (up to 1100℃)	Egyptalum	Egypt	A	1999	A	A	C
31	Heat Treatment	Salt bath furnace (300-600℃)	CMRDI	Egypt	A	1999	C	A	C

No.	Field	Specification	Manufacturer	Manufacture Country	Provider (1*)	Installed Date	Operation (2*)	Maintenance (3*)	Availability (4)
32	Metal cutting	CNC Lath machine two directions	Profturn 400S	Holand	C TNO	1992	A	B	A
33	Metal cutting	CNC Milling Machine three direction X,Y,Z	Hartford	China	C TNO	1992	A	B	A
34	Metal cutting	Conventional lath machine length 3m (full automation)			C TNO	1992	A	B	A
35	Metal cutting	Universal milling machine max. diameter 320mm	TOZ		C TNO	1992	A	B	A
36	Metal cutting	Table lathe	TOZ		C TNO	1992	A	A	A
37	Metal cutting	Drilling machine drill hole form 1-40mm	Flon	Germany	C TNO	1992	A	A	A
38	Metal cutting	Mechanical saw max. cut diameter 400mm	C.M.(SCORTEGAGNA)	Italy	C TNO	1992	A	A	A
39	Heat Treatment	Muffle Furnace, 230x200x400 Ni-Cr Heating Wires	Gallenkamp	England		1982		A	
40	Heat Treatment	Muffle Furnace, 190x130x350 Ni-Cr Heating Wires	Gallenkamp	England	C UNDP	1982		A	
41	Heat Treatment	Muffle Furnace, 160x100x300 SiC-Glowbars	Lotus	Egypt	C UNDP	1970		A	
42	Heat Treatment	Tempering Furnace, Φ270x280 Heating Wires	Birlec	England	C UNDP	1980		A	
43	Heat Treatment	Salt Bath with two Crucibles, (Φ160 & Φ 270)x200	Wild Barfield	England	C UNDP	1978	C	B	
44	Heat Treatment	Three Zone Furnace, Φ95x1200 SiC-Glowbars	Birlec	England	C UNDP	1973	C	C	
45	Heat Treatment	Chamber Furnace, 200x150x400 SiC-Glowbars	Lindburg	USA	A	1975	C	B	
46	Heat Treatment	Chamber Furnace, 220x170x300 Super Cantal Wires	Gallenkamp	England	A	1970		A	
47	Heat Treatment	Box Furnace, 140x170x300 TiC-Glowbars	Lindburg	USA	A	1975	C	B	
48	Mechanical Testing	Universal Tension Testing Machine 30 tons	Shimazu	Japan	B			A	A
49	Mechanical Testing	Rotaing Bending Fatigue Testing Machine					C		

No.	Field	Specification	Manufacturer	Manufacture Country	Provider (1*)	Installed Date	Operation (2*)	Maintenance (3*)	Availability (4)
50	Welding Metallurgy	SEM, model JSM20	JEOL	Japan	A			A	A
51	Welding Metallurgy	Profile Projector	Nikon	Japan	B			A	A
52	Welding Metallurgy	Vickers Hardness Tester			B			A	A
53	Welding Metallurgy	Micro Vickers Hardness Tester	Shimazu	Japan	B			A	A
54	Welding Metallurgy	Metallurgical Microscope, x400,without Camera	Olympus	Japan	A			A	
55	Welding Metallurgy	Metallurgical Microscope, x800, with Camera	Olympus	Japan	A			A	A
56	Welding Metallurgy	Metallurgical Microscope, x1000, with Camera	Nikon	Japan	B			A	A
57	Welding Metallurgy	Stereo Scope			B			A	A
58	Welding Metallurgy	Multi Channel X-T Recorders, 3ch	Rika Denki	Japan	A		C	C	B
59	Welding Metallurgy	Multi Channel X-T Recorders, 6ch	Rika Denki	Japan	B		C	C	
60	Welding Metallurgy	2 Sets Polishing Machine			A			A	A
61	Welding Metallurgy	Electrolytic Etching			A			A	A
62	Welding Metallurgy	Ultrasonic Cleaners			B			A	A

As for the (1*) - (4*), A - C mean as follows:

(1*) A: Egypt
B: Japan
C: Other Donors (Please Specify)

(2*) A: Operated many times
B: Operated a few times
C: Almost not opertated

(3*) A: Good
B: Necessary to repair (operated now)
C: Necessary to repair (not operated now)

(4*) A: Existing and to be used in the Project.
B: Existing but to be replaced to be utilized in the Project.
C: Existing but to be increased to be utilized in the Project.

Annex 18 Sample of R/D

RECORD OF DISCUSSIONS BETWEEN JAPANESE IMPLEMENTATION STUDY TEAM AND AUTHORITIES CONCERNED OF THE GOVERNMENT OF THE ARAB REPUBLIC OF EGYPT ON JAPANESE TECHNICAL COOPERATION FOR THE PROJECT ON UPGRADING OF METAL PROCESSING TECHNOLOGY

The Japanese Implementation Study Team organized by Japan International Cooperation Agency and headed by Mr. xxxxx xxxxx, (hereinafter referred to as "the Team") visited the Arab Republic of Egypt from (Date Month Year) to (Date Month Year), for the purpose of working out the details of the technical cooperation program concerning the Project on Upgrading of Metal Processing Technology in the Arab Republic of Egypt.

During its stay in the Arab Republic of Egypt, the Team exchanged views and had a series of discussions with the Egyptian authorities concerned with respect to the desirable measures to be taken by both Governments for the successful implementation of the above-mentioned Project.

As a result of the discussions, and in accordance with the provisions of the Agreement on Technical Cooperation between the Government of Japan and the Government of the Arab Republic of Egypt, signed in Cairo on June 15th, 1983, (hereinafter referred to as "the Agreement") the Team and the Egyptian authorities concerned agreed to recommend to their respective Governments the matters referred to in the document attached hereto.

Cairo, (Date Month Year)

Name Leader Implementation Study Team Japan International Cooperation Agency Japan	Name Central Metallurgical Research and Development Center Arab Republic of Egypt

ATTACHED DOCUMENT

I. COOPERATION BETWEEN BOTH GOVERNMENTS

1. The Government of the Arab Republic of Egypt will implement the Project on Upgrading of Metal Processing Technology (hereinafter referred to as "the Project") in cooperation with the Government of Japan.

2. The Project will be implemented in accordance with the Master Plan which is given in Annex I.

II. MEASURES TO BE TAKEN BY THE GOVERNMENT OF JAPAN

In accordance with the laws and regulations in force in Japan and the provisions of Article III of the Agreement, the Government of Japan will take, at its own expense, the following measures through Japan International Cooperation Agency (hereinafter referred to as "JICA") according to the normal procedures of its technical cooperation scheme.

1. DISPATCH OF JAPANESE EXPERTS
The Government of Japan will provide the services of the Japanese experts as listed in Annex II. The provision of Article VIII of the Agreement will be applied to the above-mentioned experts.

2. PROVISION OF MACHINERY AND EQUIPMENT
The Government of Japan will provide such machinery, equipment and other materials (hereinafter referred to as "the Equipment") necessary for the implementation of the Project as listed in Annex III. The provision of Article VII-1 of the Agreement will be applied to the Equipment.

3. TRAINING OF EGYPTIAN PERSONNEL IN JAPAN
The Government of Japan will receive the Egyptian personnel connected with the Project for technical training in Japan.

III. MEASURES TO BE TAKEN BY THE GOVERNMENT OF THE ARAB REPUBLIC OF EGYPT

1. The Government of the Arab Republic of Egypt will take necessary measures to ensure that the self-reliant operation of the Project will be sustained during and after the period of Japanese technical cooperation, through the full and active involvement in the Project by all related authorities, beneficiary groups and institutions.

2. The Government of the Arab Republic of Egypt will ensure that the technologies and knowledge acquired by the Egyptian nationals as a result of the Japanese technical cooperation

will contribute to the economic and social development of the Arab Republic of Egypt.

3. In accordance with the provisions of Article IV and V of the Agreement, the Government of the Arab Republic of Egypt will grant, in the Arab Republic of Egypt privileges, exemptions and benefits to the Japanese experts referred to in II-1 above and their families.

4. In accordance with the provisions of Article VII of the Agreement, the Government of the Arab Republic of Egypt will take the measures necessary to receive and use the Equipment provided through JICA under II-2 above and equipment, machinery and materials carried in by the Japanese experts referred to in II-1 above.

5. The Government of the Arab Republic of Egypt will take necessary measures to ensure that the knowledge and experience acquired by the Egyptian personnel from technical training to be organized in Japan will be utilized effectively in the implementation of the Project.

6. In accordance with the provision of Article IV-(b) of the Agreement, the Government of the Arab Republic of Egypt will provide the services of the Egyptian counterpart personnel and administrative personnel as listed in Annex IV.

7. In accordance with the provision of Article IV-(a) of the Agreement, the Government of the Arab Republic of Egypt will provide the buildings and facilities as listed in Annex V.

8. In accordance with the laws and regulations in force in the Arab Republic of Egypt, the Government of the Arab Republic of Egypt will take necessary measures to supply or replace at its own expense machinery, equipment, instruments, vehicles, tools, spare parts and any other materials necessary for the implementation of the Project other than the Equipment provided through JICA under II-2 above.

9. In accordance with the laws and regulations in force in the Arab Republic of Egypt, the Government of the Arab Republic of Egypt will take necessary measures to meet the running expenses necessary for the implementation of the Project.

IV. ADMINISTRATION OF THE PROJECT

1. (Title), as the Project Director, will bear overall responsibility for the administration and implementation of the Project.

2. (Title), as the Project Manager, will be responsible for the

managerial and technical matters of the Project.

3. The Japanese Chief Advisor will provide necessary recommendations and advice to the Project Director and to the Project Manager on any matters pertaining to the implementation of the Project.

4. The Japanese experts will provide necessary technical guidance and advice to the Egyptian counterpart personnel on technical matters pertaining to the implementation of the Project.

5. For the effective and successful implementation of technical cooperation for the Project, a Joint Coordinating Committee will be established whose functions and composition are described in Annex VI.

V. JOINT EVALUATION

Evaluation of the Project will be conducted jointly by the two Governments through JICA and the Egyptian authorities concerned, at the middle and during the last six months of the cooperation term in order to examine the level of achievement.

VI. CLAIMS AGAINST JAPANESE EXPERTS

In accordance with the provision of Article VI of the Agreement, the Government of the Arab Republic of Egypt shall bear claims, if any arises, against the Japanese experts engaged in technical cooperation for the Project resulting from, occurring in the course of, or otherwise connected with the discharge of their official functions in the Arab Republic of Egypt except for those arising from the willful misconduct or gross negligence of the Japanese experts.

VII. MUTUAL CONSULTATION

There will be mutual consultation between the two Governments on any major issues arising from, or in connection with this Attached Document.

VIII. MEASURES TO PROMOTE UNDERSTANDING OF AND SUPPORT FOR THE PROJECT

For the purpose of promoting public support for the Project, the Government of the Arab Republic of Egypt will take appropriate measures to make the Project widely known to the nation.

XI. TERM OF COOPERATION

The duration of the technical cooperation for the Project under this Attached Document will be xxxx years from (Date Month Year).

ANNEXES

ANNEX I MASTER PLAN

ANNEX II LIST OF JAPANESE EXPERTS

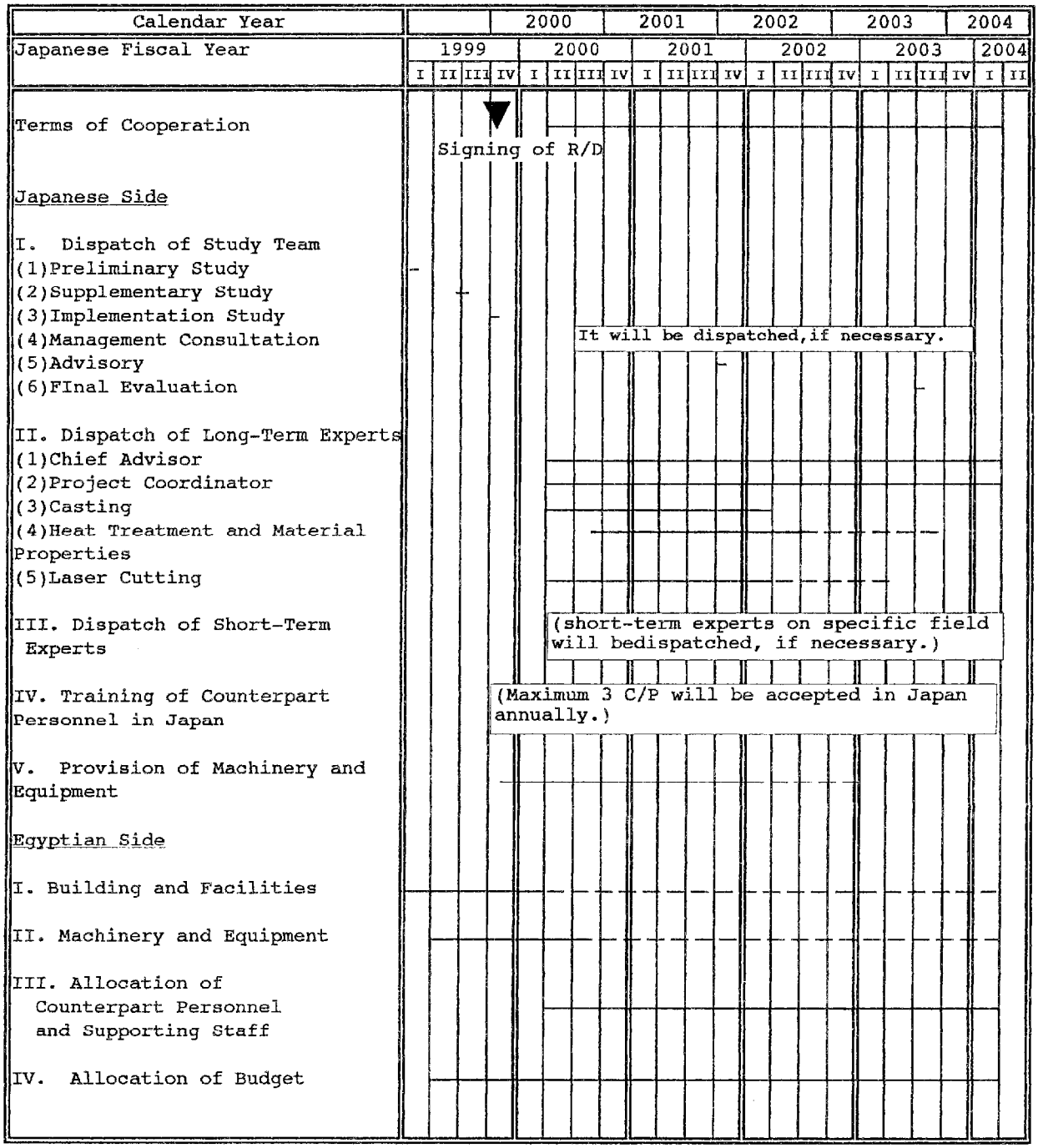
ANNEX III LIST OF EQUIPMENT

ANNEX IV LIST OF EGYPTIAN COUNTERPART PERSONNEL AND ADMINISTRATIVE PERSONNEL

ANNEX V LIST OF LAND,BUILDINGS AND FACILITIES

ANNEX VI JOINT COORDINATING COMMITTEE

Annex 19 Tentative Schedule of Implementation (TSI)



Note:

1.Japanese fiscal year starts in April and ends in March.

2.Egyptian fiscal year starts in July and ends in June.

3.This schedule is subject to change in accordance with the progress of the Project.

4.Advisory Mission in 2001 will conduct Mid-term Evaluation.

Annex 20 The Functions and Composition of Joint Coordinating Committee

1 Functions

The Joint Coordinating Committee will be held at least once a year and whenever necessity arises.

Its functions are as follows:

(1) To settle on the Annual Plan of Operations (APO) of the Project in line with the Tentative Schedule of Implementation (TSI) and Technical Cooperation Programme (TCP) and Plan of Operations formulated under the framework of the Record of Discussions;

(2) To coordinate necessary actions to be taken by both sides;

(3) To review the overall progress of the TCP as well as the achievement of the AWP;

(4) To exchange views on major issues arising from or in connection with the TCP.

2 Composition

(1) Chairperson

President, CMRDI

(2) Committee Members

(Egyptian side)

a Representative(s), Ministry of Foreign Affairs

b Representative(s), Ministry of Industry

c Representative(s), CMRDI

d Other personnel concerned with the Project decided by the Egyptian side, if necessary

(Japanese side)

a Chief Advisor

b Coordinator

c Japanese Experts designated by the Chief Advisor

d Representative(s) of the JICA Office in Egypt

e Other personnel concerned to be decided and dispatched by JICA, if necessary

Note :

Official(s) of the Embassy of Japan in Egypt may attend the Committee as observer(s).

Annex 21 List of Attendance to the Discussions

Japanese side

1. Preliminary Study Team

Mr. Yukio Ishida	Leader
Mr. Minoru Fujita	Technical Cooperaton Planning
Dr. Chisato Yoshida	Casting Technology
Dr. Makoto Kabasawa	Metal Processing
Mr. Susumu Katsumata	Cooperation Planning

2. Embassy of Japan in Egypt

Mr. Zentaro Yamashita	First Secretary

3. JICA Egypt Office

Mr. Kikuo Takeuchi	Resident Representative
Mr. Masami Fuwa	Deputy Resident Representative
Mr. Hitoshi Sato	Assistant Representative
Mr. Mahmoud Abd El Halim	Development Projects Coordinator

4. JICA Expert in CMRDI

Mr. Hisayuki Aoi	JICA Expert
Mr. Junzo Kamimura	JICA Expert
Mr. Hajime Fukumoto	JICA Expert

Egyptian side

1. Ministry of Foreign Affairs

Ms. Nagla El-Hussainy	Deputy Assistant Minister for International Cultural Relations

2. Ministry of Industry

Mr. Soliman Reda	Minister
Mr. Hamdy Sanad	Vice Minister
Dr. Eid Hasan	Deputy Chairman of General Organization for Industrization

3. Central Metallurgical Research and Development Institute

Prof. Adel Nofal	President
Prof. Dr. Eng. Bahaa Zaghloul	Head of Welding Department

2　プロジェクト要請書

①　1996年８月に作成された要請書

رقم الصادر ٦١٢٦ + صورة مشروع

تاريخ الصادر ٩٦/٩/٢

التاريخ ١٩٩٦/٩/١

وزارة الخارجية

العلاقات الثقافية الدولية

مذكرة

تهدى وزارة خارجية جمهورية مصر العربية – العلاقات الثقافية الدولية – أطيب تحياتها الى سفارة اليابان بالقاهرة (القسم الاقتصادى) .

وتتشرف بان ترفق مع هذا صورة مشروع التعاون الفنى المقدم من مركز بحوث وتطوير الفلزات تحت اسم :

DEVELOPMENT OF METALLURGICAL ENGINEERING TECHNOLOGIES

والذى يطلب ادراجه ضمن خطة التعاون مع هيئة التعاون الدولى اليابانيه بالقاهرة (جايكا)

وتنتهز وزارة خارجية جمهورية مصر العربية – العلاقات الثقافيه الدوليه – هذه المناسبه لتعرب للسفارة الموقره عن فائق تقديرهـــا .

الى سفارة اليابان بالقاهـــرة

RECEIVED
03 SEP 1996

مركز بحوث وتطوير الفلزات
مكتب رئيس المركز

عناية السيادة / هالـــة

السيد السفير / صبحي لالع
مساعد وزير الخارجيه للعلاقات الثقافيه

تحيه طيبه وبعد ،،،

أتشرف بأن أرفق صورة من مشروع بعنوان :

"DEVELOPMENT OF METALLURGICAL ENGINEERING TECHNOLOGIES"

والذى أعده مركز بحوث وتطوير الفلزات فى اطار خطة التطوير التى يقوم المركز حاليا بتنفيذها للنهوض بالصناعه المصريه فى مجالات الصناعات المعدنيه .

برجاء التكرم باتخاذ اللازم نحو ادراج هذا المشروع ضمن خطة التعاون مع هيئة التعاون الدولى اليابانيه JICA .

وانني اذ أشكر لكم جميل تعاونكم ودعمكم المستمر لمركز بحوث وتطوير الفلزات

لأرجو ان تتفضلوا بقبول فائق الاحترام ...

رئيس المركز
أ.د. عادل عبد المنعم نوفل

تحريرا فى ١٩٩٦/٨/٢٦.

ص . ب : ٨٧ حلوان القاهرة تليفون : ٥٠١٠٦٤٠ فاكس : ٥٠١٠٦٣٩ تلكس : CMRDI - UN ٢٢١١٦

DEVELOPMENT OF METALLURGICAL ENGINEERING TECHNOLOGIES IN EGYPT

Project Proposal

Submitted by

Central Metallurgical R&D Institute (CMRDI)

To

Japanese Government

Cairo - August 1996

C O N T E N T S

I. PROJECT TITLE

Development of Metallurgical Engineering Technologies.

II. INTRODUCTION

CMRDI has been established in the early eighties, primarily to participate in the national economic growth, by enhancing material competitiveness in the industrial sector. Over the past decade, a wide range of industries has been drawing upon the technological capabilities and facilities of CMRDI, about 200 industrial contracted R&D projects have been conducted, aiming at improvement of the quality of products and processes or the development of new products and new processes.

CMRDI has a large exprience in successful and fruitful international cooperation, which has always been oriented to the technological needs of local industry. The institute has benefited from cooperation with institutions and organisations in different industrialized countries, such as JICA-Japan and TNO-Netherlands, where two strong centres of excellence in welding and foundry respectively have been established.

The experience accumulated over years in these two departments has been successfully used in transferring technologies to the concerned Egyptian and regional industries through :-

- Contracted R&D projects
- Training courses (about 20 different training courses have been organized during 1995/1996),
- Technical consultances, particulary to private sectors and SMEs.

Today, the institute employs about 420 personnel; from them about 40% research staff and technicians, 30 administration and support staff and 30% skilled and normal labors.

The annual budget of CMRDI ranges between 5-6 million Egyptian pounds, from which the earned income through contracted R&D projects ranges between 60-75%, which according to the United Nations ratings is considered to be excellent.

The following table shows the earned income of CMRDI distributed over the different categories of R&D projects over the past 10 years. More details about these projects are shown in the development plan (1997-2001) of CMRDI enclosed as Annex I to this proposal.

Table (1) : Earned Income of Different Activities, Over the Past 10 Years at CMRDI.

Category of Activities	Earned Income, 1000 L.E.	%
i) Introduction of new technologies to the Egyptian industry	2150	6.48
ii) Production of new products as import substitutes	3100	9.35
iii) Development of a product or production process	2275	6.86
iv) Maximization of indigenous raw material exploitation	2908	8.77
v) Development of new alloys	250	0.75
vi) Environmental protection	678	2.04
vii) Development of small and medium enterprises SME's	680	2.05
viii) Failure analysis and trouble shooting	322	0.97
ix) Technical services and consultations	788	2.38
x) Nondestructive testing and third party inspection	830	2.50
xi) Training	1783	5.38
xiii) Capability strengthening of CMRDI	17400	52.47
TOTAL	**33164**	**100.00**

Under the dramatic political and economical changes the whole world is undergoing, the industry in the third world is being exposed to fierce competition. In order to be able to pursue its mission in enhancing the competitiveness of local industries, CMRDI is now considering a comprehensive process, e.g. development and revitalization. This project proposal submitted to the Japanese Government is considered to be a great leap towards that target.

The proposed organizational chart of CMRDI to be adopted throughout the development process is shown in Annex II.

III. OBJECTIVES

To strengthen the R&D capabilities of CMRDI in the field of metal processing, which will positively reflect on the Egyptian industry through different technology transfer programs. The project aims at introducing the following advanced technolgoeis to the Egyptian industry :

III.a. Main Objectives

1. Die Manufacturing Techniques

1.1. Die design.
1.2. Die fabrication.
1.3. Pressure die casting.
1.4. Injection die casting.

2. Casting : Techniques

2.1. Vacuum melting of special alloys.
2.2. Precision casting techniques.

3. Welding Techniques

3.1. Resistance and friction welding.
3.2. Techniques used for evaluation of the performance of metals on long-term service, mainly; fatigue, creep and dynamic thermo-mechanical tests.
3.3. Laser cutting and welding techniques.

4. TQC : Metallurgical engineering industries.

III.b. Submain Objectives

1. Heat-treatment and induction hardening techniques.
2. Powder-metallurgical techniques.

IV. BACKGROUND AND JUSTIFICATION

i. Die Manufacturing Techniques

Die manufacturing techniques are of prime importance to any industry involved in metal processing, e.g. forging, extrusion, die casting, precision casting (shell moulding and investment casting) as well as powder metallurgical processes. The quality of the items produced by these techniques and the productivity of the machines used rely mainly on factors related to the design and manufacturing characteristics of the dies used in the process.

The die design and manufacturing techniques in different Egyptian industries need to be developed, and such development would necessarily reflect on the quality of so many products, produced by the abovementioned techniques.

The application of new concepts of die design and manufacturing techniques to dies used in die casting (whether pressure or injection) would have a considerable impact on Egyptian industry due to the expanding fields of application, these two techniques are finding now in the Egyptian industry.

The experimental foundry at CMRDI, although incorporates different foundry techniques, but still lacks the different die casting technologies, which are becoming of special importance in the manufacturing castings from non-ferrous metals and alloys. Moreover, the metal cutting R&D unit at CMRDI with its CNC-machining centre would be an excellent place for training and technology transfer in the field of die design and manufacturing when provided by the Japanese experienced in this field.

ii. Casting

Through its long-term cooperation with TNO-NL, CMRDI was able to establish an experimental foundry and metal-cutting unit with rather modern facilities. These two units have very effectively contributed to technology transfer to Egyptian metallurgical and engineering industries. A wide variety of locally produced items were able to replace imports, and some end-users started to export items produced after CMRDI's technologies.

These two units, however, lack experience in some fields, vital to the Egyptian industry in its present phase of development where it has to meet the challenges imposed by the new world economic situation. Some topics of prime importance are :

1. **Vacuum induction melting of special alloys :**

A wide variety of alloys badly needed by the Egyptian industry have to be melted under vacuum or controlled atmosphere, examples are special high strength steels, titanium alloys, used in medical applications and other super-alloys used under elevated temperature conditions. Introduction of vacuum melting technology to CMRDI and hence to the Egyptian industry will help in tackling a wide range of special alloys, completely imported in the time being.

2. **Precision casting techniques :**

The existing precision casting development at CMRDI and experimental foundry includes a shell moulding and investment casting unit. Addition of a third unit for lost-foam technology will make that department complete.

Local training opportunities on different precision casting technologies are very limited. Therefore, technology transfer through short-term JICA-experts or training programs for CMRDI personnel will be very highly appreciated. CMRDI puts precision costing techniques on the top of priorities of its potential technical support activities to SMEs.

iii. **Welding**

The WRD at CMRDI has been developing since its establishment in 1985 thanks to the continuous support of JICA. WRD, therefore, was able to play a very effective role in transferring a wide variety of welding technologies on both local and regional levels. The interaction between WRD and different industrial sectors, especially the flourishing private sector, has revealed a real need of many of these industries to apply friction or resistance welding techniques. Due to its flexibility, low-cost, high productivity and quality of weld-joints, friction welding is widely applied in industries as automobile, cutting tools, electrical and refrigeeration, transportation, gas and oil industries.

Metal cutting, surface treatment and welding technologies have been revolutionized in the last years through introduction of laser technologies in the industrialized countries. CMRDI should have a pioneering role in introduction such technologies which offer so many advantages for the metal processing techniques mentioned above.

On the other hand, the diversity of technial services, welding problems and trouble shooting, frequently demanded by the different industrial sectors requires to carry out performance tests for long-term service of the weld-joint, as fatigue, creep and Gleeble test. Although primordial, these test facilities are not available at WRD.

iv. TQC

The interaction of welding and casting departments with different industrial sectors has revealed that one of the major problems that generally faces the Egyptian industries is the absence of adequate quality control and quality assurance systems, which represents a difficult barrier for exportation.

Therefore, it is becoming important for CMRDI to take an active role in implementing adequate quality control/quality assurance system to the concerned industries in order to improve the quality level and promote the export chance for these industries.

v. Heat Treatment

Heat-treatment is one of the most powerful tools to control the structure and properties of metallic parts. Most of items, whether manufactured by casting, welding, cutting should undergo a proper heat-treatment cycle to optimize its properties. Heat-treatment facilities at CMRDI are still rather limited and can not meet the technology transfer demands of the Egyptian industry in that field.

vi. Powder-Metallurgy

The applications of powder-metallurgy techniques are finding an increasing demands in the industrialized countries. As one of the first steps in the development plan of CMRDI, it was decided to establish a new section for powder metallurgical techniques. Considerable experienced and a wide range of facilities are necessary for this section to take-off.

V. INPUTS TO THE PROJECT

- Introduction of modern technologies for metal melting, casting and fabrication techniques.

- Build-up technological capabilities of CMRDI.

- Existing facilities in metal fabrication techniques acquired by CMRDI through previous cooperation programs (e.g. WRD with JICA and experimental foundry and metal cutting unit with TNO-NL).

- Rather good reputation CMRDI gained over the past years, and the experience its personnel acquired in dealing with industrial R&D projects.

- The excellent experience of Japanese R&D institutions and the rather high level of metal fabrication techniques developed in those institutions over the past years.

- The project will build-upon the already existing cooperation programs between CMRDI, represented by WRD, and JICA, and the mutual understanding between the two parties.

VI. OUTPUTS OF THE PROJECT

- A modern centre of excellence at CMRDI capable of introducing advanced technologies to the Egyptian metallurgical industries.

- A high potential of the end-user industries to produce new items as import replacement, or even as export promotion.

- A focal point for training and technology transfer in the whole region, which may be utilized for third-party-cooperation programs.

- The project will represent a substantial progress towards fulfillment the development plans of CMRDI to cope with the ever increasing demands of the Egyptian industry for modernization.

VII. REQUIRED JAPANESE EXPERTS

i. Long Term Experts

		Number
1.	Team leader	1
2.	Team coordinators	1
3.	Die manufacturing	1
4.	Pressure die casting	1
5.	Welding technology	1
6.	TQM	1
	TOTAL	6

ii. Short Term Experts

1.	Die design-CAD	1
2.	Machining of die	1
3.	Precision casting	2
4.	Vacuum technology	1
5.	vacuum metallurgy	1
6.	Titanium alloys	1
7.	Welding machinery	1
8.	Leaser cutting	1
9.	Laser welding	1
10.	Laser equipment	1
11.	Power metallurgy	2
12.	Maintenance	2
	TOTAL	15

VII. PROJECT MANAGER

Prof. Adel Nofal - Chairman of CMRDI (C.V. is attached as Annex III)

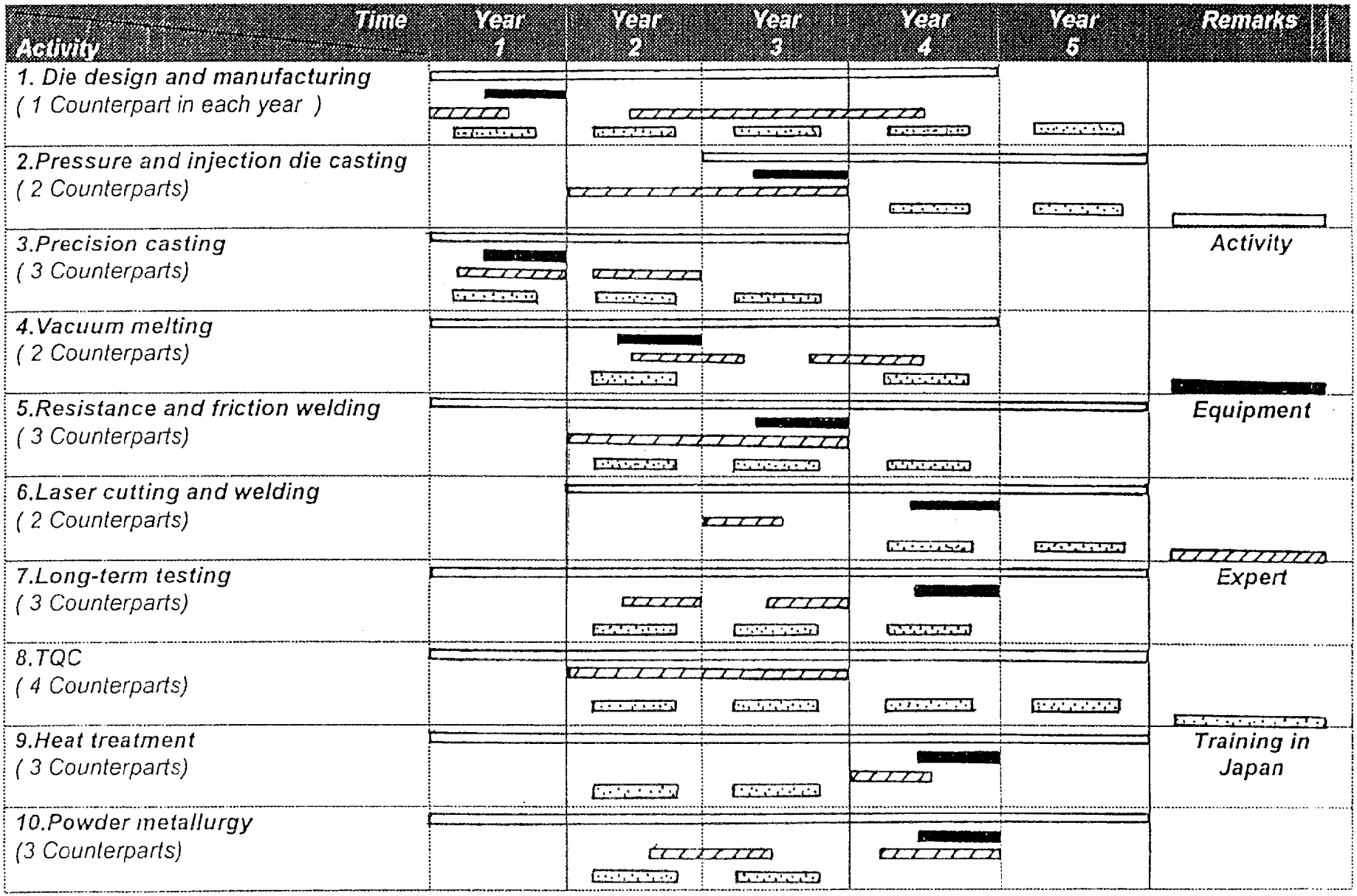
IX. LIST OF EQUIPMENT

Equipment	Estimated Price, 1000 US Dollars
1. Pressure die casting machine.	400
2. Vacuum induction melting furnace,100 kg.	400
3. Precision casting machine	200
4. Friction and resistance welding machines and related facilities.	400
5. Fatigue, creep and Gleeble testing machines.	200
6. Laser R&D unit for metal cutting and welding.	350
7. Heat treatment facilities.	200
8. Powder metallurgical facilities.	350
TOTAL	2,500

X. CONTRIBUTION OF CMRDI TO THE PROJECT

1. Provision of facilities : to provide facilites such as offices for Japanese experts dispatched through the project, rooms, electric powder supply, secretarial and communication services as well as local transportion facilities.
2. CMRDI will provide the required number of research and technical staff to implement the project activities. All salaries and other expenses related to the employment of the required personnel will be borne by CMRDI.
3. CMRDI puts any available equipment under the disposal of the present project. Moreover, any foundation and local expertise necessary for the erection of equipment provided through the submitted project will be secured by CMRDI.
4. All the running expenses necessary for the implementation of the project will be covered by CMRDI.
5. CMRDI will assign the required of counterpart staff of each Japanes expert.

TIME SCHEDULE OF PROJECT ACTIVITIES



ANNEX I

DEVELOPMENT PLAN OF CMRDI
(1997 - 2001)

CENTRAL METALLURGICAL RESEARCH AND DEVELOPMENT INSTITUTE (CMRDI)

DEVELOPMENT PLAN
(1997 - 2001)

ACKNOWLEDGEMENT

Thanks are due to the Excellency State Minister of Scientific Research for raising the idea of development of research organisations in Egypt, her persistance and continuous support.

The contribution of senior staff-members of CMRDI in the development plan is highly appreciated.

Special thanks are dedicated to Prof. Dr. Aziza Youssef, Chairman of CMRDI and Prof. Dr. Adel Abdul Azim, Former Chairman of CMRDI for leading and supervising the work.

ABSTRACT

During the past 10 years CMRDI proved to be a model of research and development organisation effectively inter-acting with industry. 33 millions L.E. were earned from R&D projects sponsored by local industry and international cooperation. Success leads to further success. CMRDI is aiming at expanding its service to industry, attracting new clients, supporting private sector and small scale industries, tackling new technologies, intentifying its regional role, strengthening its international relations. To achieve these objectives plans of action to meets clients needs were proposed based on carefully planed projects, identification of project needs, strengthening staff capabilities, expansion of laboratories and pilot plant building.

The total funds required amount to 51 millions L.E. over five years. It is assumed that CMRDI could cover about 35% through projects inputs and international cooperation. The Government of Egypt would support the development plan by 32 millions L.E. during 5 years with a rate of 6.5 million L.E./year.

CONTENTS

I. GENERAL ADMINISTRATION

I.1. INTRODUCTION

The whole world is undergoing dramatic political and economical changes. The protective regulations are being abolished, thus exposing industry in the third world countries to fierce competition. In order to be able to pursue their mission in enhancing the competitiveness of local industries, research and technology organizations (RTOs) will have to undergo a process of revitalization.

I.2. MISSION

To participate in the national economic growth by enhancing material competitiveness in the industrial sector.

To fulfill this mission, the institute will keep abreast of technological development.

I.3. GOALS

The improvement of the quality of products and processes or the development of new products and new processes.

I.4. BOARD OF DIRECTORS

The board consists of the chairman of CMRDI, who is in the meantime the managing director :

- The Heads of the 4 Divisions of CMRDI.
- The Chairman of the Egyptian Iron and Steel Company (EISCO).
- The Chairman of Aluminium Co. of Egypt (EGYPTALUM).
- The Chairman of Egyptian Copper Works (ECW).
- Representative of Academy of Scientific Research and Technology.
- The chairman of the National Research Centre (NRC).
- Members with special experience, e.g. the Former Chairman of CMRDI, a University Professor.

I.5. MEETINGS AND GROUP DISCUSSIONS

Monthly meetings are being held at the levels of laboratories, divisions, division heads and the board. Brain storming sessions are held to deal with the critical issues in the strategic planning.

I.6. CLIENTS

There is a wide range of industries which would draw upon the technological capabilities and facilities of CMRDI, e.g. all industries which produce, use, recycle or protect minerals, metals and alloys such as the mining, metallurgical, engineering, chemical, food, power, oil, construction, pharmaceutical and transportation industries.

Annex (I) shows examples of different contracted industrial R&D projects carried out by CMRDI over the past decade. These projects are classified according to their main objectives as projects aiming at :

i) introduction of new technologies to the Egyptian industry
ii) production of new products as import substitutes
iii) development of a product or production process
iv) maximization of indigenous raw material exploitation
v) development of new alloys
vi) environmental protection
vii) development of small and medium enterprises SME's
viii) failure analysis and trouble shooting
ix) technical services and consultations
x) nondestructive testing and third party inspection
xi) training
xii) capability strengthening of CMRDI

The total budget of these projects exceeded 30 million L.E. Table (1) shows some details.

Table (1) : Earned Income of Different Activities, Over the Past 10 Years at CMRDI.

Category of Activities	Earned Income, 1000 L.E.	%
i) Introduction of new technologies to the Egyptian industry	2150	6.48
ii) Production of new products as import substitutes	3100	9.35
iii) Development of a product or production process	2275	6.86
iv) Maximization of indigenous raw material exploitation	2908	8.77
v) Development of new alloys	250	0.75
vi) Environmental protection	678	2.04
vii) Development of small and medium enterprises SME's	680	2.05
viii) Failure analysis and trouble shooting	322	0.97
ix) Technical services and consultations	788	2.38
x) Nondestructive testing and third party inspection	830	2.50
xi) Training	1783	5.38
xii) Capability strengthening of CMRDI	17400	52.47
TOTAL	33164	100.00

II. ADMINISTRATION OF TECHNICAL ACTIVITIES

II.1. SELECTION OF PROGRAM AREAS

The institute serves a large number of companies within the Mining, Metallurgical, Chemical and Engineering Sectors. The technological needs of these sectors are known to the institute through many avenues :

- Mutual visits paid to the companies at all levels and vice versa.
- A technical committee which consists of representatives of companies, with which the institute is connected with contract research.
- The National Councils of the Academy of Scientific Research and Technology (ASRT).
- Conferences.
- Societies.
- Training Courses.

The technical needs being known, the institute focuses on recruitment and training in such areas where the demand is increasing, e.g., welding foundry, composites, ... etc.

The institute does not have a special unit for marketing, the job being done by the senior staff.

II.2. THE IN-HOUSE PROJECTS

The evaluation of the proposals and progress and final reports is done by a committee of emeritus professors of the institute. The final approval rests with divisions' councils. Each project is managed by the "principal investigator" who plans, organizes, staffs and controls the project. The original proposal contains the outputs, objectives, plan, bar chart, members of the team, the task of each member and the resources available and resources needed (including budget and equipment). Six-monthly reports are presented.

II.3. CONTRACT RESEARCH

Contract research aims at the improvement of quality of product or process or the introduction of new products or processes. In many cases, the companies finance

such projects. However, financing may be secured through the Academy or foreign agencies. In each case the evaluation of proposals and reports is done by - and according to the formats of the funding agency in question.

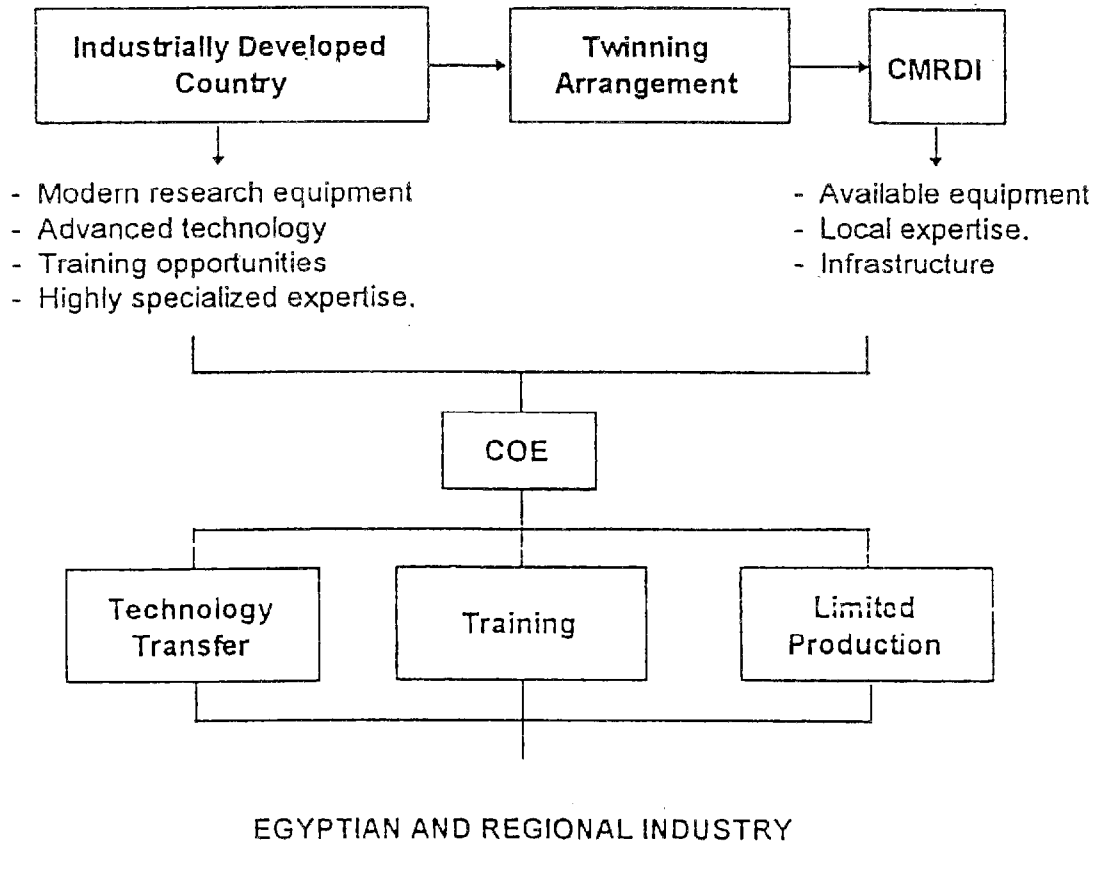
The institute has a special unit for the administration of technical services. The unit acts as a liaison between the customers and the different laboratories.

II.4. CENTRES OF EXCELLENCE (COE)

Over the past decade, CMRDI has adopted the policy of establishing specialized centres of excellence in collaboration with institutions from industrially advanced countries. These centres played a major role in :

- Strengthening the research capabilities of CMRDI by providing modern equipment.
- Technology transfer to CMRDI and hence to Egyptian and regional industry.

The mechanism of establishing those COE may be summarized in the following chart :



Presently, CMRDI has the following COE :

COE	Established in Cooperation With
Hydrometallurgy	Berlin University - Germany
Foundry	TNO - the Netherlands
Welding	JICA - Japan
Steel making	MEPHOS - Sweden
Metal Cutting	TNO - the Netherlands
Precision Casting	AID - USA
Ore Beneficiation	UNIDO + AID-USA

The production activities at the Foundry and Metal Cutting COEs may be considered as pioneering for RTOs even on the international scale. High quality spare parts produced at these COEs currently cover the demands of more than 50 organizations in both industrial and service sectors, e.g. the Egyptian Railway Authority, El-Nasr Automotive Co., ... etc as import replacement. The welding COE has become a recognised training centre for the whole African Continent, where more than 150 engineers from 20 African countries have been trained over the past 7 years.

II.5. INTERNATIONAL RELATIONS AND TWINNING ARRANGEMENTS

CMRDI maintains good relations with RTOs and research funding organizations in countries like Japan, Sweden, the Netherlands, U.K., Canada, United States, Germany, France ... etc. These relations enable the institute to transfer modern technology to local industry, to acquire modern laboratory and pilot equipment, to send young researchers to get their training and scientific degrees abroad and to receive experts.

III. GENERAL EVALUATION OF THE PRESENT STATUS

III.1. EVALUATION OF STAFF CAPABILITIES

III.1.1. Size and Classification

Table 2 shows the human resources' size and classification. Table 3 shows that the ratio of the research staff to the total staff is maintained at about one third and that the average rate of annual growth of the research staff and total staff is 7/106 = 6% and 15.4/327 = 5%, respectively. The growth in number is, however, dictated by the need of those divisions where the demand is increasing.

III.1.2. Professional Training and Experiences of Staff

The young researchers get their training in research through their work for M.Sc. or Ph.D. either in Egypt or abroad. Post-doctor training is obtained in industrialized countries through fellowships which enable them to spend one-two years in one of the well-reputed laboratories.

Simultaneously, the young staff are trained on industrial research or RD&E through their work in contract research which brings them in direct contact with industrial production.

Moreover, they attend short courses on computers, report-writing, ... etc.

Iii.2. EVALUATION OF FACILITIES

III.2.1. The Area for Each Member of the Research Staff

The area available to each research staff member (including laboratories and pilot plants) amounts to :

Table (2) : Human resource progress.

Position	90/91	91/92	92/93	93/94	94/95
Research Professor	17	17	18	19	22
Assistant Research Professor	16	16	15	15	13
Researcher	20	22	21	22	23
Assistant Researcher	15	14	17	21	25
Research Assistant	20	28	30	46	40
Total (1)	**88**	**97**	**101**	**123**	**123**
Chemists and Engineers	19	25	27	22	31
Administrations	30	32	33	34	35
Technicians	27	32	31	40	38
Clerks	68	79	76	77	79
Workers	53	47	44	56	56
Total (2)	**197**	**215**	**211**	**239**	**239**
Grand Total of Employees	**285**	**312**	**312**	**362**	**362**

Table (3) : Ratio of professional to support staff.

Position	90/91	91/92	92/93	93/94	94/95
Research Staff	88	97	101	123	123
Total Staff	285	312	312	362	362
Ratio (%)	**31**	**31**	**32**	**34**	**34**

941.4/123 = 76.5 m^2 i.e. ≅ 80 m^2/researcher

This area is adequate since the literature recommends 20-40 m^2/researcher. In the present case 80 m^2 may be divided (40 m^2 each) between the laboratories and the pilot plant sheds.

III.3. EVALUATION OF FINANCIAL POSITION

Over the past 5 years, the earned income/individual ranged from 15 to 46 thousand pounds and from 6 to 14 for the research - and total staff members, respectively.

The earned income comes mainly from process and product development projects and from technical services. Training per se does not contribute substantially to the earned income. However, training is usually done as a part of product and process development projects.

The earned to the total income ranged between 40 and 70%, averaging 55%. According to the United Nations rating: < 30 is modest, 30-50 good and 50 > is excellent. The data collected from 5 Canadian research and technology organizations in a study conducted by the Saskachewan Research Council. A comparison shows that CMRDI's financial performance is mostly in the excellent range - though it might be in the upper range of "Good".

It is important to notice that the earned income figures mentioned do not include the value of pilot facilities obtained through individual efforts of CMRDI research staff over the past decade, which amounts to about 15 million pounds (Table 2). If this value is to be added to the earned income of the institute, then the abovementioned ratios may reach unprecedented values.

III.4. POINTS OF CMRDI'S STRENGTH AND WEAKNESS

Based on the very brief analysis of CMRDI's performance metnioned in the above discussion, the main points of strength and weakness of CMRDI in its present situation may be summarized in the following :

Points of Strength

1. Strong relations with the customer. CMRDI has created an image which continuously attracts new customers. The CMRDI staff, and in particular the new generation are quite aware of the institute's mission.

2. The basic skills of project management have been acquired by the CMRDI staff through on-the-job training. The CMRDI has successfully completed a large list of contracted projects.

3. CMRDI has a large experience in successful and fruitful international cooperation which has always been oriented to the technological needs of local industry. The institute has benefited from cooperation with institutes in all industrialized countries by getting foreign consultants, training opportunities, modern equipment and pilot units.

4. CMRDI has highly competent teams in the areas of ore beneficiation, steel making, hydrometallurgy, pyrometallurgy, surface protection, welding technology, foundry and machining. The team constitutes more than 60% of the work force of the institute. Benchmarking shows that through these teams the institute scores "Excellent" if evaluated through the earned to the total income ratio.

5. Successful cooperation at the regional level.

6. Material resources : equipment and space are presently satisfactory to carry out conventional R&D programs.

Points of Weakness

1. A strong need to restructure the institute in order to re-orient research staff and administrators.

2. Inter-departmental relations are weak.

3. The selection of middle management must be based on sound criteria. The selection must be followed by periodic training and evaluation.

4. Modern equipment and laboratory extension are urgently needed in order to cope with the future needs of the clients and to tackle areas of modern technologies and new advanced materials.

5. Lack of engineering and specialized maintenance departments.

6. Absence of strong and planned relationships with rather important sectors such as SME's and private sector. The bulk of CMRDI clients in the past has been concentrated in the public sector companies.

7. The governmental budget of CMRDI mainly covers the salaries and can not be relied upon for acquiring any capital equipment or conducting any extensive and advanced research programs.

8. The transport facilities are hailing and need considerable support. Being located in a remote area, this issue seems to be vital for CMRDI existence.

9. The working hours of the institute should be seriously revised.

10. Lack of important units such as sound information system, marketing and techno-economic feasibility studies, process engineering, process simulation and modelling.

11. Strong bureaucracy and modest standard of a major part of the administrative, financial and secretarial staff.

IV. STRATEGIC FUNDAMENTAL DEVELOPMENT GUIDELINES

IV.1. BENCHMARKING AND BEST PRACTICES STUDIES

Benchmarking is defined as "the process of continuously measuring and comparing an organization, product or process against leaders anywhere in the world to gain information which will help the organization take action to improve its performance".

Although benchmarking is conceptually fully applicable to CMRDI as any other RTO, it has not been benchmarked to this point.

Currently, CMRDI is involved in a project designed to identify, benchmark and document successful RTO practices (best practices and underlying principles) and assist RTOs in the implementation of these practices, in order that they can serve their clients better. The project is led by WAITRO and sponsored by the Danish International Development Assistance (DANIDA) and Canada's International Development Research Center (IDRC).

This project may be a powerful tool in the developmerit process of CMRDI and will assist the institute to meet the ever changing demands being placed on it by its competitive environment.

VI.2. ACCREDITATION

International recognition of RTOs has become a major prerequisite for both national and international competitiveness. Thus, the accreditation of RTO's and the certification of their entire operations has become an integral part of industrial and technological R&D management. And yet these subjects remain relatively unknown to many RTO's, especially in the less advance countries.

Being aware of the importance of that subject, CMRDI together with the World Association of Industrial and Technological Research Organizations (WAITRO) are preparing a seminar to be held in Cairo 19-22 Nov. 1996 to raise awareness and to shed lights on the problems and prospects that it potends for RTO's.

The seminar will provide CMRDI an opportunity to make use of the experience of international experts and organizations concerned with these issues. The accreditation of CMRDI and the certification of its activities seem essential - at this phase of growth - to increase CMRDI's competitiveness on both regional and international areas.

CMRDI is currently carrying out analysis and testing of various materials, e.g., minerals, metals, alloys with respect to chemical, physical and mechanical properties. Profound experience is gained in failure analysis and non-destructive testing. CMRDI is issuing certificates of the results, which are recognised nationally. After the establishment of material testing department, these certificates will be recognised internationally assuming that the department will be accredited by internationally reputed organisations.

CMRDI is cooperating with the National Institute of Standards, Egyptian Organisation for standardization and the Inspection of Exports and Imports Authority in the establishment of a National Accreditation Body in Egypt and its alliance with one of the European Accrediation bodies, e.g., European Organisation for Testing and Certification EOTC, or European Accreditation of Certification EAC, or European Cooperation for Accreditation of Laboratories EAL. CMRDI has already established links with these organisations. Moreover, CMRDI is collaborating with the World Association of Industrial and Technological Research Organisations WASTRO in organizing conferences and seminars on certification and accreditation in Egypt, the first conference is due to start in Nov. 1996.

IV.3. METALLURGICAL INFORMATION CENTER

In the last years of the 20th Century and at the threshold of the 21st Century, access to information is a key element in managing the increasing pace of industrial technological development. Intensive use of modern communication technologies is therefore an essential element of the proposed route for CMRDI development. Accordingly establishing a metallurgical information center is a profound milestone in the development programme. This information center will get the chance to communicate with various national and international networks providing information services of science and technology in the fields of metallurgy, mineral processing, chemical industries and relevant activities. On the national basis, the information center will be a documented reliable source for information about local metallurgical, mineral and chemical industries which could help decision makers to access and apply quality data and relevant current information to developmental activities. Also, the center will be

a nucleus for national data base for local metallurgical, mineral and chemical research work which will be made available for people working in the universities, research institutions and industry. On the other hand, the information center will host international CD Roms for metal and material standards, phase diagrams, physical and chemical properties, etc. as well as various engineering software.

The information center with the above mentioned capabilities will be able to provide research, industrial and technological service organizations with continuous updating of the latest development in industrial technology, provide training for human resource development and industrial technologies, establish and develop an international task force for developing national and transnational networks for small and medium size industry and finally provide commercial information service related to industrial and technological development opportunities.

IV.4. TECHNICAL SUPPORT TO SME'S

SMEs are now being recognized as critical in the economic and social development of Egypt. They are especially important for their role in job creation with low investment, regional development, as suppliers to large companies, and in case of new technology - based firms, innovation of new products and processes.

In the recent years, Egypt has undertaken special schemes to develop and strengthen SMEs. These assistance schemes have focused on both the formation of new SMEs as well as on assistance to existing SMEs. Assistance has included different facets of their operations, including financing, marketing and management, but with so little done related to technical aspects, manufacturing engineering, quality and human resource development. It is clear that SMEs cannot attain their full potential without improvements in their ability to access, absorb, adapt and exploit advanced technologies. For this to happen CMRDI can play a rather critical role.

Currently, CMRDI is involved in a project sponsored by IDRC aiming at establishing an industrial technology support unit (ITSU) at Dakahlia Governorate. This unit will assist SMEs in the metal working sector to improve access to better technologies and to enhance productivity and competitiveness.

The technical support services CMRDI can provide to SMEs include :

- Technical advice on production and quality control problems.

- Consultancies on larger issues in enterprise operations.
- Advice on waste exchange or reprocessing.
- Pilot plant implementations.
- Project development.
- Plant layout advice.
- Advice on materials and product handling.
- Energy saving and management.
- Material testing.
- Assessment of equipment capabilities.
- Industrial safety.

Being the first experience of CMRDI to work with SMEs, different problems emerged during implementation. The main lesson learned was that, when dealing with SME's, it is very important to distinguish between two important concepts - "need" and "demand". The majority of Egyptian SMEs *need* to upgrade the often inefficient or outmodel technology which they use. However, this need only becomes an effective demand when enterprises are prepared to make the necessary investment decision to bring about technological change and human resource development.

Any sound SMEs support effort, CMRDI has to play in the future, should be concerted with the Ministry of Industry with its different concerned institutions such as the Productivity Council, Standardization Organization, General Organization for Industrialization (GOFI) and Federation of Industries together with the Social Fund for Development. Such consortium can suggest a SME support system for metal industries which should develop :

- A program to identify the business needs of the SMEs.

- A system to diagnose "the real needs" of the SME at that particular time.

- Methods to identify the appropriate technology to solve the problems faced by individual SMEs.

- The capcity to organize and use management/technology teams to operate in the needs assessment and opportunity identification stage of collaboration with firms.

- Reoriented seminar and training programs so that they focus on the needs of specific subsectors or industry groupings.

- Ways to collaborate with private sector groups in order to enhance the quality and scope of services available at CMRDI.

- Collaboration with other provincial institutions to develop an outreach program.

IV.5. CLEANER INDUSTRIAL PRODUCTION (CIP)

Metallurgical industries are among the most polluting industries, and it is the role of CMRDI in the next phase of development to take active part in seeking clean production technologies (CIP) in the metallurgical and related fields. It is of vital importance that CMRDI would be able to have access to share the information on cleaner technology options made available by the different international, regional and national bodies involved in the production of cleaner production. In this respect, a standardized approach to information management, i.e., data collection, storage and dissemination mechanism, should be established. The proper funding mechanisms present a challenge and should include industries and end-users.

The training aspect and development of human resources constitute a very important issue and may be viewed as the basis for any successful program on cleaner industries. In alliance with other concerned bodies, CMRDI will consider organising training courses and seminars on specific subjects such as assessment of adequate technologies in the metallurgical and related industries.

Apart from cleaner technologies in the conventional production fields such as foundries, steelmaking ... etc., Bioleaching processes will deserve special attention in the near future at CMRDI. Leaching of minerals using micro-organisms provide a new clean technology for mineral processing compared with the conventional environmentally non-friendly techniques. No chemicals will be used thus avoiding pollution and corrosion problems. Micro-organisms will extract the elements without wastes under mild temperature conditions. The bioleaching techniques are clean, safe and cheap. Much care should be taken to allow the micro-organisms to grow. Preference will be given to bioleaching of phosphate and manganese ores. Contacts have been already established between CMRDI and bioleaching centers in Canada, Engiand and Thailand.

IV.6. REGIONAL ROLE

As Africa is the main source for numerous mineral resources of the world, CMRDI is highly interested in establishing cooperation programs with various African countries either bilaterally or through international cooperation agencies. CMRDI already signed agreements with Nigeria and Tanzania for the development of mineral resources. A major cooperation program for Nile-Basin countries aiming at purification of Nile water using domestic raw materials, e.g., bauxite and clay is under preparation. The technology for processing of these raw material to produce water cleaning chemicals is available in CMRDI.

As CMRDI has already acquired a profound experience in the processing of bentonite ore (activation for foundry, drilling, oil bleaching purposes); a cooperation program will be prepared for technology transfer to North African Arab Countries where extensive reserves of high quality bentonite are present. Establishment of bentonite industry in these countries, especially for drilling for oil will secure the needs of the oil-producing Arab Countries so that self-sufficiency from this material can be reached and consequently dependence on imports from outside the region could be minimized.

CMRDI has been involved in several R&D projects with Syria (ore beneficiation), Saudi-Arabia (SABIC) as well as other countries in the region. The all-Africa annual training program on welding technology hs been carried out for the seventh year in 1995 with sponsorship from JICA-Japan. The Dutch Government has contracted CMRDI to train the foundry engineers operating Khartoum Central Foundry. African Foundry Network Project is being now considered by IDRC-Canada, where CMRDI's foundry experience could serve other countries in the continent. Extensive training programs has been organized in Libya through the Industrial Research Centre in Tripoli.

All these examples indicate the increasing role CMRDI can play in developing the metallurgical and related industries in the region. Networking proposals are available at CMRDI and has been submitted to international funding organizations and it is quite hopeful that some networking projects will start in the next few years.

IV.7. TECHNOLOGY INCUBATORS

The existing pilot facilities at CMRDI could represent a sound basis for technology incubators for different metallurgical industries. The available foundry, metal-cutting, ore beneficiation as well as process metallurgy pilot facilities could be very well utilized in this respect.

For establishment of technology incubators (production models - prototype plants) for chemical processing of materials to produce inorganic chemicals, CMRDI has already established production lines including reaction, solid/liquid separation by thickening, filtration, and drying. Expansion of this plant will include evaporation, crystallisation, spray drying unit. Further expansion will include rotary furnace calcination line, high pressure station. The capacity of the CMRDI prototype plant is about 1 ton/day. This plant will enable the preparation of technology package for investors to establish small scale chemical industries.

IV.8. ESTABLISHMENT OF NEW CENTRES OF EXCELLENCE (COE)

The policy of establishing (COE) has shown considerable success over the past few years and the existing ones are very actively involved in technology transfer, training and even limited production of spare parts for different industrial sectors.

CMRDI should consider in the very near future expanding the same concept to new centres dealing with novel and advanced technologies, examples are :

- Composite metal-matrix materials
- Ultra-fine particulates of metals, metal oxides and super concentrates
- Lazer applications in metal welding, cutting, heat-treatment and surface treatment
- Vacuum melting for the production of superalloys of strategic importance.

The advanced equipment required by such COE are rather expensive and the end-users should be approached for serious contribution in the expenses of establishing such COE.

IV.9. PRODUCTION ACTIVITIES AT CMRDI

The pioneering experience of limited production of high quality spare parts at the foundry and metal-cutting pilot facilities of CMRDI should be encouraged and expanded. This department is, currently, supplying more than 50 production and service organizations with their needs of spare parts as import substitution (examples are the Egyptian Railway Authority, El-Nasr Automotive and many others). The revenue of that production may represent substantial support for the current R&D projects.

The same experience could be as successfully implemented in other CMRDI departments.

IV.10. NEW DEPARTMENTS

(i) Process Engineering Department

The department deals with the engineering aspects of the technologies developed by CMRDI basically in the area of mineral processing. This department comprises :

- Process Design Unit :

  Design of the processing equipment, flowsheet, calculations of the mass balance, i.e. quantitative material flow along the various streams of the process, calculation of energy balance and utilities consumption.

- Basic Engineering Design Unit :

  Identification of the equipment, specification, production of basic engineer-ing design drawings of the individual equipment.

(ii) Material Testing and Central Services Department

The department deals with characterisation and testing of minerals, metals and their products, e.g., concentrates, inorganic chemicals, alloys with respect to chemical composition, physical and mechanical properties. It will provide service to the mineral, metal, chemical and engineering industries in addition to services to the on-going projects in the other departments of the institute. The laboratories of this department are :

- Chemical analysis
- Physical metallurgy including metallurgy
- Mechanical properties,
- Information and standards.

Contacts have been established for technical assistance with Germany (Material Testing Institute, Technical University of Berlin).

It is very important to establish this department and to accredit it nationally and internationally as testing laboratories will not be able to continue its activities unless they are accredited.

(iii) Simulation and Modelling Unit

Modern fundamental studies are an essential back-up requirement for evaluating initial ideas for metallurgical processes or to solve basic technical problems which might have been encountered on plant. Such studies can involve mathematical modelling, physical modelling or simulation of metallurgical and mineral processing experimentation. Mathematical modelling of processes are undertaken both to evaluate new process ideas and to aid the progress and development of research projects or new plants. On site computer facilities can be used in an interactive mode for rapid programme development and for routine runs of established programmes. A number of invaluable library programmes can be used regularly ranging from a free energy mainimisation routine to statistical packages. Physical modelling studies can be undertaken in a water modelling laboratory for simulating problems ranging from metal flow to modify the design of water cooling

system. Air modelling laboratory can help studying problems such as gas flow measurement, air pollution and packed-bed aerodynamics.

(iv) Techno-economic Feasibility Studies

Having reached the technical goals of the research project is not an enough visa for passing to the implementation phase due to lack of techno-economic assessment. Economic studies have to start early and proceed side by side with progress of the research project. Throughout the project and at different intermediate steps, economic evaluation must be undertaken not only to answer "STOP', "GO" questions but also to determine which route out of different alternatives should be adopted. Also the general objective of the project, e.g., product quality improvement, improved production technique, use of local raw materials, etc. has to be evaluated money wise in order to identify priorities for investment opportunities. Pre-feasibility study has to be undertaken so as to demonstrate preliminary project viability. This initial evaluation of the technical, financial and economic aspects of a project is carried out in broad terms and on its outcome depend decisions to go ahead with promotional activities and a full feasibility study. Estimates for the capital investment, financial structure and profitability measures will help investing parties to take decision about implementation of the project.

(v) Marketing

During the past 10 years, marketing of research results was carried out by the principal investigators or their associates, practically without complete awarness of the marketing skills, which to a certain extent limited the implementation of the projects. To bridge the gap, a marketing unit should be established. Information about client needs, specification of materials, export and import prices ... etc. are essential inputs. The unit is closely connected with the feasibility studies unit to ensure proper marketing of the projects and products.

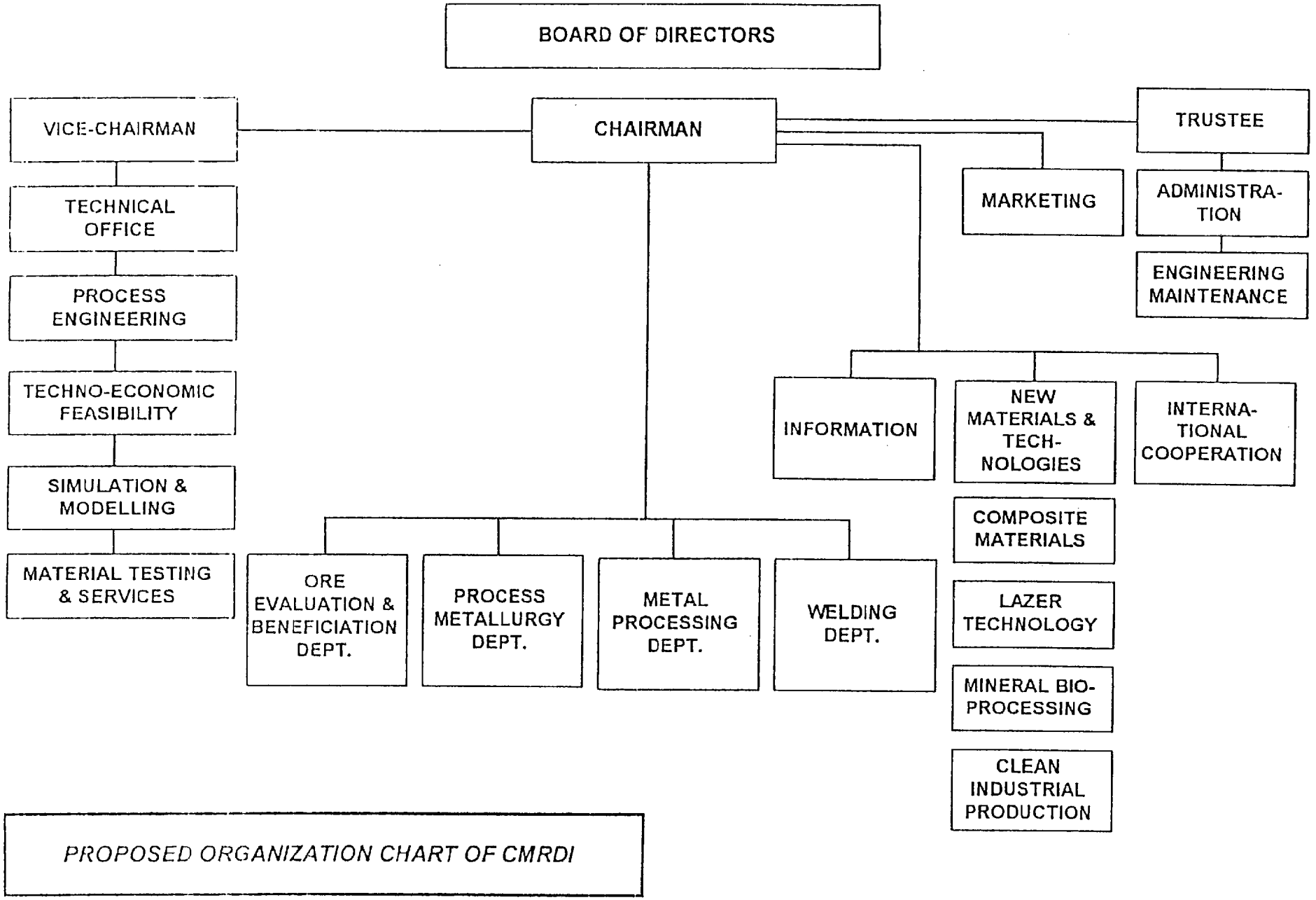
IV.11. RESTRUCTURING AND ORGANIZATIONAL CHART

The organizational chart of CMRDI has not undergone any changes since the institute was established. With the new units and departments to be established in the light of this development plan, complete restructuring of the

institute should be considered. This issue is nowadays a subject of a serious and constructive debate between the research staff and a final chart should be settled down very soon. However, there is general agreement, that the new units of common interest to different departments of the institute should start as units affiliated to the Institute's Chairman. The following organizational chart is a preliminary suggestion.

IV.12. PROMOTION SYSTEM

Research staff promotion criteria should be reconsidered. More effective weight should be given to the researcher's contribution to the industrially oriented programs.



PROPOSED ORGANIZATION CHART OF CMRDI

V. TECHNOLOGICAL NEEDS OF THE CLIENT DURING THE NEXT FIVE YEARS

V.1. ORE BENEFICIATION

V.1.1. General Objectives

With such low grade national ores and mineral commodities, high labor cost, impending increase in energy prices and the gradual privatization of the Egyptian industry, R&D futuristic plans in mineral processes should be directed to (i) break-through technologies and innovation for the production of extremely pure mineral concentrates that can be used in the manufacture of special quality high technology compounds and (ii) adaptation of mineral separation flowsheets to developing environmentally acceptable recycling technology.

V.1.2. Specific Objectives

- Adaptation of sofisticated fine particle technology in the production of super concentrates of kaolin, talc, feldspar, phosphate, sand, quartz, iron ... etc. for the production of semi-conductors, mineral composites, fillers, extenders, sponge iron agglomerates, mineral fibers.

- Rationalization of mineral beneficiation plants' operations by applying mathematical modelling.

- Application of microorganisms in mineral processing technology.

V.2. PROCESS METALLURGY

V.2.1. General Objectives

Chemical, electrochemical and pyrometallurgical processing of ores, concentrates, intermediates and industrial wastes.

V.2.2. Immediate Objectives

- Production of inorganic chemicals, e.g., chromium, barium and manganese salts.
- Biohydrometallurgical treatment of ores.
- Sol-Gel and metal powder production.
- Quality improvement of electrometallurgical extraction of metals, e.g., copper refining, aluminium production in addition to acid, alkaline and dry batteries.
- Pioneering subjects such as aluminium deposition from organic solvents, electrodeposition of composite material and superconductors.
- Utilization of Egyptian ores in the production, e.g., local high-manganese iron ore for production of steel.
- Development of electric arc furnaces with different capacities through implementation of water cooling of walls, roofs and electrodes to increase the productivity and decrease the product cost.
- Application of ladle treatment to improve the steel quality. The process improvement will cut through all steel mills in Egypt.
- Production of special steel grades to satisfy the local market.
- Development of a clean technology for the production of high strength steel for prestressed concrete.
- Production of tool steels by electro-slag remelting.
- Ladle metallurgy treatment of pig iron to produce iron of low phosphorous, sulphur and manganese.
- Injection of coal and oxygen in blast furnace to decrease coke consumption and increase productivity.

- Production of high purity iron powder suitable for powder metallurgical processes.

- Recovery of metals from industrial wastes, e.g., lead and lead alloys, copper from scrap.

- Utilization of industrial wastes, e.g., spent catalysts (reactivation), cement dust, galvanization dust, casting dross, spent photographic solutions, gold brushing, spent electroplating solutions.

V.3. METAL PROCESSING

- Designing of new materials to suit new applications (e.g. metal cutting consumable tips, high speed steel compacts, ... etc.).

- Technology transfer for the production and processing of high alloyed steels (Mn steels, heat resisting steels, maraging steels ... etc.).

- Production of very special spare parts of steel alloys (e.g. wear-, corrosion- and erosion-resistant steels).

- Failure analysis of spare parts to overcome future production problems.

- Selection of steel alloys to substitute imported spare parts or to improve performance.

- Technology transfer of precision casting techniques to the Egyptian foundry industry specially to those foundries in the *small and medium sizes*, which are the potential feeders for high quality castings used as spare parts for different sectors of Egyptian industry.

- Foundry industry is one of the most polluting industries allover the world. Such pollution arises - mainly - from the irrational use of fuel as well as from organic bindrs used with foundry sand. The foundry group plans to *monitor environmetnal conditions* in and around foundries with the help of a mobile laboratory.

- Assist SMEs to upgrade their production. CMRDI is already moving in this direction through a cooperative program including the Regional Development Centre in Dakahlia Governorate.

- Production of new casting alloys, e.g. Ti alloys and other special castings and superalloys needed for strategic applications.

- Technology transfer for the production of steel rolls in the large Egyptian foundries.

- Upgrading the existing welding technology.

- Implementation of adequate QA/QC systems for welding fabrication.

- Improving quality of welded products and reducing production cost.

- Implementation of proper non-destructive testing techniques.

V.4. CORROSION

- Analysis of failure due to corrosion and prescription of remedy.

- Selection of the suitable alloy for a specific environment.

- Design aspects for the avoidance of corrosion.

- Transfer of modern testing and monitoring technologies.

- Corrosion mitigation through recommendations of technologically viable methods such as corrosion inhibitors and cathodic and anodic protection.

V.5. COATINGS

- Process development for quality assurance, e.g., wire galvanizing.

- Quality improvement of products, e.g., sheet galvanizing.

- Transfer of modern technologeis for testing coated products (e.g. pipeline).

- Local substitution of imported plating material and propriety solution, e.g., phosphating solution for plating on plastics.

- Trouble shooting.

- Cathodic protection of submerged marine structures.

- Transfer of sofisticated technologies of coating, e.g., plasma coating, vapour deposition, coating of superalloys, black nickel and composite coating.

VI. PROPOSED R&D PROJECTS TO MEET CLIENT'S DEMANDS FOR THE NEXT FIVE YEARS

To meet the client's technological needs during the next five years, the different departments of CMRDI propose the following list of R&D projects. The prepared projects can be categorized in three groups :

Group (A) : projects based on conventional technologies - with high probability of sponsorship through contracts with the local industry. These projects can be carried out using the available facilities in addition to the input of the expected contracts.

Group (B) : projects meeting the demands of the International Research Funding Organization - with serious and sincere efforts from CMRDI staff linked with some optimisms, the bulk of these projects could find financing from these international agencies.

Group (C) : projects based on novel and advanced technologies - although these projects may not find an immediate end-user on the local market but are indispensable for the near future development of the Egyptian industry. These projects need "core money" from the Government together with serious contribution from the potential end-users, this money is mainly essential for CMRDI to acquire advanced equipment, which cost is beyond the capacity of CMRDI annual budget or the input of group (A) projects.

The following is a list of different projects proposed by CMRDI "existing" departments, categorized as groups (A), (B) or (C). It is important to note that this list should be annually revised, especially with the establishment of new research units or departments mentioned under the organization chart, Chapter IV-13.

VI.1. PROJECTS BASED ON CONVENTIONAL TECHNOLOGIES - COULD BE CARRIED OUT USING THE AVAILABLE FACILITIES IN ADDITION TO THE PROJECTS INPUTS - GROUP (A)

	Project Title	Duration, Years	End User	Estimated Budget, 1000 L.E.
	ORE EVALUATION AND BENEFICIATION DEPT. :			
A-1	Evaluation of nepheline syenite for glass and ceramic purposes.	2	Ceramic companies	250
A-2	Evaluation of the pure limestone to be used in different industries.	5	Pharmaceutical and Agriculture companies	200
A-3	Evaluation and upgrading of Egyptian kaolin for advanced industries.	5	Ceramics and paper companies Glass, rubber and fiber	200
A-4	Evaluation of white sand deposits to be used in different applications.	5	companies Ceramic and paper	100
A-5	Evaluation of fluorspar and nepheline syenite for application in different industries.	3	companies Mining companies.	100
A-6	Sintering and pelletization of Egyptian ores specially iron, manganese, chromite and phosphates.	3	Egyptian iron and steel	30
A-7	Application of some materials as alternative for the conventional fuel in the reduction and sintering of iron ores.	3	companies Metallurgical industrial	40
A-8	Uses of the different industrial wastes.	3	companies	30
	SUBTOTAL			950

	Project Title	Duration, Years	End User	Estimated Budget, 1000 L.E.
	II. PROCESS METALLURGY DEPARTMENT :			
A-9	Production of magnesium chloride and sulphate from magnesite ore.	1	Textile preparation companies.	100
A-10	Production of magnesium carbonate from magnesite ore.	1	Pharmaceutical, chemical companies.	100
A-11	Production of magensium hydroxide and oxide from magnesite ore.	1	Ceramic, fertilizer, pharmaceutical Cos.	100
A-12	Production of manganese sulphate from manganese ore by direct leaching.	1	Micro-neutrient fertilizers companies.	100
A-13	Production of barium sulphate from barite ore.	1	Paint producing companies	150
A-14	Production of sodium sulphide from barite ore and sodium sulphate.	1	Leather tanning companies.	100
A-15	Production of zinc sulphate and chloride from zinc dust.	1	Micro-nutrient fertilizer companies.	100
A-16	Production of dicalcium phosphate from calcite ore.	1	Poultery food manu-facturing company	100
A-17	Production of sodium chromate, dichromate, chromium sulphate from chromite ore.	1	Leather tanning companies	150
A-18	Production of sodium chloride and calcium chloride from waste liquor of Misr Chemical Company.	1	Misr Chemical Industries Co.	150
A-19	Production of magnesium and potassium salts from Qarun lake.	2	El-Fayoum Co. for Production of Salts	150
A-20	Preparation of medium quality compound fertilizers from sludges of phosphoric acid prepared from Abu-Tartur phosphate concentrate.	3	Abu-Tartur phosphate project	150

	Project Title	Duration, Years	End User	Estimated Budget, 1000 L.E.
A-21	Treatment of pig iron for production of ductile cast iron.	2	Egyptian iron and steel company.	120
A-22	Diminution of manganese in Egyptian iron ores.	2	Egyptian iron and steel company.	100
A-23	Studying the behaviour of barium oxide, zinc oxide and alumina in blast fumace.	2	Egyptian iron and steel company.	150
A-24	Electrorefining of copper.	3	Egyptian copper works	250
A-25	Development of acidic batteries.	3	Batteries companies	200
A-26	Extraction of zinc from local ores.	2	Aluminium Co. of Egypt	250
A-27	Pilot plant production of titanium oxide and zirconium using black sand concentrate.	2	Paints, ceramic and paper companies.	350
A-28	Production of formed coke using local carbonaceous ores.	2	El-Nasr Coke and Chemical Co.	200
A-29	Classification, sorting and identification of industrial wastes.	2	Metallurgical industries	65
A-30	Updating lead extraction technology from battery scrap.	1	Lead producing companies	35
A-31	Recovery of Ni-Cr-Fe alloy from metallurgic scrap.	1	Metallurgical industries	20
A-32	Utilisation of iron oxide fine wastes in Alexandria National Iron & Steel Co.	2	Alexandria National Iron and Steel Co.	100
A-33	Decoppering of crude lead.	1	Lead producing Cos.	20
A-34	Recycle of copper, nickel and tin scrap.	1	Lead producing Cos.	20
A-35	Application of water cooling for walls and roofs of electric arc furnaces in Egyptian plants.	3	Steel production companies.	400
A-36	Production of ferrotitanium alloy 25% using Egyptian ilmenite.	2	National Co. for Metallic Industries.	150

	Project Title	Duration, Years	End User	Estimated Budget, 1000 L.E.
A-37	Service, scientific and technical consultancies.	5	Different industrial companies.	400
A-38	Production of high resistant steel for prestressed concrete on industrial scale.	3	Holding Co. for Metallurgical Indusries.	100
	SUBTOTAL			4380
	III. METAL PROCESSING DEPT.			
A-39	Introduction of ductile iron technology to small and medium-size foundries.	2	Small and medium size foundries.	150
A-40	Introduction of precision casting techniques (shell, investment, lost-foam ..) to the Egyptian foundries.	3	Small and medium size foundries.	200
A-41	Quality control of steel foundries.	3	Egyptalum, El-Nasr Castings, Steel Rolling Plants.	200
A-42	Centrifugal casting of iron and steel rolls.	3	Steel rolling plants, iron and steel foundries.	200
A-43	Market study of high quality aluminium castings and recommendations for the optimum production technology.	1	Aluminium foundries, automotive industries, electrical industries.	150
A-44	Production of high quality spare part casting in the pilot-facilities of CMRDI.	5	Production and service plants in Egypt.	250
A-45	Production technology of compacted/ vermicular iron castings.	2	Iron foundries, engineering industries.	80
A-46	Optimization of furnace charges in Egyptian foundries.	2	Egyptian foundries.	120
A-47	Application of computers in foundries	2	Egyptian foundries.	200
A-48	Heat treatment of spare parts for textile industries.	1	Textile and textile machinery producers.	40

	Project Title	Duration, Years	End User	Estimated Budget, 1000 L.E.
A-49	Development of austempering process for gears and other parts made of ductile iron.	2	Automotive companies, engineering companies	50
A-50	Heat treatment of spare parts of earthmoving equipment.	1	All companies involved in earthmoving, mining	40
A-51	Melt treatment of copper alloys.	1	General Metals Co., Egyptian Copper Works	100
A-52	Permanent mold casting of Al-alloys used in automotive industnes.	1	Non-ferrous foundries, automotive industries.	100
A-53	Quality control of admirality alloys.	2	Egyptian Copper Works, Power Plants.	150
A-54	Ozone technology treatment in cooling water systems.	1	Industrial plants using water cooling and heat exchange units.	30
A-55	Corrosion scaling and biofouling.	1	Chemical industries.	30
	SUBTOTAL			1690
	IV. WELDING DEPARTMENT :			
A-56	Production of low hydrogen welding electrode.	1	Steel manufacturing Co., electrode manufacturing Co.	
A-57	Optimization of spot welding conditions.	1	Automobile Co., washing machines Co.	
A-58	Technology transfer of quenched and tempered steel.	1	Shipbuilding Co., steel construction Co.	
A-59	Optimization of hard facing conditions using different techniques.	1	Power stations, construction Co., other sectors using earthmoving equipment.	
	SUBTOTAL			700
	TOTAL OF GROUP (A)			7920

VI.2. PROJECTS EXPECTING FINANCING FROM INTERNATIONAL COOPERATION AGENCIES - GROUP (B)

	Project Title	Expected Sponsor/ Cooperating Agencies	End User	Estimated Budget, 1000 L.E.
	ORE EVALUATION AND BENEFICIATION DEPARTMENT :			
B-1	Evaluation, beneficiation and production of some phosphates in Egypt and Morocco	Morocco/ Egypt	Egyptian and Morocco Mining and fertilizer	100
B-2	Pilot plant production of some white mineral fillers for different applications.	USA/ NSF	industries. Ceramics, paper, paint, chemical companies.	5000
	SUBTOTAL			5100
	II. PROCESS METALLURGY DEPARTMENT :			
B-3	Production of iron powder	SIDA	SABI Co.	
B-4	Production of magnesium metal by electrolysis.	Trondheim University, Norway	Aluminium Co. of Egypt	
B-5	Extraction of heavy metal such as copper, silver and lead from industrial wastes		Electroplating and galvanizing company.	
B-6	Collection and use of dust produced from electric arc furnace during steelmaking (3 years)	MEFOS Lulea, Sweden	Steel production companies	
	SUBTOTAL			1680

	Project Title	Expected Sponsor/ Cooperat-ing Agencies	End User	Estimated Budget, 1000 L.E.
	III. METAL PROCESSING DEPARTMENT :			
B-7	Environmental control in foundries.	DANIDA-EC-IDRC	All foundries in private and public sectors	1500
B-8	Foundry training and technology transfer network in Africa and Middle East.	JICA-IDRC	Foundries in the region.	250
B-9	Simulation of thermomechanical treatment processes for continuously cast, directly rolled micro-alloy thin steel slabs.	GTZ	Steel rolling plants.	400
	SUBTOTAL			2150
	IV. WELDING DEPARTMENT :			
B-10	Metal fabrication and construction of thin metal sheets. (4 years) (N.T.)	JICA	Metal fabrication companies, Steel construction companies.	2250
	SUBTOTAL			2250
	TOTAL OF GROUP (B)			11080

VI.3. PROJECTS BASED ON ADVANCED TECHNOLOGIES AND NEED "CORE-MONEY" FROM THE GOVERNMENT - GROUP (C)

	Project Title	Duration, Years	End User	Estimated Budget, 1000 L.E.
	I. ORE EVALAUTION AND BENE-FICIATION DEPARTMENT :			
C-1	Pilot plant production of some white mineral fillers for different applica-tions.	2	El-Nasr Phosphate Co., Red Sea Phosphates, painting and chemical industrial companies.	450
C-2	A multi-purpose technology incubator for continuous production of mineral concentrates that satisfy the require-ments of the local industry.	3	Mining and ceramic Cos.	5000
C-3	Evaluation of fluorspar for different industrial aplications.	2	Mining and ceramic Cos..	150
C-4	Evaluation of bentonite deposits to be used in different applications.	5	Drilling muds, foundry, civil engineering, iron and steel, paint, advanced ceramic Cos.	200
C-5	Evaluation of Egyptian talc ores.	3	Mining and ceramic Cos.	100
C-6	Studies and evaluation of diatomite deposits for different industrial uses.	3	Fillers, absorption materials and bricks Cos.	100
	SUBTOTAL			6000

	Project Title	Duration, Years	End User	Estimated Budget, 1000 L.E.
	II. PROCESS METALLURGY DEPARTMENT :			
C-7	Preparation of ultrafine and pure metal powders from metal salts by reduction under pressure.	1	Powder metallurgy Co. and electronic Cos.	200
C-8	Preparation of nano-size ultra-fine particulate of alumina, titania, zirconia by sol-gel techniques.	2	Ceramics, electronic, engineering Co.	200
C-9	Extraction of manganese from low grade manganese ores by bacterial leaching.	2	Sinai Manganese Co.	200
C-10	Conversion of phosphate concentration tailings (slimes) into fertile soil by bacterial leaching.	2	Abu-Tartur Phosphate Project.	100
C-11	Iron removal from New Valley phosphate ores by bacterial leaching.	2	Abu-Tartur phosphate project.	100
C-12	Application of ion exchange and solvent extraction techniques for the preparation of compounds of rare and precision metals.	2	Ceramic, electronic engineering Cos.	200
C-13	Direct leaching of complex oxides ores by mechano-chemical activation technique.	2	Painting, leather tanning Cos.	200
C-14	Production of some magnetic materials (ferrites) used in electronics.	2	Electronic Cos.	200
C-15	Treatment of high manganese pig iron for production of foundry cast iron, steel and high manganese slag.	5	Egyptian iron and steel Co.	300
C-16	Replacement of nickel by other cheap elements for production of margaging steel.	3	Engineering industries.	150

	Project Title	Duration, Years	End User	Estimated Budget, 1000 L.E.
C-17	Production of ferro-silicon-magnesium alloy on pilot scale for ductile cast iron.	3	Foundry mill Cos.	150
C-18	Using Egyptian ores for production of Cr-Ti alloy.	3	Steel Cos.	100
C-19	Production of cored wires for killed and alloyed steel.	3	Holding Company for Metallurgical Industries	100
	SUBTOTAL			2300
	III. METAL PROCESSING DEPARTMENT :			
C-20	Application of laser techniques in metal cutting, welding and surface treatment.	3		2000
C-21	Setting-up of a new material testing department.	3		1500
C-22	Premium quality aluminium castings.	2	Mainly the	200
C-23	Technology transfer of special steel castings of strategic applications.	2	engineering and	350
C-24	Production of Al-Li alloys for aerospace applications.	2	electronic industries	300
C-25	Production of high strength Al-alloys (AlCuMg and AlZnMg).	2	sector.	200
C-26	Particle reinforced metal-matrix composites.	2		300
C-27	Application of high technology casting processes by plasma, and chemical or physical vapour deposition (CVD-PVD).	2		1000
C-28	Production of some magnetic materials and metal/ceramic composites using powder metallurgy technique.	2		500

Project Title	Duration, Years	End User	Estimated Budget, 1000 L.E.
C-29 Production of maraging steel grades. C-30 Production of castings from superalloys.	2 2	Mainly the Engineering and electronic industries sector.	1000 1000
SUBTOTAL			8350
IV. WELDING DEPARTMENT :			
C-31 Introduction of laser beam welding technology to Egyptian industries	2	Automobile companies	200
C-32 Technology transfer of welding of duplex St.St. (1 year).	1	Power stations, refineries and fertilizer plants.	200
C-33 Techno-economic study for St.St. welding conditions. (2 years).	2	Petrochemical Co., Fertilizer Co., Egyptian Authority of Electricity.	250
SUBTOTAL			650
TOTAL GROUP (C)			17300
GRAND TOTAL (A+B+C)			36300

VI.4. PROPOSED FINANCING MECHANISM FOR THE (C) CATEGORY PROEJCTS

It is expected that projects of groups A and B will be self-financed and will not need governmental support - supposing that the building and infrastructure plans attached in the following chapter will be approved. Only the cost of the projects mentioned under group (C) will seek governmental support (about 17.300 million pounds over 5 years).

The main end-users of these projects are :

- the engineering industries sector
- the mining and mineral wealth sector
- the metallurgical industries sector
- the chemical industries sector.

It is proposed that these organizations will be approached with concrete proposals for the establishment of new centres of excellence, so well equipped as to serve the direct interests of these sectors. The setting-up expenses of these centres may be born jointly by these sectors and the government.

As an example, the establishment of a new centre of excellence, capable of transferring technologies for production of new and high strength alloys may cost about 7 million pounds, which may be jointly paid by the engineering industries sector and the government. A part of the contribution of that sector may be considered as advance payment for R&D projects, to be carried out later in the interest of the sector.

VII. RESOURCES NEEDED BY CMRDI OVER THE NEXT FIVE YEARS

VII.1. EQUIPMENT RECRUITMENT SCHEDULE AND EXPENSES

The following list covers the equipment needed to carry out the projects mentioned in the last chapter under categories A, B and C.

FIRST YEAR

No.	Equipment	Estimated Cost, 1000 L.E.
	A. ORE BENEFICIATION DEPARTMENT	
1	Pilot high intensity wet magnetic separator.	500
2	Alpine pilot fine grinding of silica or quartz with air classification (one t/h).	3000
3	An apparatus for mesuring the softeness under pressure in a reducing atmosphere.	250
4	Coulter LS Series (LS230) laser diffraction particle size analysis.	250
5	F-4500 rapid scan fluorescence spectrophotometer.	750
	B. PROCESS METALLURGY DEPARTMENT	
6	Pilot evaporation unit (1/2 ton/hr).	300
7	Pilot crystallisation unit (1/2 ton/hr).	300
8	Spray dryer output (100 kg/hr).	500
9	Blast furnace, capacity 5-10 kg.	300
10	Electroslag remelting unit (100 kg).	600

No.	Equipment	Estimated Cost, 1000 L.E.
11	Semi-pilot chlorination unit.	150
12	High temperature viscometer.	120
13	Semi-pilot high temperature press.	100
14	Fused salt electrolysis system.	150
15	High power potentiostat/galvanostat.	100
16	Computerstat, computerized system for electrochemical processes.	150
17	CAD, CAM computer design system.	300
18	Software for design of processes and equipment.	300
19	Plottter	200
20	Atomic absorption spectrometer.	750
	(C) METAL PROCESSING DEPARTMENT	
21	Universal R&D laser unit	1000
22	Induction vacuum furnace, capacity 100 kg.	1000
23	Heat treatment pilot facilities	1000
24	Salt spray test chamber	400
25	Coating set by plasma spraying mini-unit	100
26	Complete unit for powder metallurgy	1000
	(D) WELDING DEPARTMENT	
27	Shearing machine	100
28	Sheet bending machine	100
29	Mobile X-ray machine	300
30	Extruder of flux covered electrode	80
31	Laser beam welding machine	1000
	(E) LIBRARY AND INFORMATION CENTER	
32	Computer 486 memory 540 mega byte with fax and modem (4 units).	40

No.	Equipment	Estimated Cost, 1000 L.E.
33	Dot printing unit (2 units).	2
34	Laser 4L unit (2 units)	6
35	Safe	1
36	Air condition unit LHP (2 units).	13
37	International telephone line (2 lines).	8
38	Subscription in ENSTINET	6
39	Furniture	17
40	Subscription in international periodicals.	150
41	Photocopying machine.	20
42	Computer and laser printer for library.	18
43	Air conditioning of library	50
44	Furniture	95
SUBTOTAL (FIRST YEAR)		15476

SECOND YEAR

No.	Equipment	Estimated Cost, 1000 L.E.
	A. ORE BENEFICIATION DEPARTMENT	
1	A 3-5 t/h gravity-flotation pilot plant complete with a ball mill and classifier	2000
2	Four slurry pumps	500
3	Laboratory sintering under pressure machine	250
4	DME dual scope (scanning probe and optical microscope).	500
5	Computerized polarized microscope fully equipped with photograph facilities and screen.	750

No.	Equipment	Estimated Cost, 1000 L.E.
	(B) PROCESS METALLURGY DEPARTMENT	
6	Boiler station, 1/2 ton/hr vapour.	200
7	High pressure autoclave, 100 lit. with flash tanks.	500
8	Metal oxide resistivity measurements unit.	75
9	Melting point measurement unit.	75
10	Micronizer-1μ	350
11	Crucible furnaces up to 1600°C.	100
12	Electric arc melting furnace capacity 100 kg.	300
13	Semi-pilot shaft furnace 0.5 ton/day, > 1200°C.	250
14	Programmable curing chamber.	40
15	Ampere-hour counter.	40
16	Semi-pilot plasma unit.	250
17	Eco-cell.	100
18	Cycler for battery charge and discharge and battery life estimation.	40
19	Double beam spectromphotometer.	200
20	Density measurements instruments.	45
21	Micrometrics accelerated surface area and porosity measurement unit.	45
	(C) METAL PROCESSING DEPARTMENT	
22	Universal tensile testing machine.	500
23	Fatigue torsion testing machine.	500
24	Creep testing machine.	300
25	Complete metallography lab.	200
26	Pilot pressure die-casting machine.	400
27	Vacuum heat treatment furnace.	500
28	Prototype printed circuit plating line bench-top.	50
29	Corrosion meter console for direct lab. measurements.	50
	(D) WELDING DEPARTMENT	
31	Gleeble testing machine type : A210.	800
	SUBTOTAL (2ND YEAR)	10910

THIRD YEAR

No.	Equipment	Estimated Cost, 1000 L.E.
	A. ORE BENEFICIATION DEPARTMENT	
1	The multi-gravity separator for pilot/lab.	500
2	Laboratory granulator with possible use of reagent.	250
3	FT-IR with vision (Fourier Transform Infrared).	500
4	ELTRA-Analyzer for determination of carbon and sulfur.	250
5	Computerized X-ray diffraction unit.	1000
	B. PROCESS METALLURGY DEPARTMENT	
6	Rotary kiln 5 m, dia. 50 cm. up to 14000	600
7	Ion exchange pilot unit.	200
8	Electrodialysis unit.	100
9	Ceramic filter, area 5 cm^2	200
10	Centrifugal, vacuum, dosing, diaphragm pumps.	50
11	Pilot immersion heater with temperature control units.	100
12	Laminar flow hoods.	100
13	Temperature control rooms.	100
14	Rotating biological contactors.	100
15	Fermenters, different capacities.	100
16	Anaerobic chamber.	100
17	High temperature press.	200
18	Semi-pilot resistivity and magnetic properties measurement unit.	50
19	Semi-pilot graphitization unit (> 3000°C).	100
20	High temperature vacuum furnace.	250
21	Dynatronix programmable series of pulse and D.C. power supply.	30
22	Filter pumps for corrosive liquid applications.	20
23	Crucible furnace up to 1600°C.	50

No.	Equipment	Estimated Cost, 1000 L.E.
	(C) METAL PROCESSING DEPARTMENT	
24	Impact testing machine.	300
25	Pilot die casting machine.	500
26	Precision (lost-foam) casting machine	400
27	Ion nitriding unit.	700
28	CVD unit for metals bell type.	850
	(D) WELDING DEPARTMENT	
29	Tension-compression fatigue testing machine, 10 ton.	450
SUBTOTAL (THIRD YEAR)		8150

FINANCIAL PLAN FOR RECRUITMENT OF EQUIPMENT

Year	Equipment Costs, 1000 L.E.
First Year	15476
Second Year	10910
Third Year	8150
TOTAL	34536

VII.2. EXECUTION OF NEW BUILDINGS (SCHEDULE AND EXPENSES)

No.	Building	Expense, 1000 L.E.
1	Laboratories, I	600
2	Fence and towers.	150
3	Roads, lightening net	400
4	Water supply, drainage (system)	500
5	Maintenance, workshop, transport.	800
6	Steel making shed.	300
7	Water reservoir, steam, air, gas station	1250
8	Pilot plant sheds II	2000
9	Laboratories II	1000
10	Material testing.	200
11	Conferences, training center.	2000
12	Mud lake.	150
13	Mosque.	50
14	Guest house.	100
15	Cantine and cafeteria.	100
TOTAL		9600

BUILDING BAR CHART

No.	Activity / Year	1st Year	2nd Year	3rd Year	4th Year	5th Year
1	Completion of laboratory building I					
2	Fence and observatory towers.					
3	Roads, lightening net.					
4	Water supply and drainage system.					
5	Maintenance workshop, transport bulding					
6	Steel making shed					
7	Water reservoir, steam, compressed air, gas station					
8	Pilot plant sheds (4 units)					
9	Laboratory building II					
10	Material testing department.					
11	Conference and training center					
12	Mud lake					
13	Mosque					
14	Guest house					
15	Cantine and cafeteria					

VII.3. TRANSPORT EXPENSES

No.	Item	Expenses, 1000 L.E.
1	Bus, 4	800
2	Mini Bus 4	500
3	Truck 2	400
4	Passenger Vehicle 4	300
	TOTAL	2000

VII.4. FURNITURE EXPENSES

No.	Item	Expenses, 1000 L.E.
1	Conference, training center	1000
2	Laboratories, pilot sheds, other buildings	200
3	Guest house	200
4	Cantine and cafeteria	200
	TOTAL	1600

VII.5. HUMAN RESOURCES NEEDED OVER THE NEXT FIVE YEARS

(i) Personnel Recruitment Schedule

No.	Specialisation \ Year	1st	2nd	3rd	4th	5th	Total
1	Metallurgical engineer (MTE)	4	3	5	5	3	20
2	Chemist (CHM)	6	4	5	4	5	24
3	Mechanical engineer (MCE)	2	2	4	4	3	15
4	Physist (PHY)	1	2	3	2	2	10
5	Chemical engineer (CHE)	1	1	2	2	2	8
6	Electrical engineer (ELE)	1	1	2	2	2	8
7	Geologist (GEO)	1	-	-	1	1	3
8	Biologist (BIO)	-	2	-	-	2	4
9	Mathematician (MAT)	-	-	1	1	1	3
10	Economist (ECO)	-	2	-	1	2	5
11	Technician, high school (T)	5	5	10	10	10	40
12	Labour (L)	5	10	15	15	15	60
TOTAL		26	33	46	47	48	200

PERSONNEL RECRUITMENT SALARIES :

Salary/month/hr.	200 L.E.	for university graduate
	150 L.E.	for technician
	100 L.E.	for labour

Year	Expenses, in 1000 L.E.
First	267.0
Second	247.2
Third	266.4
Fourth	177.6
Fifth	91.2
TOTAL	1049.4

(ii) Training Schedule and Expenses

No.	Field of Training	Trainee		No. Month	Month/Year					Expenses, 1000 L.E.
		Qualification	No.		1st Year	2nd Year	3rd Year	4th Year	5th Year	
1	Laser technology	MTE	3	9			6	3		180
2	Production of metal products.	MTE,CHM	3	12	12					240
3	Ultrafine particle preparation	CHM,MTE	2	12	12					240
4	Bioleaching	BIO,CHM	3	18				9	9	360
5	Computer aided design, CAD,CAM	MCE	2	12			6	6		240
6	CD-Rom, Metadix for data acquisition.	ELE	1	6	6					120
7	Precision casting	MTE	1	6		6				120
8	Material testing (Chem., Phys., Mech.)	PHY,CHM,MCE	6	24			12	12		480
9	Certification	PHY,MTE	2	6				6		120
10	Plasma techniques	MTE,CHM	3	9		6			3	180
11	Mathematical modelling	MAT,MTE	2	12			12			240
12	Project management	Senior Staff	8	8	4	4				160
13	Eddy current, infra-red inspection.	PHY	2	6		6				120
14	Electron beam welding	MTE	1	6			6			120
15	Flash smelting	CHM	1	6					6	120
16	Zone refining	CHM,MTE	2	8						160
17	Single crystal preparation and slicing	CHM,PHY	2	12					12	240

MTE : Metallurgical engineer. MCE : Mechanical engineer. ELE : Electrical engineer
CHM : Chemist. PHY : Physist BIO : Biologist MAT : Mathematician.

(ii) Training Schedule and Expenses (Cont'd)

No.	Field of Training	Trainee		No. Month	Month/Year					Expenses, 1000 L.E.
		Qualification	No.		1st Year	2nd Year	3rd Year	4th Year	5th Year	
18	Vacuum melting	MTE	2	6	6					120
19	Vacuum furnace engineering	MCE	2	12	6			6		240
20	Powder metallurgy	MTE	2	12		6	6			240
21	Ion nitriding heat treatment	MTE	1	6				6		120
22	Cathodic protection	CHM	1	6				6		120
23	Atmospheric corrosion	CHM	2	12	6		6			240
24	Environmental protection	CHM,MCE	2	12		6			6	240
25	Novel welding techniques (ceramic, spot, arc sensor, polymer)	MTE	4	12		3	3	3	3	240
26	Adhesive bonding		2	6				3	3	120
TOTAL			62	256	52	37	65	60	42	
TOTAL EXPENSES, 1000 L.E.				5120	1040	740	1200	1200	840	5120

MTE : Metallurgical engineer. MCE : Mechanical engineer. ELE : Electrical engineer
CHM : Chemist. PHY : Physist BIO : Biologist MAT : Mathematician.

PROPOSED FINANCIAL RESOURCES FOR TRAINING

Resource	Share, 1000 L.E.	%
International cooperation	3000	58
Research projects	1000	20
Government contribution	1120	2
TOTAL	5120	100

SUMMARY OF THE GOVERNMENT SUPPORT EXPECTED OVER THE NEXT FIVE YEARS (IN 1000 L.E.)

	Year					Total
	1	2	3	4	5	
Equipment	7000	6000	4300	-	-	17300
Building	3000	2000	2000	1600	1000	9600
Furniture	400	400	300	300	200	1600
Transport	700	600	300	200	200	2000
Personnel	267	247	267	177	92	1050
Training	300	300	200	200	120	1120
TOTAL	11667	9547	7367	2477	1612	32670

ANNEX I

EXAMPLES OF INDUSTRIAL R&D PROJECT CARRIED OUT AT CMRDI (1985 - 1995)

I. INTRODUCTION OF NEW TECHNOLOGIES.

	Project	Client/Sponsor
1.	Implementation of water cooled panels in 6-tonne EAF.	The Egyptian Iron & Steel Co.
2.	Implementation of water cooled walls and rods in 25-tonne EAF.	Delta Steel Mill Co.
3.	Introduction of oxygen lancing in 5-tonne EAF.	The Egyptian Iron & Steel Co.
4.	Application of oxygen lancing technology in 25-tonne EAF.	Egyptian Copper Works Co.
5.	Optimization of oxygen lancing technology in 12-tonne EAF.	The Egyptian Iron & Steel Co.
6.	Introduction of oxygen blowing technology in 25-tonne EAF of Delta Steel Mill.	Delta Steel Mill Co.
7.	Application of oxygen lancing technology in 35-tonne EAF.	The National Metal Ind. Co.
8.	Production of free-cutting, spring, bolts and nut steels.	Delta Steel Mill Co.
9.	Evaluation of heat treatment processes of spring steels.	Spring and Transport Needs Manufacturing Co.
10.	Production of high strength reinforcing bars.	The Academy of Scientific Research
11.	Production of corrosion and heat resisting steels.	Abu-Zaabal Chemical and Fertilizer Co.
12.	Production of high strength low alloy steels in open hearth furnace.	The National Metal Industries

Project	Client/Sponsor
13. Production of high strength steel for pre-stressed concrete.	The Academy of Scientific Research
14. Production of special steel grades for local needs.	The Academy of Scientific Research
15. Production of tool steels.	The Academy of Scientific Research
16. Production of silicon-manganese alloy on pilot plant and industrial scale from local and imported raw materials.	The Academy of Scientific Research
17. Production of ferro-titanium in the National Metal Ind. Co.	The National Metal Industries Co.
18. Production of ferro-titanium.	The Academy of Scientific Research
19. Production of ferro-vanadium from boiler ash.	The Academy of Scientific Research
20. Production of ferro-chrome.	The Academy of Scientific Research
21. Introduction of ductile iron technology to Egyptian foundries.	The Aluminium Co. of Egypt Delta Steel Co. The Egyptian Copper Works El-Nasr Casting Co.
22. Welding of ductile iron.	El-Nasr Casting Co.
23. Welding of aluminium.	The Aluminium Co. of Egypt
24. Production of some special steels.	Helwan Engine Factor
25. Permanent mould casting of ductile iron.	El-Nasr Casting Co.
SUBTOTAL BUDGET, 1000 L.E. : 2150	

II. PRODUCTION OF NEW PRODUCTS AS IMPORT REPLACEMENT

	Project	Client/Sponsor
1.	Local manufacture of chemicals used for treatment of water used in cooling towers.	Abu-Zaabal Fertilizer & Chemical Co./ASRT
2.	Chemiphos, local antifoaming agent in phosphoric acid production and phosphate flotation collectors.	Abu-Zaabal Fertilizer & Chemical Co.
3.	Production of ductile iron rolls.	The Aluminium Co. of Egypt
4.	Production of ductile iron rolls.	Egyptian Copper Works
5.	Production of ductile iron rolls.	El-Nasr Casting Co.
6.	Production of ductile iron rolls.	Helwan Iron Foundries
7.	Production of ductile iron spare parts for textile machinery.	Misr Spinning & Weaving Co.
8.	Production of axle end cap.	Egyptian Railway Authority
9.	Production of brake holder.	SIGWART
10.	Selection and application of steel alloys required for grinding of raw materials used in building industries.	Supervision and production
11.	Developing cold work tool steel castings for preparation of the materials used in stone ware pipes.	CIPAC
12.	Manufacturing of corrosion inhibitors for cooling water systems.	ASRT
13.	Production of valve nuts from ductile Ni-resist alloys.	Egyptian Valves Co. (EVACO)
14.	Production of quality spare part castings for different industrial sectors.	ASRT
15.	Researches about improving the abrasion resistance of brick-forming dies	Egyptian companies for refractories.
	TOTAL BUDGET, 1000 L.E. : 3100	

III. DEVELOPMENT OF A PRODUCT OR PRODUCTION PROCESS

	Project	Client/Sponsor
1.	Evaluation of production technique of cold rolled sheet steel.	The Egyptian Iron & Steel Co.
2.	Follow-up of quality control at El-Nasr Steel Pipes and Fittings Co.	El-Nasr Steel Pipes & Fittings Co.
3.	Production of high strength reinforced bars in 35-tonne EAF.	National Metal Industries Co.
4.	Production and quality improvement of 6-tonne EAF.	The Egyptian Iron & Steel Co.
5.	Consultation, technical and research assistance in production of ferro-manganese.	Sinai Manganese Co.
6.	Modification of production technology of phosphoric acid to the hemi-dihydrate process.	Abu-Zaabal Fertilizer & Chem. Co./Academy of Scien. Res.
7.	Improvement of filtration rate during phosphoric acid production from New Valley phosphate-concentrate.	The Executive Complex for Mining & Industrial Projects.
8.	Production of microwave absorbing material.	Engineering industries.
9.	Production of graphite and carbon products from Egyptian petroleum coke.	El-Nasr Co. for Graphite
10.	Upgrading of heat treatment processes of spare parts.	Misr Spinning & Weaving Co. (Mahalla El-Kobra).
11.	Production of ductile iron ingot moulds.	Delta Steel Co. El-Nasr Casting Co.
12.	Quality control of Delta Steel Foundries.	Delta Steel Co.
13.	Quality control of ENC Foundries.	El-Nasr Casting Co.
14.	Production of sand-casting Al-bronzes.	The Egyptian Iron & Steel Co
15.	Study of the status of foundry industry in Egypt.	ASRT
16.	Quality improvement of steel rolls.	Egyptian Copper Works
	TOTAL BUDGET, 1000 L.E. : 2275	

IV. MAXIMIZATION OF INDIGENOUS RAW MATERIAL EXPLOITATION

Project	Client/Sponsor
1. Production of activated bentonite from local ores.	Sinai Manganese Co./ Academy of Scientific Res.
2. Survey and study of ores used in glass and ceramic industries (white sand and feldspar).	Academy of Scientific Res.
3. Investigating the performance of the phosphate beneficiation plant at Sebaiya West.	Abu-Zaabal Fertilizer & Chem. Co.
4. Beneficiation of manganese ore for welding electrodes production.	Orlicon Co.
5. Pilot plant beneficiation of Abu-Tartur phosphate concentrate.	The Executive Complex for Mining & Industrial Projects.
6. Production of zircon from black sand for refractories.	Academy of Scientific Res.
7. Improving the specifications of ores used in glass and ceramic industries.	Sinai Manganese Co.
8. Upgrading of Egyptian kaolin to meet specifications for paper making and ceramic industries.	Academy of Scientific Res.
9. Production of metallurgical alumina from local ores, imported ores and blends of them.	Misr Aluminium Co., Academy of Scientific Res.
10. Beneficiation of low grade and fine Sinai Manganese ores for ferromanganese and dry batteries industries.	Academy of Scientific Res.
11. Pilot plant beneficiation of Eastern Desert chrome ores for refractories industry.	Academy of Scientific Res.
12. Removal of alkalies from cement dust.	Portland Cement Helwan, Academy of Scientific Res.
13. Production of titanium dioxide for paints and welding rods industries from local Egyptian ores.	Academy of Scientific Res.
14. Production of pure silicon and silicon carbide from local ores.	Academy of Scientific Res.
SUBTOTAL	2908

V. DEVELOPMENT OF NEW MATERIAL

Project	Client/Sponsor
1. Development of SG Ni-hard for roll casting applications. 2. Production of Al-Ti-C grain refining master alloy.	The Aluminium Co. of Egypt The Aluminium Co. of Egypt
SUBTOTAL	250

VI. ENVIRONMENTAL PROTECTION

Project	Client/Sponsor
Production of aluminium fluoride from fluosilicic acid waste of phosphate fertilizers industry. Control of flue dust from lead and cast iron smelters.	Abu-Zabal Fertilizer & Chemical Co. Lead and iron foundries
SUBTOTAL	678

VII. DEVELOPMENT OF SMALL AND MEDIUM ENTERPRISES.

Project	Client/Sponsor	Estimated Budget, 1000 L.E.
1. Development of SMEs at Dakahlia 2. The use of sponge iron in small scale foundries.	IDRC IDRC	80 600
SUBTOTAL		680

VIII. FAILURE ANALYSIS AND TROUBLE SHOOTING.

Project	Client/Sponsor
About 40 project	Engineering, chemical, petrochemical, metallurgical sectors and power plants.
SUBTOTAL	322

IX. TECHNICAL SERVICES (IN LAST 2 YEARS)

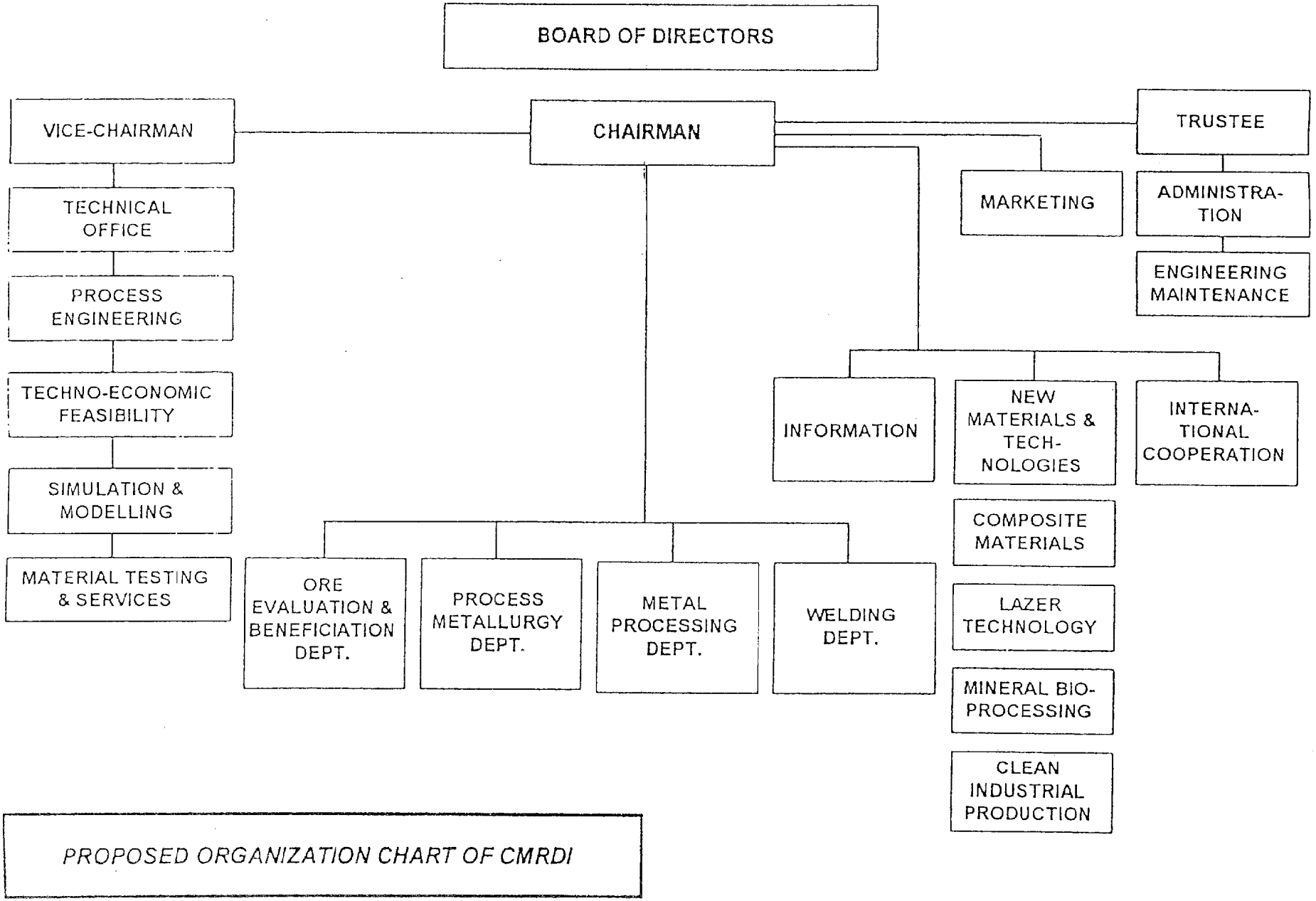
Service Category	Estimated Budget, 1000 L.E.
1. Chemical analysis 2. Metallography 3. Mechanical testing 4. X-ray analysis 5. Surface coating and corrosion services	
SUBTOTAL	788

X. NON-DESTRUCTIVE TESTING AND THIRD PARTY INSPECTION

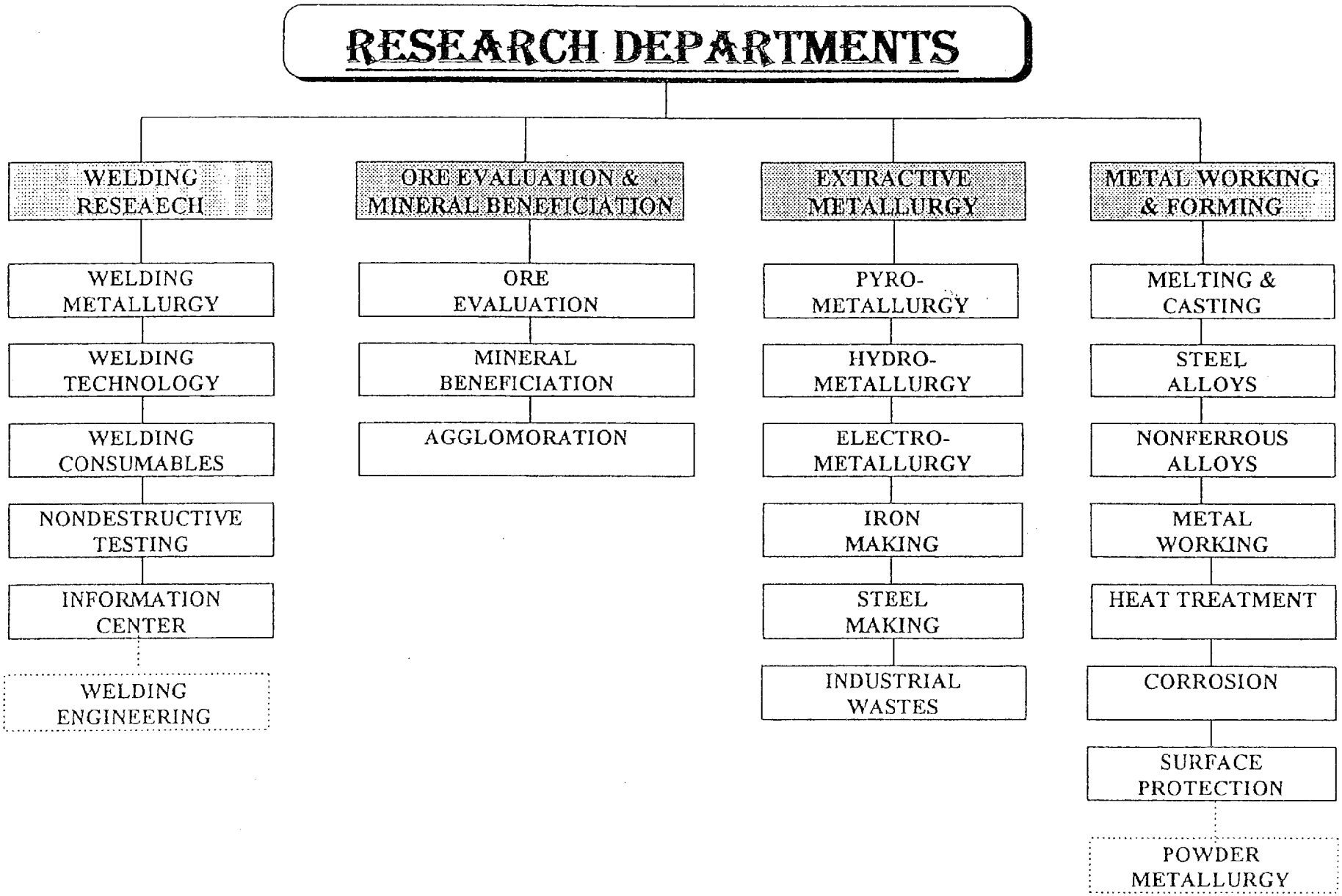
Project	Client/Sponsor
1. Third party inspection of 400 t/day ammonia plant.	El-Nasr Fertilizers Co.
2. Third party inspection of reformer tubes and accessories.	El-Nasr Fertilizers Co.
3. Full inspection of ammonia reactor, HP stripper and HP condenser.	El-Nasr Fertilizers Co.
4. Full inspection of steam turbines at Cairo-West Power Station (5 units).	Cairo-West Power Station
5. Full inspection of steam and gas turbines at Cairo-South Power Station.	Cairo South Power Station
6. Inspection of hydroturbine buckets at High Dam Power Station.	High Dam Power Station.
7. Inspection of hydroturbine buckets at El-Fayoum Power Station.	El-Fayoum Power Station
8. Inspection of crude oil transfer pipelines.	SUMED
9. Inspection of fire extinguishers at Helwan Eng. Co.	Helwan Eng. Co.
10. Inspection of VCM tower and EDC cracker.	Egyptian Petrochemicals Co.
11. Inspection of chlorine tanks.	El-Nasr for Intermediate
12. Inspection of boiler fire-tubes.	Chem. Co.
13. Inspection of boiler weldments.	Arab Brick Co.
	Varta Paper Manufacture Co
SUBTOTAL	830

ANNEX II

ORGANIZATIONAL CHART OF CMRDI



PROPOSED ORGANIZATION CHART OF CMRDI


RESEARCH DEPARTMENTS
WELDING RESEAECH
WELDING METALLURGY
WELDING TECHNOLOGY
WELDING CONSUMABLES
NONDESTRUCTIVE TESTING
INFORMATION CENTER
WELDING ENGINEERING
ORE EVALUATION & MINERAL BENEFICIATION
ORE EVALUATION
MINERAL BENEFICIATION
AGGLOMORATION
EXTRACTIVE METALLURGY
PYRO-METALLURGY
HYDRO-METALLURGY
ELECTRO-METALLURGY
IRON MAKING
STEEL MAKING
INDUSTRIAL WASTES
METAL WORKING & FORMING
MELTING & CASTING
STEEL ALLOYS
NONFERROUS ALLOYS
METAL WORKING
HEAT TREATMENT
CORROSION
SURFACE PROTECTION
POWDER METALLURGY

ANNEX III

AVAILABLE PERSONNEL WORKING AT THE WELDING AND CASTING DEPARTMENT

ANNEX III

III.1. AVAILABLE PERSONNEL WORKING AT THE WELDING AND CASTING DEPARTMENT*

	Welding	Casting
Research staff	8	6
Engineers	14	13
Technicians	12	16

**These numbers represent the available personnel in August 1996. It is expected that by the end of 1997, these numbers will be increased by at least 50%. Moreover, CMRDI has the flexibility to employ any number of research and technical staff when needed.*

III.2. AVAILABLE SPACE FOR THE PROJECT

The space available for the different activities of the present project is about 300 m^2.

III.3. AVAILABLE FACILITIES AT THE CASTING AND WELDING DEPARTMENTS

(A) Casting

I. The Experimental Foundry

1. A series of open-air induction melting furnaces (capacities from 1-400 kgs).
2. A complete mechanized sand preparation plant (capacity 8 t/hr).
3. Two pairs of Jolt/squeeze moulding machines.
4. Core blowers (2.5 litres).
5. Continuous sand mixer for chemically bonded sands (2 tons/hr).
6. Shot-blast machine for cleaning of castings surfaces.
7. A Vortex-unit for production of ductile cast iron.
8. Electro-slag melting and casting unit.
9. Shell moulding machine.
10. A complete unit for precision investment casting.

II. Quality Control Facilities

- Carbon-silicon determination by thermal analysis.
- Two emission spectrometers with programs for iron, copper and aluminium-base alloys.
- Complete foundry sand testing laboratories.
- A unit for measurement of tribological properties of alloys.
- Complete metallographic laboratories.
- An electron-scanning microscope with EDX and image-analysis facilities.

III. Metal Cutting Unit

- Conventional lathe.
- Conventional milling machine.
- CNC-lathe.
- CNC vertical machining centre.
- Drilling machine.
- Set of dynamometers for measuring the cutting force.
- Device for measuring the surface roughness of machined surfaces.

(B) Welding

I. Welding Metallurgy Laboratory

		Quantity
1.	Scanning electron microscope SEM	1
2.	Quantamet (image analyser)	1
3.	Strain gaugemeter	1
4.	Profile projector	1
5.	Optical microscopes (metallurgical)	3
6.	Portable ferrite scope	1
7.	Differential thermal analyser	1
8.	Stereoscope	1
9.	Hardness tester	2
10.	Microhardness tester	1
11.	Cutting machine (with cooling system)	1
12.	Polishing machine	2
13.	Bakalite moulding for metallurgical specimens	1
14.	Universal tensile testing machine	2
15.	Impact testing machine (charpy)	1
16.	Ultrasonic cleaner	1

II.	Welding Workshop	Quantity
1.	Arc welding machine up to 300 A	14
2.	Arc welding machine up to 500 A	3
3.	TIG welding machine	4
4.	Automatic TIG filler wire	1
5.	No. gas semi-automatic welding machine	1
6.	Automatic pipe cutter	1
7.	Automatic positioner	1
8.	Full automatic submerged arc welding machine	1
9.	Semi automatic CO_2 and gas welding machine	3
10.	MIG welding machine	2
11.	Transistor automatic pulsating welding machine	1
12.	Electrode drying oven	1
13.	Plasma cutting and welding machine	1
14.	Spot welding machine	1
15.	Gravity welding machine	2
16.	Hard facing machine	1
17.	Air compressor	2
18.	Drilling machine	
19.	Cutting saw	1
20.	Turning machine	1
21.	Shaping machine	1
22.	Varestrain testing machine	1
23.	Post-weld heat treatment equipment	1
24.	Arc mointor	

III.	Non-Destructive Testing Equipment	
1.	X-ray machine	3
2.	UT flaw detector	3
3.	UT thickness meter	1
4.	MT yoke	2
5.	MT mobile	1
6.	UV intensity meter	1
7.	Gause meter	1
8.	Roughness meter	1
9.	Portable hardness tester	1

		Quantity
10.	Sunp test	1
11.	Eddy current tester	1
12.	Portable spectroscope	1
13.	UT standard test blocks	3 sets
14.	Dye penetrant test facilities	1
15.	Film processing and examination facilities	1

IV. Training Facilities

1.	PC with laser printers and plotter	5
2.	Standards i.e. ASME, API, JIS, DIN, AWS, ASTM	
3.	iiW publications.	
4.	Welding books and technical notebooks	
5.	Audio visual facilities.	
6.	Training video tapes and slides.	

ANNEX IV

C.V. OF THE PROJECT MANAGER

PROF. ADEL A. NOFAL, DR. ENG.
3 Salah El-Din Mostafa St.,
Dokki, Cairo, Egypt

PERSONAL INFORMATION

Birth Date : July 21, 1942 Birth Place : Mansoura, Egypt Citizenship : Egyptian

EDUCATION BACKGROUND

B.Sc.	Metallurgical Engineering	(1963)	Cairo University
M.Sc.	Metallurgical Engineering	(1969)	Cairo University
Ph.D.	Melting and Casting	(1972)	Moscow Institute for Steel and Alloys, Moscow, USSR

Language : Fluent in Arabic, English, Russian, and German, knowledge of French.

EMPLOYMENT HISTORY

June 1996 to Present — Chairman of the Central Metallurgical Research and Development Institute

Oct. 1995 — Vice-Chairman of the Central Metallurgical Research and Development Institute

Oct. 1984 to Oct. 1995 — *Position :* Head of Metal Casting Department, Central Research and Development Institute (CMRDI), Academy of Scientific Research and Technology, Cairo, Egypt.

Supervise R&D and Technology Transfer Programs with Egyptian Foundries. Organize Foundry Training Programs for Egyptian, African and Arab Foundrymen. Design, Establish and then Run Pilot Foundry at CMRDI (capacity 1000 t/year).

May 1977 to Oct. 1984 — *Position :* Head of Foundry Section, Central Metallurgical Research and Development Institute, Academy of Scientific Research, Cairo, Egypt

Research programs in casting alloys with emphasis on ductile cast iron. Development of quality control systems in local foundries. Consultance services for local and foreign organizations conceming evaluation of foundry raw material. Study courses for engineering staff of foundries, e.g. quality control in iron foundries, defects in iron castings, DC casting of aluminium, metallurgy of iron castings, etc.

March 1976 to April 1977 — *Position :* Research Fellow, Fulmer Research Institute, U.K.

Supervise a developing program of temperature resistant alloyed iron with spheroidal graphite.

Oct. 1973 to Feb. 1976 — *Position :* Senior Research Officer, Foundry Group, Central Metallurgical Research and Development Institute, Cairo.

Assist local foundries in solving production problems; Specify and study equipment for the foundry laboratories and pilot plant of CMRDI.

June 1972 to Sept. 1973 — *Position :* Specialist in Foundry Technology, General Organization for Industrialization (GOFI), Cairo, Egypt.

Feasibility study of foundry projects, preparation of technical specifications of foundry equipment.

Dec. 1967 to May 1972 — *Position :* Postgraduate in the Foundry Department, Moscow Institute for Steel and Alloys, USSR.

- Carrying-out a research on control of structure and properties of ductile cast iron using additions of REM and solidification in ultrasonic field, training in some leading iron foundries in Moscow.

July 1963 to Dec. 1967 — *Position :* Foundry Engineer, El-Nasr Co. for Steel Pipes and Pipe Fittings.
In charge of a state-owned malleable iron foundry producing about 1200 t/year of small pipe fittings.

HONOURS

- Cairo University Award for Best Industrial Applied Research in Egypt from (1990-1995).
- Member of Board of Directors of the Aluminium Co. of Egypt (1992-1996) and Member of the General Assembly of El-Nasr Casting Co. (1992-1996).
- Member of the Committee of Metallurgical Industries, Egyptian Academy of Scientific Research and Technology (since 1982), Member of the Supreme Council for Industrial Research (1987), Member of the Supreme Consulancy Group of the Ministry of Scientific Research and Technology (1992).
- Delegate and author of Official Exchange Paper to the International Foundry Congress No. 48, Varna, Bulgaria (1981) - No. 49, Chicago (1982) - No. 50, Cairo (1983) - No. 52, Melbourne (1985) - No. 54, New Delhi (1987) - No. 56, Dusseldorf (1989).
- Delegate to Symposium on Foundry Equipment - Economic Commission for Europe, Geneva (1977), International Foundry Conference, Bejing, China (1984), WAITRO Seminar on Interaction between R&D and Local Industry, Arhuns, Denmark (1986), International Foundry Symposium, Shenyang, China (1988), 4th Symposium on Physical Metallurgy of Cast Iron, Tokyo (1989), 58th International Foundry Congress, Cracow, Poland (1991), 63th International Foundry Congress, Bejing (1995), WAITRO General Assembly, Mexico (1996), UNIDO Symposium on Cleaner Production Technologies, Vienna (1996), BCIRA Annual Conference, U.K. (1995), Metal Casting and Forming Seminar, UNIDO, Prague (1989), AOTS Seminar on Environmental Control in Industry, Osoka, Japan (1994).
- Visiting Scientist to :
  - Moscow Institute of Steel and Alloys, (1975).
  - Fulmer Research Institute, U.K. (1976-1977).
  - Foundry Institute of Aachen Technical University, Germany (1981).
  - Institute of Scientific and Industrial Research, Osaka University, Japan (1984).
  - Technical Centre of Foundry Industries CTIF, Paris (1985).
  - Institute of Physical Metallurgy, Berlin University (1986).
- General Secretary and Chief Organizer of :
  - 50th International Foundry Congress, Cairo, 1983.
  - Second International Arab Aluminium Conference (Arabal-85), Cairo, 1985.
  - First International Arab Foundry Symposium, Cairo, 1991.
  - Sixth International Arab Aluminium Conference (Arabal-93), Cairo, 1993.
- Member of Board of Directors of the Egyptian Foundrymen's Society.
- General Secretary of the Egyptian Alumini Society of the Japanese Association of Overseas Technical Society (AOTS), since 1995.
- Lecturer in Cairo University, Faculty of Engineering (1973-78).
  El-Tebbin Institute for Higher Metallurgical Studies (1980).

  Editor of El-Sebaka, the Journal of the Egyptian Foundrymen Society (1973-1987).

INDUSTRIAL R&D PROJECTS

Principle Investigator of Numerous Industrial R&D Projects since 1977, some examples are :

- Introduction of Ductile Iron Production Technology by Vortex Process, Joint Dutch-Egyptian Project.
- Use of Sponge Iron in Foundries, Joint Canadian-Egyptian Project.
- Production of Quality Precision Castings, Joint USA-Egyptian Project.
- Production of Ductile Iron Rolls at ECW and ENC Foundries.
- Production of Double-Poured Rolls at Egyptalum Foundries.
- Production of Ductile Iron Spare Parts for Textile Machinery at MSW Co.
- Evaluation of Egyptian Foundry Coke.
- Evaluation and Development Prospects of the Foundry Industry in Egypt - A National Project - ASRT.
- Activation of Egyptian Bentonites.
- Evaluation of Sudanese Foundry Raw Materials.
- Testing of Somalian Sands, Binders and Fluxes for Foundry Purposes - UNIDO Contract No. 75/34.
- Production Technology of Aluminium Bronze Casting - EISCO.

- Quality Control Systems at Delta Steel Mill and ENC Foundries.
- Production of Ductile Iron Permanent Dies for Aluminium Casting.
- Analysis of Casting Defects at ENC-Foundries.
- Structure and Machinability Control of Ni-hard for Roll Applications.
- Production of Al-Ti-C Grain Refiners for Aluminium - Egyptalum.
- Production of Ultra-High-Strength Steels.
- Quality Improvement of Steel Rolls at Egyptian Copper Works (ECW).

REGIONAL ACTIVITIES

Organizer for the following activities :

CONFERENCES :

- Second International Arab Aluminium Conference, (ARABAL-85), Cairo, 1985.
- First International Arab Foundry Symposium, (ARABCAST-1), Cairo, 1991.
- Sixth International Arab Aluminium Conference, (ARABAL-93), Cairo, 1993.
- WAITRO Seminar on Metallurgical Industries in Africa, Cairo, 1993.
- UNIDO Seminar on Manufacturing of Spare Parts for African Countries, Cairo, 1994.
- Roving Seminar on "Cleaner Foundry Technology", with (UATI-UNIDO), under preparation.

TRAINING :

Design and conducting the following programs :

- Khartoum Central Foundry (KCF), with TNO-NL (1987-1988).
- Different foundries in Libya with the Industrial Research Centre, Tripoli, (1990-1993).
- Arab Company for Engineering Industries, Jordan, March-July, 1995.
- National Foundries, Dammam, Saudi Arabia (1995-1996).
- Evaluation of the foundry raw materials of :
  - Somalia (UNIDO - Project 1975).
  - Sudan (TNO, NL Contract 1987).

DELEGATE TO AND LECTURER IN THE FOLLOWING REGIONAL MEETINGS :

- Third Arab International Aluminium Conference (ARABAL-87), Dubai, 1987.
- Arab Foundry Conference, Tunis (1988).
- Member of TNO-NL mission to African countries to study foundry training needs in the continent, 1988.
- First African Foundry Conference, Harari, ZW, 1989.
- First Arab Conference on Future Industries, Libya, 1990.
- Arab Steel Conference, Morocco, 1992.
- Symposium of Economic and Social Committee of West Asia (ESCOWA-UN), Jordan, 1993.
- Fifth Arab International Aluminium Conference (ARABAL-94), Bahrain, 1994.
- COMESA Symposium on Steel Industries, Nairobi, 1995.
- Member of TNO-NL mission to African countries to study foundry training needs in the continent, 1988.

PUBLISHED WORK

Author of a long list of scientific publications, some examples are :

1. Lead in cast iron inoculated with cerium, Liteinoe Prolzvodstovo (Russian Castings Production), No. 6, 26-29 (1971).
2. Grain refinement of small aluminium ingots solidified under the influence of low frequency vibrations, Egyptian J. Chem. 16, No. 2, 143-152, (1973).
3. Survey on Ingot manufacture, Indian Foundry Journal, June 1973, Vol. 19, No. 6, p. 7-18.

4. Elastic vibration to modify as-cast structure, Indian Foundry Journal 1974, Vol. 20, Aug., pp. 1-18.
   Solidification behaviour of Ce-treated ductile iron in an ultrasonic field, Liteinoe Proizvodstvo No. 3, 1976, p. 7-9, also translated and published in Rusian Casting Production by the British Cast Iron Research Association in March 1977, p. 94-97.
5. The evaluation of inoculants for ductile iron, Second Symposium on Foundry Technology, CMRDI, Cairo Nov. - Dec., 1977, Paper No. 12, also published in El-Sebaka J. of Egyptian Foundrymen's Society No. 7, 1978, p. 40-46.
6. A new method for evaluation of the binding properties of bentonites in moulding sands, ibid, p. 13.
7. Improvement of the hot blast cupola lining, ibid, p. 10, also the Buletin of El-Tebbin Institute for Metallurgical Studies No. 28, March 1987, 40-47.
8. Choice and evaluation of inoculants for S.G. iron, Official Exchange Paper, International Foundry Congress, Varna, 1981.
9. High-temperature corrosion of cast iron in Fe_2O_3-NaCl, mixture, International Corrosion Conference, Mainz, W. Germany, Sept. 1981.
10. Metallurgical analysis of surface defects in continuous casting of aluminium, Second International Conference on Technology for Development, Cairo, 1982.
11. Choice of melting aggregate in Egyptian foundries, First International Symposium on Production Engineering, Cairo, 1981.
12. Cast iron alloyed with 9.0% aluminium, Egyptian Official Exchange Paper, 50th International Foundry Congress, Nov. 1983, Cairo.
13. Operational characteristics of cokeless cupola, La Fonderie Belge, Sept. 1983, No. 3, pp. 17-30.
14. Metallography of spheroidal graphite cast iron alloyed with 3.5% aluminium, Egyptian Official Exchange Paper, No. 29, International Foundry Congress, Melbourne, 1985, also, Fonderie, June-July 1985, pp. 44-59.
15. Surface quality of level-poured 6063 aluminium alloy billets as correlated to meniscus freezing, Arab International Aluminium Conference, Cairo, 1985.
16. Theoretical evaluation of equilibrium partition coefficients of solute elements in Fe^2C base quaternary and multicomponent system, material science and technology, Sept. 1985, Vol. 1, pp. 678-683.
17. Production of ductile iron castings in Egyptian foundries; Seminar on "Interaction between R&D and Local Industry", Arhus, DEnmakr, 1986.
18. Contribution to the solidification of C/V graphite cast iron; Egyptian Official Exchange Paper, 54th International Foundry Congress, New-Delhi, 1987.
19. The role of R&D in the foundry industry; AISU First International Foundry Symposium, Tunisia, 1988.
20. Nucleation and growth characteristics of C/V graphite; and other associated morphologies, World Foundry Congress, Düsseldorf, 1989.
21. Solidification characteristics of C/V graphite cast iron, 4th Sympsoium on Physical Metallurgy of Cast Iron, Tokyo, Sept. 1989.
22. Production of ductile iron rolls - a model for cooperation between CMRDI and Egyptian foundries, First Arab Foundry Symposium, Cairo, 1991.
23. Surface defects formation on the DC-cast aluminium products, Casting Research and Technology - Woodhead Publiishing Ltd., 1992, pp. 205-218.
24. Grain refinement of aluminium alloys by Al-Ti-C alloys, Arab International Aluminium Conference (ARABAL-6), Cairo 1993.
25. Thermal analysis of Al-alloys as a tool to evaluate the grain refiners efficiency, Light Metals, L.A., U.S.A., 1986.
26. Contracted Industrial R&D Projects - Case Studies from CMRDI, International Conference on Engineering Education and Industry Leaders, Paris, 1996.
27. CMRDI Faces New Challenges - Support of SMEs, Production Activities and Regional Networking, ibid.

② 1998年８月正式要請書

وزارة الخارجية

نائب مساعد وزير الخارجية

للعلاقات الثقافية الدولية

رقم الصادر : ٥٦٤

تاريخ الصادر : ١٩٩٨/٨/١١

مذكـــــره

تهدى وزارة خارجية جمهورية مصر العربية – العلاقات الثقافيه الدولية – أطيب تحياتها الى سفارة اليابان – هيئة التعاون الدولى اليابانيه بالقاهرة (جايكا) .

وتتشرف بأن تبعث رفق هذا المشروع المقترح للتعاون الفنى وفقاً لإتفاقية التعاون الفنى الموقعه عام ١٩٨٣ والمقدم من مركز بحوث وتطوير الفلزات :

DEVELOPMENT OF METALLURGICAL ENGINEERING TECHNOLOGIES

برجاء إدراج المشروع المشار اليه ضمن المشروعات الخاصة بالتعاون الفنى لعام ١٩٩٩.

وتنتهز وزارة خارجية جمهورية مصر العربية – العلاقات الثقافية الدولية – هذه الفرصة لتعرب عن فائق تقديرها .

الى سفارة اليابان بالقاهرة

AMRO

Translation (Susan Hanna)

Ministry of Foreign Affairs
Deputy Assistant Foreign Minister
for International Cultural Relations

Ref. No.: 4545 + Forms
Dated: 12/8/1998

NOTE VERBALE

The Ministry of Foreign Affairs of the Arab Republic of Egypt- International Cultural Relations - presents its compliments to the Embassy of Japan - Japan International Cooperation Agency (JICA), and has the honour to send, enclosed herewith, the proposal for technical cooperation project, submitted by the Central Metallurgical Research and Development Institute, in accordance with the Technical Cooperation Agreement signed in 1983:

DEVELOPMENT OF METALLURGICAL ENGINEERING TECHNOLOGIES

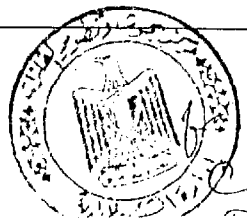
Kindly include the above-mentioned project among the technical cooperation projects of 1999.

The Ministry of Foreign Affairs of the Arab Republic of Egypt- International Cultural Relations - avails itself of this opportunity to renew the assurance of its highest consideration.

To : Embassy of Japan in Cairo.

SUMMARY OF REQUEST PROGRAM (1/2)

Tittle of the program:	Development of Metallurgical Engineering Technologies in Egypt
Requesting organization:- (the name of the person who is responsible for the program)	Central Metallurgical Research and development Institute (CMRDI) Prof. Dr. Adel Nofal, Chairman
Executing organization: (the name of the person who is responsible for the program)	Same as above
The activities of the executing organization: (please attach the structure/chart of the organization)	R & D & Engineering activities in the areas related to Metallurgical Industries as well as industries concerned with metallic materials and its performance.
Background and necessity of the program:	In order to be able to persue its mission in enhancing the competitiveness of local industries, CMRDI aims at strengthening its capabilities in the fields of metallurgical engineering and metal processing. This will high-rise the necessity of upgrading the existing units such as the casting workshop, metal processing shop, heat treatment unit and testing and evaluation labs in addition to introducing new technologies such as laser technology for metal cutting, welding and surface treatment.
Outline of the program:	The program will include the following fields:- • Transforming casting and foundry technology to the small and medium industries specifically die casting and last-wax precision casting • Introduction of laser technology for metal, welding , cutting and surface treatment. • Up grading the heat treatment facilities at CMRDI. • Up grading testing and performance evaluation facilities at CMRDI in order to be able to assist Egyptian industries to improve the quality.



Approved
A.R Ismail
Chairman CMRDI

SUMMARY OF REQUEST PROGRAM (2/2)

Specification for the request	
Duration of the program:	5 Years
Japanese experts required: (please specify their duties and number of experts)	3 long term experts 5 short term experts The experts will assist in teaching CMRDI staff and helping them in transferring the technologies to Egyptian industries.
Counterpart training in Japan: (please specify the contents of training and number of trainees)	training of 10to15 engineers in the filed of: Die casting, Lost-wax casting, Laser technology in welding, Heat treatment,testing materials, cutting and surface treatment.
Equipment and materials required (please specify their names and their cost about the main items)	Laser machine (900,000 US $) Heat treatment furnace (200,000 US $) Sand molding facilities (150,000 US $) CNC (additional control unit) (150,000 US $) Fatigue machine (250,000 US $) Die casting facilities (200,000 US $) Creep machines (150,000 US $)
Major goal of the program:	The program aims at improving the technical potential of CMRDI staff and assisting them to be able to offer necessary services to small and medium scale industries in Egypt to help them in improving the quality of their products and introducing new techniques.
Related national plans or strategies: (If there are any official or authorized plans or strategies in the national level or governorate level relating to the program, please give the name of it here and attach the related papers)	CMRDI is considered as the main institute in Egypt while is responsible to carry on all activities related to metal industries and assist concerned companies. Therefore, upgrading the level of CMRDI is the only strategic plan regarding the metallurgical industries in Egypt.
Related program implemented by the other donor countries or international organization: (If any, please give the name of the executing organization and the name of the program, and attach the related papers)	The existing experimental foundry shop has been established through a collaboration with a Dutch Institute (TNO)

Approved
A.K. Ismail
Chairman of MRDI

I - Project Title :

Development of Metallurgical Engineering Technologies .

II - Introduction :

CMRDI has a large experience in successful and fruitful international cooperation , which has always been oriented to the technological needs of local industry. The institute has benefited from cooperation with organizations, such as JICA – Japan and TNO- Netherlands, where two strong centers of excellence in welding and foundry, respectively have been established.
The experience accumulated over years in these two departments has been successfully used in transferring technologies to the concerned Egyptian and regional industries.
In order to be able to persue its mission in enhancing the competitiveness of local industries, CMRDI aims at strengthening its capabilities in the field of metallurgical engineering and metal processing.

III - Objectives :

The proposed project aims at introducing and transferring some advanced technologies in metal processing to the relevant Egyptian industries. Consequently , this would increase competitiveness of the small and medium scale industries in the local market and assist their export activities .

The acquired techniques shall also be transferred to other African and Arab countries in the region through appropriate training and technology transfer programs.

IV - Background and Justification :

I – Casting :

The pilot foundry at CMRDI has very effectively contributed to technology transfer to the metal casting industry both on the local as well as regional scales. However, this unit which was established some ten years ago needs updating of its sand molding department through introduction of novel molding techniques. The project would assist CMRDI foundry

department to make the optimum use of the existing lost-wax precision casting unit and to introduce die casting technology. The transfer of these two casting technologies to the small and medium size foundries will drastically increase the potential for producing high quality castings with much higher added value and wider export opportunities.

ii – **metal processing** :

Metal processing by laser is already a well established technology for cutting, welding and surface treatment of metallic items as it enhance productivity and improves quality. Establishment of a pilot laser unit at CMRDI will certainly help acquainting the local industry with this relatively new technology .

On the other hand the already existing CNC turning machine and vertical machining centre need upgrading as CNC cutting techniques will represent an integral part of this proposed project .

iii - **heat treatment**

The final desired properties of most metallic items could be reached only after the appropriate heat treatment cycle. The heat treatment department at CMRDI needs upgrading before it may be used in introducing important processes such as induction hardening , chemical hardening, austempering..etc.., which largely contribute to the required properties and performance of metallic parts.

iv - **performance evaluation** :

Evaluation of long-term performance of metallic objects and weld joints such as fatigue and creep resistance is frequently demanded by different industrial sectors. Although primordial, these testing facilities are not available at CMRDI

V - **Required Japanese experts** :

		No. required
1.	Team leader (long term)	1
2.	Team coordinator (long term)	1
3.	Laser (long term)	1
4.	Die casting (short term)	1
5.	Precision casting (short term)	1
6.	Fracture mechanices (short term)	1
7.	Sand molding processing (short term)	1
8.	CNC programing & operation	1

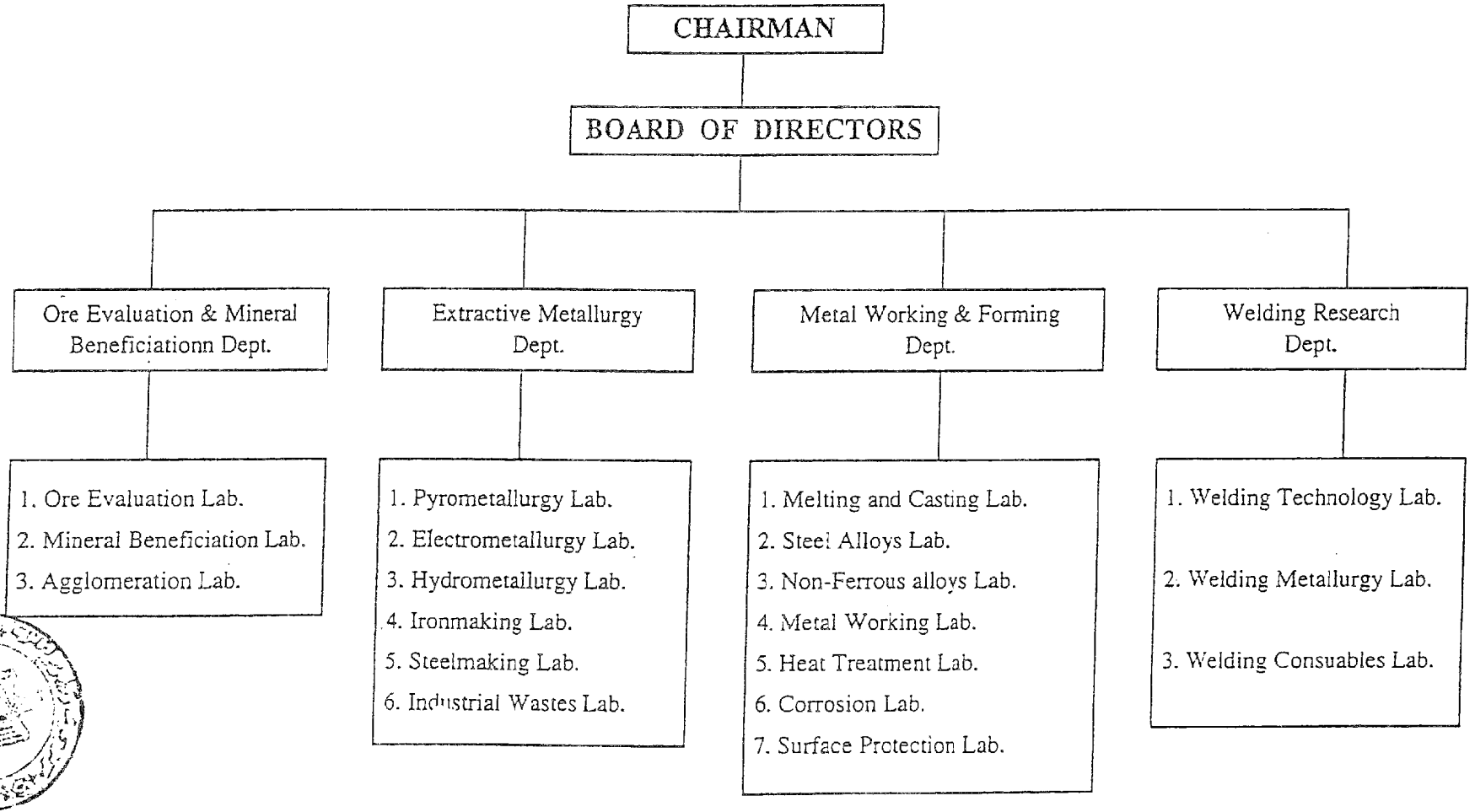
VI - **Required Equipment** :

		Estimated Price (1000 US $)
1.	Laser machine	900
2.	Heat treatment furnaces	200
3.	Sand molding facilities	150
4.	CNC (additional control unit)	150
5.	Fatigue machine	250
6.	Die casting facilities	200
7.	Creep machines	150
	Total	2000

VII - **Training Activity** :

CMRDI has a long experience in conducting third country training programs (TCTP) in welding. Therefore CMRDI will continue to assume its regional role to support this activity in the field of metal casting and processing, subject of this project proposal.

The Latest Structure of CMRDI



3 調査団質問状及び回答

MI 658 号(2/2)

QUESTIONNAIRE
FOR THE PRELIMINARY STUDY TEAM
ON THE PROPOSED PROJECT
ON DEVELOPMENT OF METALLURGICAL ENGINEERING TECHNOLOGIES
IN THE ARAB REPUBLIC OF EGYPT

This questionnaire is designed to grasp the current situation of Central Metallurgical Research and Development Institute (hereinafter referred to as "CMRDI") and the proposed Project on Development of Metallurgical Engineering Technologies (hereinafter referred to as "the Project"), in line with the dispatch of Preliminary Study Team of JICA for the Project in March or April 1999. It will be highly appreciated if you could prepare the answer in writing for the following questions and submit them to JICA Egypt Office at your earliest convenience not later than February 10, 1999. Due to the limit of time, you may be allowed to put priority on the questions which are underlined to prepare and submit the answers by the above-mentioned date.

Although some questions may have been answered already in the Project proposal submitted by your side, we would like to confirm the latest information on the Project.

It is highly appreciated if you understand that the fields of technology transfer mentioned below are not always to be included in the Project, even if it is realized, with the possibility to implement one (1) or two (2) at most among four (4) proposed fields of technology transfer in the Project.

Please also understand that before the dispatch of the said Team, additional questionnaire might be sent to you for the supplementary information.

Thank you for your kind cooperation in advance.

I QUESTIONS RELATED TO CMRDI

1 Please inform us of the latest organization chart and functions of the following ministries and agencies:

(1) Ministry of Scientific Research

(2) Central Metallurgical Research and Development Institute (CMRDI)

(Remarks) Please inform us of the current status of the proposed organization chart of CMRDI shown in page 23 of CMRDI's Development Plan (1997-2001) (hereinafter referred to as "the CMRDI's Plan").

(3) Please inform us of the organization chart and functions of the ministries and agencies related to CMRDI, if any.

2 Please inform us of the following information related to the

current situation of CMRDI:

(1) Detail function of each department of CMRDI
   a Ore Evaluation & Mineral Beneficiation Department
   b Extractive Metallurgy Department
   c Metal Working & Forming Department
   d Welding Research Department
   e The following New Departments mentioned from pages 19 to 21 of the CMRDI's Plan:
      (a) Process Engineering Department
      (b) Material Testing and Central Services Department
      (c) Simulation and Modeling Unit
      (d) Techno-economic Feasibility Studies
      (e) Marketing

(2) Number of staff in each department, and the speciality of each staff

(3) Salary standard in comparison to private corporations, average working year per staff and frequency of job hopping

(4) Settlement accounts of CMRDI from 1994 to 1998 by categories, if possible:

(5) Annual earned income of CMRDI from 1994 to 1998, if possible, by categories such as R&D projects, training courses, technical consultancy and etc.

(6) Budget of CMRDI from 1999 to 2001 in line with the above categories

(As far as the above (4), (5) and (6) are concerned, please refer to Annex 1 as a sample)

(7) Current activities of CMRDI in the following categories, of the fields related to the Project (Please fill in Annex 2 for a and c below and Annex 3 for b below):
   a R&D
   b Training course
   c Technical Consultancy

3 Relations with other bi-lateral and multi-lateral aid agencies, which has assisted, assist and will assist CMRDI
Please inform us of the detail of the following assistance or cooperation including duration of cooperation, target group, contents of assistance, equipment provided and etc:

   a Foundry
      (a) Dutch government(TNO)'s assistance to the establishment of the existing foundry shop of CMRDI
      (remarks) Please inform us of the relationship between the Project and the equipment provided by the TNO's assistance.
      (b) Dutch government's contract with CMRDI to train the foundry engineers operating Khartoum Central Foundry
      (c) African Foundry Network Project being considered by IDRC-Canada
      (d) Extensive training program organized in Libya through the Industrial Research Centre in Tripoli

b Assistance for the other fields than foundry related to the Project from the following organizations/countries:
(a) UNDP
(b) UNIDO
(c) Holland
(d) Germany
(e) Sweden
(f) Canada
(g) Korea
(h) Assistance from the other organizations/countries

4 The list of existing equipment in CMRDI of the fields related to the Project proposal
Please fill the Annex 4 in line with the followings. As far as the demarcation of the fields related to the Project is concerned, please refer to 7 below:

(a) Field
(b) Name of equipment
(c) Specification
(d) Manufacturer
(e) Country where the equipment manufactured
(f) Provider
(g) Date (to be) installed at CMRDI
(h) Current condition of operation
(i) Current condition of maintenance
(j) Availability for the Project

Remarks : As far as the equipment of the proposed field of lost-wax precision casting is concerned, please inform whether equipment related to the followings are existing at CMRDI or not, and if existing, please also inform the detail of the equipment in line with (a) to (j) above.

(k) Wax injection
(l) Dipping
(m) Stuccoing
(n) Dewaxing
(o) Furnace
(p) Others

5 Please raise the three (3) most important technical services provided by CMRDI to support small and medium scale enterprises.

II QUESTIONS RELATED TO THE PROJECT

6 Please explain the present condition and future prospect of

small and medium scale industries both in Egypt and the related regions targeted by the Project.

(1) Criteria among micro, small, medium, and large industries
(2) Number of the said scale of industries by sectors (last five years and projection)
(3) Number of employees of the said scale of industries by sectors (last five years and projection)
(4) Development policy towards the promotion of small and medium scale industries

7 Please inform us of the background and the needs of technology transfer for the following fields and items in the lights of the needs of CMRDI and Egypt, including numerical or statistical data such as the amount of the product, the number of companies and the amount of export/import from/to Egypt, whatever applicable:

(1) casting
  a lost-wax precision casting
    (Remarks: As far as this item is concerned, please also inform which material you consider to include in the Project such as aluminum and iron.)
  b die casting technology
    (Remarks: As far as this item is concerned, we regarded it as "high pressure die casting" and not as "gravity die casting." Please also confirm. If our understanding is not correct, please comment the detail.)
  c vacuum induction melting of special alloys
  d others
(2) metal processing
  a laser cutting
  b CNC cutting
  c others
(3) heat treatment
  a induction hardening
  b chemical hardening
  c austempering
    (Remarks: Regarding this field, we understand that the austempering in this field is regarded as austempering to manufacture ductile cast iron. Please confirm. If our understanding is not correct, please comment the detail. Please also inform us of the current development situation of austempered ductile cast iron in Egypt.)
  d others
(4) performance evaluation
  a fatigue resistance
  b creep resistance
  c others
(5) die manufacturing techniques
(6) welding
(7) total quality control

(8) powder-metallurgy

(Remarks) As far as the above (1)c, (5), (6), (7) and (8) which was listed in the proposal dated August 1996 concerned, please also inform us of the reason of being declined for the technology transfer in the latest proposal of the Project.

8 Please inform us of the detail of technology you proposed to be transferred in the Project for the fields listed in the above 7, such as methodology (lecture, hands-on training, on-the-job training in model companies, etc) and specific items of technology transfer.

9 Please inform us of the priority of the each field and item for the proposed technology transfer in the Project listed in the above 7, and the reason why such priorities are put.

10 Please specify both the present and desirable level of the technology of the proposed fields of the technology transfer particularly targeted on the small and medium scale industry, and make any comment on the level of technology to be targeted in the Project. Please answer in line with the fields listed in the above 7.

11 If you have any specific plan or idea to make the technology transferred by the Project disseminate to the region, please inform in detail including fields, target countries/groups and methodology of dissemination.

12 Please inform us of the relationship between the Project and the needs of private sectors mentioned in "V. TECHNOLOGICAL NEEDS OF THE CLIENT DURING THE NEXT FIVE YEARS" of the CMRDI's Plan (refer to pages 24 to 28), including the relationship with the specific items in the said "TECHNOLOGICAL NEEDS" and the proposed field of technology transfer in the Project:

13 Please inform us of the relationship between the Project and the following proposed R&D projects of CMRDI mentioned in "VI.PROPOSED R&D PROJECTS TO MEET CLIENT'S NEEDS FOR THE NEXT FIVE YEARS" of the CMRDI's Plan (refer to pages 29 to 41) in the following fields, including the relationship with the specific R&D PROJECTS to be conducted in the Project including the information of contents, duration, budget and etc:

(1) Foundry training and technology transfer network in Africa and Middle East (B-8 in the said list of PROPOSED R&D PROJECTS)
(Remarks: Please also inform us of the relationship between the Project and the activities supported by IDRC of Canada)

(2) Metal fabrication of thin metal sheets (B-10 in the said list of PROPOSED R&D PROJECTS)

(3) Other project in the said list of PROPOSED R&D PROJECTS related to the Project, if any
(4) In line with the above, please inform us of the definition of R&D projects in CMRDI.

14 Please inform us of the relationship between the Project and the equipment to be facilitated in CMRDI mentioned in "VII RESOURCES NEEDED BY CMRDI OVER THE NEXT FIVE YEARS" of the CMRDI's Plan (refer to pages 42 to 47) listed along with the name of the following department, including the information of the plan how to use each related equipment in the Project:
(1) Ore Beneficiation Department
(2) Process Metallurgy Department
(3) Metal Processing Department
(4) Welding Department

15 Project site
(1) Please inform us of the layout of the proposed Project site, including the current use and the specific use for the Project. It is appreciated if you can provide us with the drawings of the said Project site.
(2) Please inform us of the current situation of "BUILDING BAR CHART" indicated in the CMRDI's Plan (refer to page 49). Please also implement which part of the activities shown in the said "CHART" is related to the Project

16 Please inform us of the basic information (including name, specification, capacity and usage) of the following equipment proposed in the latest proposal of the Project to be provided by the Japanese side:

(1) Laser machine
(2) Heat treatment furnaces
(3) Sand molding facilities
(4) CNC
(5) Fatigue machine
(6) Die casting facilities
(7) Creep machines

17 Please inform the priority of the proposed equipment mentioned in 16 above.

18 Please inform us of the data on the candidate Egyptian counterpart personnel including the following information:
(1) Name
(2) Age
(3) Sex
(4) Section and title
(5) Speciality (including years of experience in his speciality)
(6) Qualification

(7) Educational background
(8) Experience of working and/or studying abroad
(8) Years of service in CMRDI
(9) Field(s) of technology transfer in the Project in charge

19 Please inform us of your plan to establish training courses and the other services in CMRDI through the technology transferred by the Project, including the course's target groups and areas.

III Other relevant information

20 Please provide us of any information which will facilitate our understanding of the activities of CMRDI.

Annex 1

1993

Expenditure	Estimated (A)	Acutual (B)	(B)/(A)	Income	Estimated (A)	Acutual (B)	(B)/(A)
Personnel Expenses	135,000	135,650	100.48%	Training Fee	18,000	16,500	91.67%
Utilities	20,000	19,550	97.75%	Software Development	55,000	60,150	109.36%
Office Consumables	23,000	22,940	99.74%	Others	125,500	122,211	97.38%
Furniture & Office E.	500	650	130.00%				
Maintenance	12,000	15,140	126.17%				
Others	8,000	7,450	93.13%				
TOTAL	198,500	201,380	101.45%	TOTAL	198,500	198,861	100.18%
				Income/Expenditure(Actual)			98.75%

1994

Expenditure	Estimated (A)	Acutual (B)	(B)/(A)	Income	Estimated (A)	Acutual (B)	(B)/(A)
Personnel Expenses	145,000	143,900	99.24%	Training Fee	25,000	26,050	104.20%
Utilities	20,000	19,800	99.00%	Software Development	65,000	62,170	95.65%
Office Consumables	25,000	24,150	96.60%	Others	126,000	125,100	99.29%
Furniture & Office E.	1,000	925	92.50%				
Maintenance	15,000	15,950	106.33%				
Others	10,000	9,520	95.20%				
TOTAL	216,000	214,245	99.19%	TOTAL	216,000	213,320	98.76%
				Income/Expenditure(Actual)			99.57%

1995

Expenditure	Estimated (A)	Acutual (B)	(B)/(A)	Income	Estimated (A)	Acutual (B)	(B)/(A)
Personnel Expenses	155,000	154,350	99.58%	Training Fee	28,000	29,215	104.34%
Utilities	25,000	25,750	103.00%	Software Development	72,000	70,376	97.74%
Office Consumables	27,000	28,150	104.26%	Others	139,300	140,220	100.66%
Furniture & Office E.	1,800	1,640	91.11%				
Maintenance	17,500	18,250	104.29%				
Others	13,000	11,905	91.58%				
TOTAL	239,300	240,045	100.31%	TOTAL	239,300	239,811	100.21%
				Income/Expenditure(Actual)			99.90%

Annex 2 Detail of R&D/Technical Consultancy

Subject	Content	Duration	Target company /organization	Note

(Remarks) As for the following items, please apply the legends as shown below.

(a) Content (Please make multiple choices, if needed.)

i introduction
ii research
iii development
iv production
v quality improvement
iv other ( )

(b) Duration

i less than one (1) day
ii less than one (1) week
iii less than one (1) month
iv less than one (1) year
v over one (1) year

Annex 3 Detail of Training Course

Subject	Content	Training Period	Number of Attencance	Frequency	Note

(Remarks) As for the following items, please apply the legends as shown below.

(a) Content (Please make multiple choices, if needed.)
- i basic information
- ii operation of equipment
- iii planning of test procedure and evaluation of test results
- iv acquisition of qualification
- v other ( )

(b) Training period
- i less than one (1) day
- ii less than three (3) days
- iii less than one (1) week
- iv less than one (1) month
- v less than half a year
- vi less than one (1) year
- vii over one (1) year

(c) Number of attendance
- i less than ten (10)
- ii less than twenty (20)
- iii more than twenty (20)

(d) Frequency
- i once a week
- ii once a month
- iii once a year
- iv other( )
- v upon request (ad-hoc)

M 2 658 5 (7/12)

Annex 4 The list of existing equipment in CMRDI of the fields related to the Project proposal

No.	Field	Name	Specification	Manufacturer	Manufctured country	Provider (1*)	Installed Date	Operation (2*)	Maintenance (3*)	Availability (4*)

As for the (1*) - (4*), please fill one of A - C.

(1*) A: EGYPT
B: JAPAN
C: Other Donors (Please specify)

(2*) A: Operated many times
B: Operated a few times
C: almost not operated

(3*) A: Good
B: Necessary to repair (operated now)
C: Necessary to repair (not operated now)

(4*) A: Existing and to be used in the Project.
B: Existing but to be replaced to be utilized in the Project.
C: Existing but to be increased to be utilized in the Project.

回答（その１）

1. Latest organization chart and function of the ministry:

(1) Latest organization chart is shown in Fig. 1.

(2) The state ministry of Scientific Research and Technology is the top authority of the Academy of Scientific Research and Technology and the Twelve National Research Institutes :-

- Academy Of Scientific Research and Technology.
- Mubarak City For Scientific Research and Technological Applications .
- National Research Center .
- National Authority For Remote Sensing & Space Sciences .
- Central Metallurgical Research and Development Institute .
- Petroleum Research Institute .
- Technical & Technological Consulting Studies Research Fund .
- National Institute Of Astronomy and Geophysics.
- National Institute Of Standards .
- National Institute Of Oceanography and Fisheries.
- Theodre Belharz Research Institute
- Electronics Research Institute .

Each institute has its own autonomy and the chairman of the institutes reports directly to the minister of the Scientific Research and Technology. CMRDI has its own board of directors which is chaired by its chairman. Board members are the vice chairmen, the heads of the four departments, the four chairman of the big holding campanies who have strong ties with CMRDI, in addition to other four members representing universities and research institutions.

The proposed organization chart of CMRDI shown in page 23 of CMRDI's Development plan (1997 –2001) is still in progress to be adapted with restructuring plan of CMRDI which is under way in order to be in good harmony and coordination with the privatization move of public sector which is taking place in Egypt now.

(3) The organization chart of the state ministry of Scientific Research and Technology is shown in Fig. 2

2-2 Number of staff in each department at CMRDI is as follow.

MI 545 3/6

Dept.	Researchers	Technician
1- Ore Evaluation an Beneficiation Department Research and Technicians.	29	17
2- Extractive metallurgy Dept.	48	37
3- Metal Working & Forming Dept.	46	53
4- Welding Technology Dept.	16	24

2-5 The earned income of CMRDI over the past 10 years is show in the attached table.

3- Relations with other bi-lateral and mult-lateral aid agencies; CMRDI is still maintaining its closed relationship with all aid agencies such as TNO, IDRC, GTZ and US-aid. The new relationship is aiming at extending the activities of CMRDI to the neighbouring countries in Africa and Middle East in addition to the practical utilization of donated equipments in the national scale for R & D projects through receiving some experts or sending trainees abroad to gain some experiences in different fields .

4- The list of existing equipment in CMRDI on the fields related to the project proposal is under preparation and will be submitted to JICA as soon as it is finished .
Lost wax precision casting equipment is available at CMRDI and its condition is :

Field : Lost wax precision casting unit.

Equipment :

1- wax injection machine (injection pressure 0 - 1500 psi)
- Mueller Phipps International, USA model 54 12 serial 0 848 injes .

2- Turn table Slurry Mixer :
- Red Oaks Mill Machine Corp. (Rommco) U.S.A
Model RT sM – 100

3- Fluidized Bed Model FCC – 24.

4- Four Slurry Stirrers, locally manufactured .

N.B. :

- The equipment are already installed at CMRDI and are in good operation conditions - They are available 100% for the project .

- The dewaxing furnace may be locally manufactured, but the sintering furnace has to be provided through the project .

Meanwhile, it should be noticed that most of the available equipments in the fields related to the project are fully utilized in R & D activities to support the Egyptian industries. However, it should be also stated that most of these equipments are conventional ones such as small induction furnaces and conventional casting facilities,semi-pilot scale rolling mill, up-set forging machine CNC Milling and lathing machines, shear (up to 10mm thickness bending machine (up to 10mm thickness), roller (up to 10mm thickness. The are evaluation and beneficiation department has a complete set of ore processing pilot plant. The equipment of Welding Research Dept. are attached therewith.

There is a lack of heat treatment facilities.

5- The most important services provided to support small and medium scale enterprises are :

1- Provision of needed spare parts which they can not obtain at the market either because the required number is small or the required quality can not be a chivied at local market. CMRDI is serving more than 150 companies with different types of spare parts.

2- Testing and characterization of some products of SMES as well as some of the input materials for essuing the quality certificates.

3- process development and improving the quality of the products as well as introducing new products particularly in the case of alloy steels and modern cast iron in many of the foundry shops.

4- Introduction of quality control and quality assurance system in many companies such as house appliances manufactures and structural steel companies.

5- Failure analysis and trouble shouting of plant equipment as well as helping in plant maintenance.

6- Transfer the technology of production of spare parts and machine parts such as parts used in textile factories and rolls used in rolling mills .

7- Substitution of imported materials with local ones after investigating the needed quality and adaptation of local materials to fit the production and quality requirements for many products.

8- Training and qualification of welders and inspectors of many companies.

9- Carring on non destructive testing on plant equipment during the shut down times and maintenance periods particularly in powers station, chemical plants, refineries and engineering plants.

10- Solving some specific technical problems which faces SMES.

6- The present condition and future prospect of small & medium scale industries.

SMES in Egypt is divided into two categories; one is the remaining public sector which is relatively old and its machines and equipment as well as applied technology is relatively old and obsolite, the others are the new private sectors which started at the seventies and its machines and equipments are relatively new . many of the private sector are almost export oriented sector Therefore it needs continuous support for maintaining the quality of its products and updating the technology continuously . This sector needs also special support for testing and characterizing the products since they can not afford to establish their own testing laboratories and facilities. Therefore, it is very important that CMRDI has to prepare itself to support this growing sector to be able to keep the quality of its products and improve and upgrade the present quality at lower cost in order to compete in the market.

7- With regard to the needed statistical data concerning the lost wax precision casting, die casting, metal processing and heat treatment, CMRDI is conducting such study and collecting necessary data from concerned sources and will be submitted to JICA as soon as it is ready. However, based on demands of the growing private sector of SMES in Egyptian, there is a large demand for introducing new products and materials specially for engineering companies and the growing market of automotive manufacturing in Egypt. Textile industries also need a lot of spare parts which needs special technique for production in a relatively small amounts that normal manufacturing companies can not produce. Besides, Being a R

& D Center, CMRDI should think for future and be a head of the companies for mastering and introducing new and modern technology such as laser technology and CNC cutting technique either for Egyptian industries or for the region in Africa and Middle East. CMRDI is considered as a regional center for metallurgical industries. It service not only metallurgical sector, but chemical petrochemical, engineering, construction and energy sectors.

a) Lost wax precision casting is supposed to be used for aluminium alloys, steel -alloys and even supper alloys since CMRDI is not a specific manufacturer, but as a research institute, it is supposed to be diversified to fit itself with the industrial demands.
b) It is supposed to be a high pressure die casting machine .

(3) Regarding the austempering, it is supposed to be for ductile cast iron since CMRDI has got enough experience in producing such material and it plays an important role to transfer the technology of production of ductile cast iron to many companies in Egypt and Africa, it will be of great importance to play the same role in the production of austempered ductile cast iron..

(4) As for performance evaluation, it is very important to have a well established testing laboratory to assist SMES in testing and characterizing their products.

10- As mentioned above, the anticipated project is targeting on the first priority the SMES in both Egypt as well African and Middle eastern countries. In some cases it has to be at the same level of technology with the existing modern companies. Meanwhile, it should proceed ahead of the companies as being a R & D institute to guide and help existing companies for developing their technology and products. Therefore, the desirable level of the technology transfer should be fitted with this target to assist SMES to for further growing to compete in the international market.

11- Certainly, it is a principal target to CMRDI as a regional institute to transfer the technology to its neighboring countries in Africa and the middle east in all concerned fields such as casting technology, welding & technology, sheet metal fabrication as well as metal forming and shaping and cutting technology, CMRDI will work for disseminating the aquired technology to African and middle east countries through conducting the Third Country Training programs and receiving trainees from these

countries either in group or as individuals in any field related to its activities. CMRDI will also dispatch its experts upon requests from those countries in related fields under the scheme of Third Country experts program. The experience which is gained from the Third Country Training Program on Welding Technology for African Engineers as well as other experience with African and middle eastern countries, encourage CMRDI to play its anticipated role in assisting neighboring countries as a regional institute in order to help them for the development of their countries.

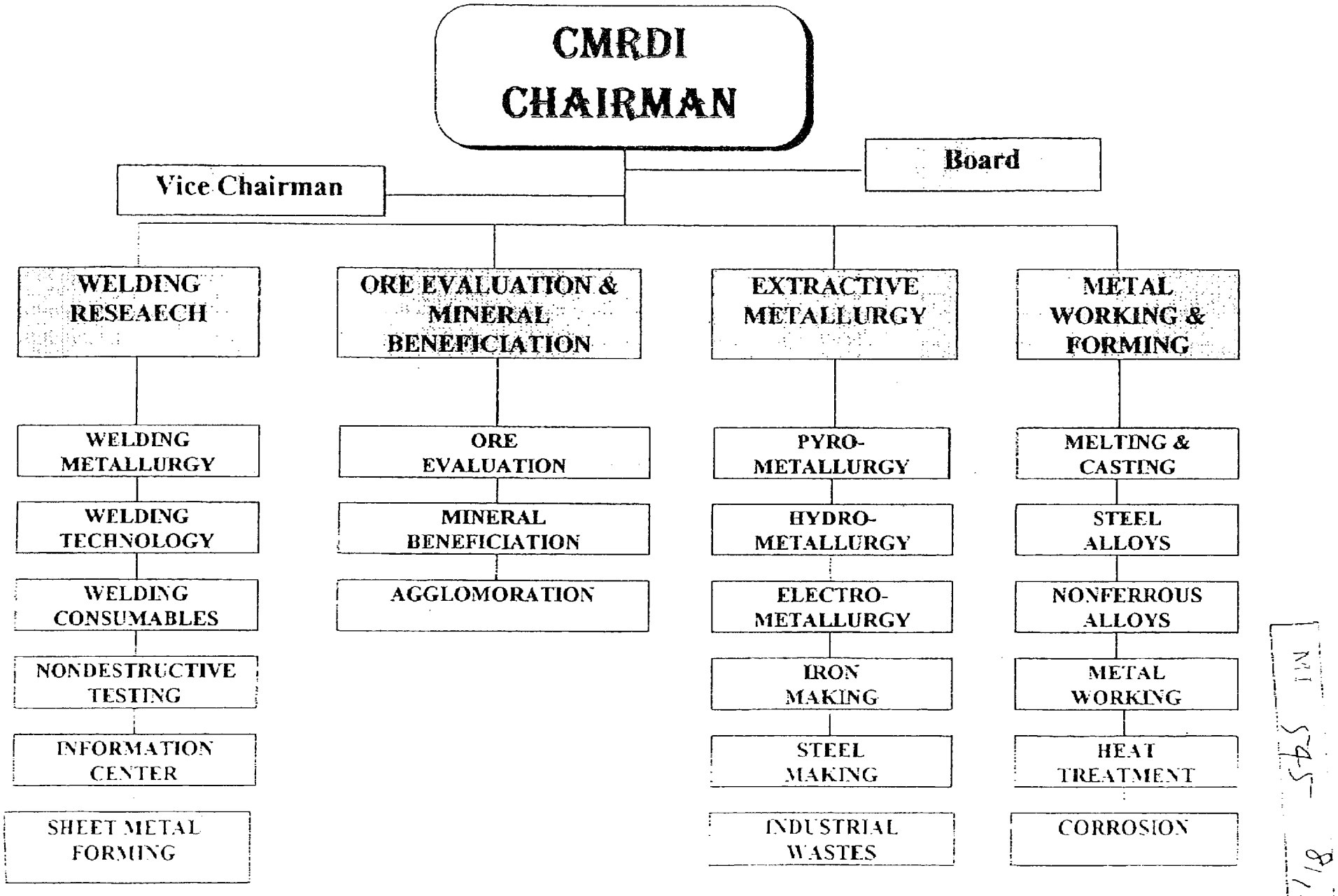
13- The relationship between the project and the other R & D projects mentioned in VI proposed are closely related to each others since such R & D proposed projects need some material and technical support from developed country such as Japan which signed an cooperation agreement with Egypt to support African countries during TICAD II. Therefore, this project will have an important role in materializing this agreement by North –Thouth – Thouth cooperation in technology transfer and human resource development in Africa. The cooperation will cover foundry technology, welding technology and sheet metal fabrication technology as well as heat treatment and metal shaping and cutting. Those fields are very important and necessary for the development of any country in Africa.

14- The layout of the project side is attached herewith and 80% of the activities mentioned in the Bar chart in page 49 has been completed, the remaining 20% is on the way and is supposed to be finished by the end of this fiscal year on June 1999. This including the laboratory building which will accommodate the equipment of the project. Main infrastructure works have been completed as well.

18- Counterparts :

Name : Prof. Dr. Adel Nofal
Age : 57
Sex : Male
Title : Chairman CMRDI
Specialty : Foundry Technology & Metallurgical Engineering
Years of Experience: 35

Name : Bahaa Zaghloul
Age : 54
Sex : Male
Title : Head of Welding Research Dept.
Specialty : Welding Technology & metallurgical Engineering.
Year of experience : 32


CMRDI
CHAIRMAN
Board
Vice Chairman
WELDING RESEAECH
ORE EVALUATION & MINERAL BENEFICIATION
EXTRACTIVE METALLURGY
METAL WORKING & FORMING
WELDING METALLURGY
WELDING TECHNOLOGY
WELDING CONSUMABLES
NONDESTRUCTIVE TESTING
INFORMATION CENTER
SHEET METAL FORMING
ORE EVALUATION
MINERAL BENEFICIATION
AGGLOMORATION
PYRO-METALLURGY
HYDRO-METALLURGY
ELECTRO-METALLURGY
IRON MAKING
STEEL MAKING
INDUSTRIAL WASTES
MELTING & CASTING
STEEL ALLOYS
NONFERROUS ALLOYS
METAL WORKING
HEAT TREATMENT
CORROSION

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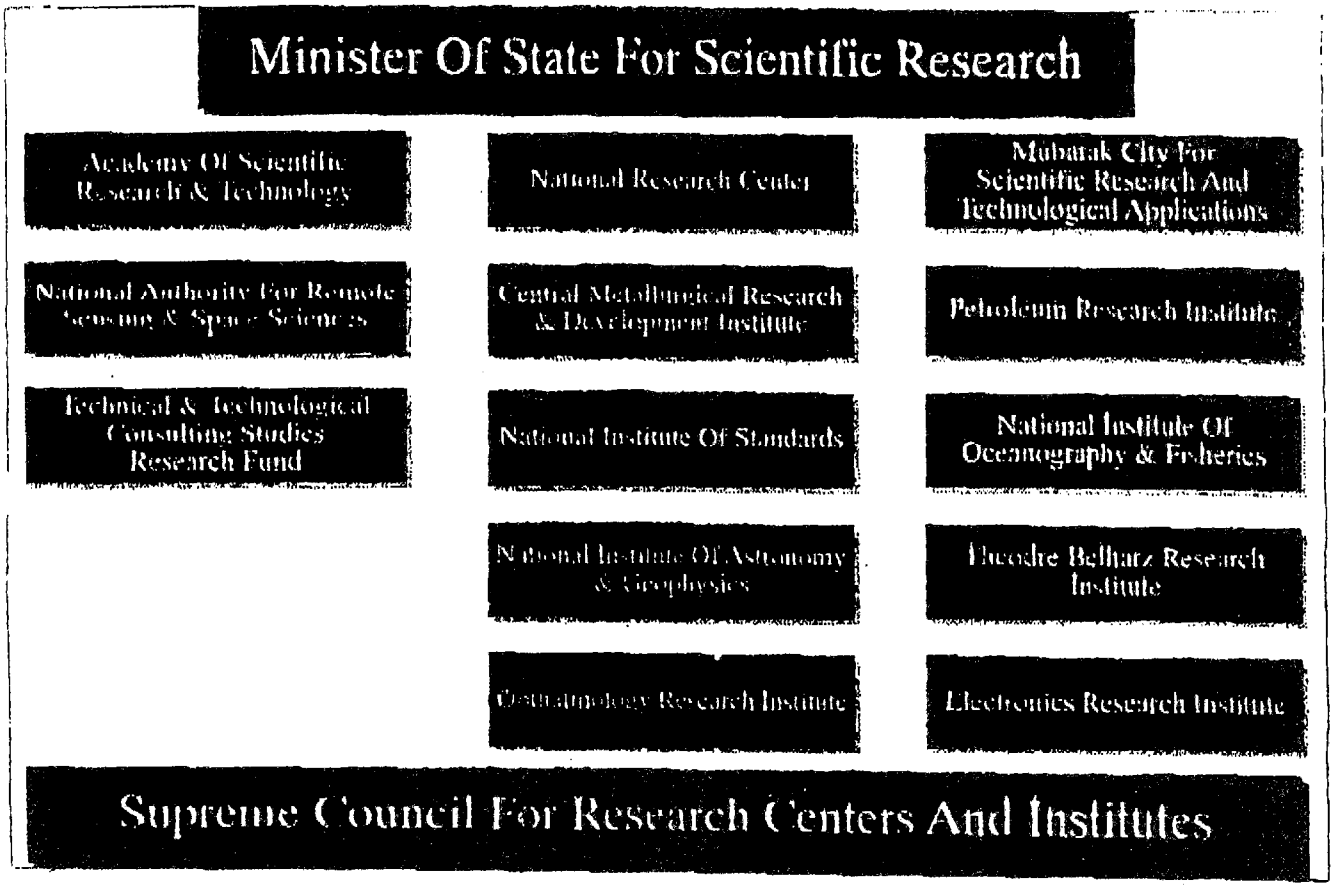

Minister Of State For Scientific Research
Academy Of Scientific Research & Technology
National Research Center
Mubarak City For Scientific Research And Technological Applications
National Authority For Remote Sensing & Space Sciences
Central Metallurgical Research & Development Institute
Petroleum Research Institute
Technical & Technological Consulting Studies Research Fund
National Institute Of Standards
National Institute Of Oceanography & Fisheries
National Institute Of Astronomy & Geophysics
Urban Planning Research Institute
Supreme Council For Research Centers And Institutes

Equipment available at Welding Research Department الأجهزة والخدمات المتاحة

Major Equipment of Metal Forming Workshop

- Hydraulic shear cutting machine for up to 12 mm thick	1 set
- Hydraulic press bending machine for up to 12 mm thick	1 set
- Hydraulic roll bending machine for up to 12 mm thick	1 set
- Arc welding machine	3 sets
- MAG - MIG welding machine	3 sets
- TIG welding machines	3 sets
- Gas cutting set	1 set
- Cutting and grinding disc	1 set
- Plasma cutting machine	1 set
- Table type drilling machine	1 set
- Column type drilling machine	1 set

Major Equipment of Welding Workshop

- Arc welding machine KRA-300	6 sets
- Arc welding machine KRA-500	2 sets
- Arc welding machine	14 sets
- Automatic TIG filler wire	1 set
- No gas semiautomatic welding machine	1 set
- Automatic pipe cutter	2 sets
- Automatic positioner	1 set
- Full automatic submerged arc welding machine	1 set
- TIG welding machines	
Plasma cutting and welding machine	1 set
TIG welding machine	4 sets
- Semiautomatic CO_2 gas welding machine	3 sets
- Gas shielded arc welding machine (MIG)	3 sets
- Electrodes drying oven	1 set
- Gas automatic cutter	1 set
- Transistor automatic pulsating welding machine	1 set
- Spot welding machine	1 set
- Post welding heat treatment	1 set

Mechanical Testing Facilities

- Universal tension testing machine	
30 tons	1 set
50 tons	1 set
- Creep rupture testing machine	1 set
- Impact testing machine (30 tons)	1 set
- Rotating bending fatigue testing machine	1 set

Machining Facilities

- Shaping machine	1 set
- High speed cutting machine	1 set
- Semiautomatic saw	1 set
- High speed disk grinders	1 set
- Table-type drill machine	1 set
- Bench grinders	3 sets
- Manual grinders (different sizes)	20 sets

Nondestructive Testing Facilities

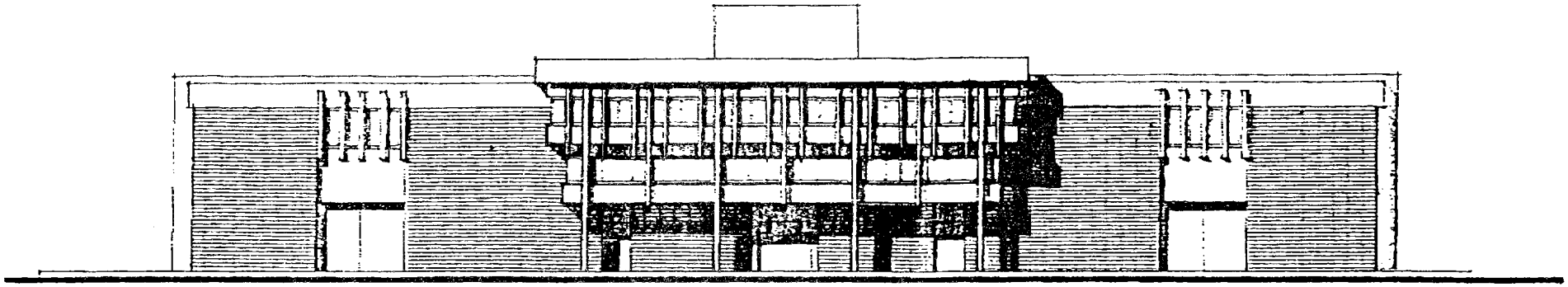
- X-Ray radiation apparatus	3	sets
- Film processing facilities		
- Densitometer		
- Mobile dark room for film processing		
- Ultrasonic flaw detector	3	sets
- Ultrasonic thickness meter	2	sets
- Wide range of Probes (several types)		
- Wide range of standard test and reference blocks		
- Portable magnetic yoke(Magna) with accessories	1	set
- Dye penetrant testing facilities, several types		
- Portable metal spectrometer 1 set	1	set
- SUMP testing (nondestructive, metallographic examination)	2	sets
- Portable hardness tester	1	set
-Eddy current testing apparatus	1	set

Welding Metallurgy Facilities

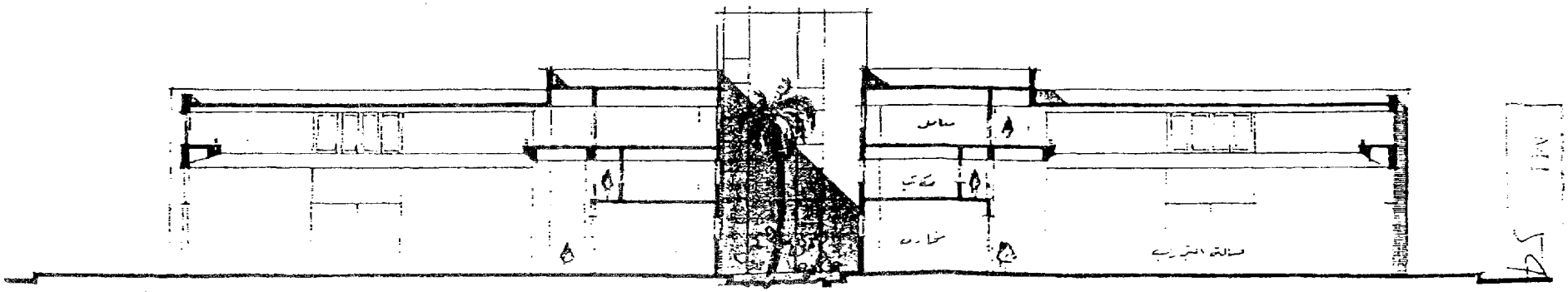
- Scanning Electron Microscope JOEL JSM 20	1	set
- Quantemet (image analyzer)	1	set
- Strain gauge meter(32 channel)	1	set
- Profile projector	1	set
- Brinel hardness tester HB type	1	set
- Vickers hardness tester	1	set
- Constant temperature & humidity chamber	1	set
- Metallurgical microscopes	3	sets
- Stereoscope	1	set
- Portable ferritescope	1	set
- Deferential thermal analyzer	1	unit
- Multichannel X-Y recorders	2	sets
- Varestrain testing machine	1	set
- Water cooled cutting machine	1	set
- Polishing machine	2	sets
- Bakalite mould furnace	1	set
- Electrolytic etching	1	set
- Ultrasonic cleaners	2	set

Table (1) : Earned Income of Different Activities, Over the Past 10 Years at CMRDI.

Category of Activities	Earned Income, 1000 L.E.	%
i) Introduction of new technologies to the Egyptian industry	2150	6.48
ii) Production of new products as import substitutes	3100	9.35
iii) Development of a product or production process	2275	6.86
iv) Maximization of indigenous raw material exploitation	2908	8.77
v) Development of new alloys	250	0.75
vi) Environmental protection	678	2.04
vii) Development of small and medium enterprises SME's	680	2.05
viii) Failure analysis and trouble shooting	322	0.97
ix) Technical services and consultations	788	2.38
x) Nondestructive testing and third party inspection	830	2.50
xi) Training	1783	5.38
xii) Capability strengthening of CMRDI	17400	52.47
TOTAL	**33164**	**100.00**

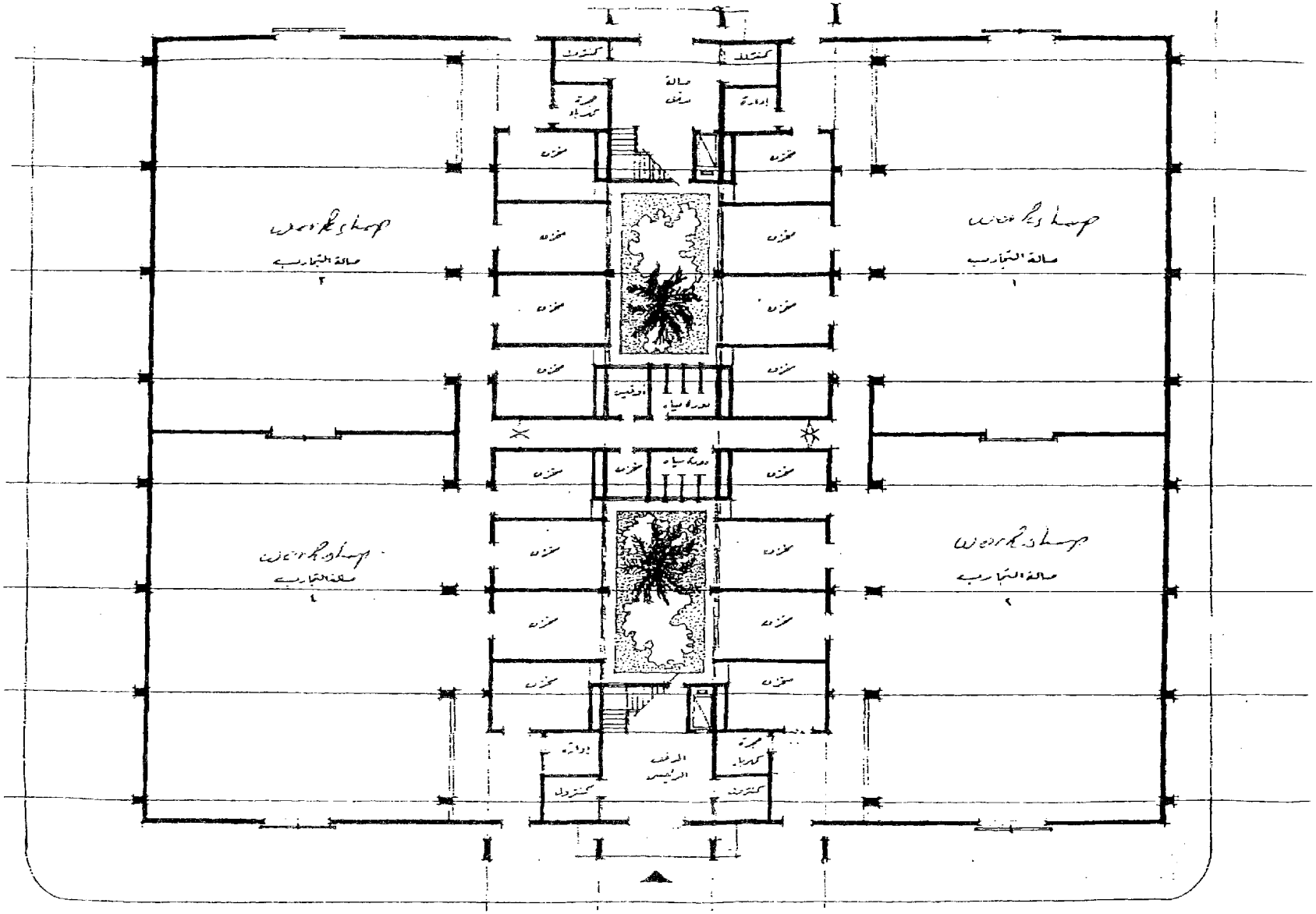


الواجهة الرئيسية ١:٢٠٠



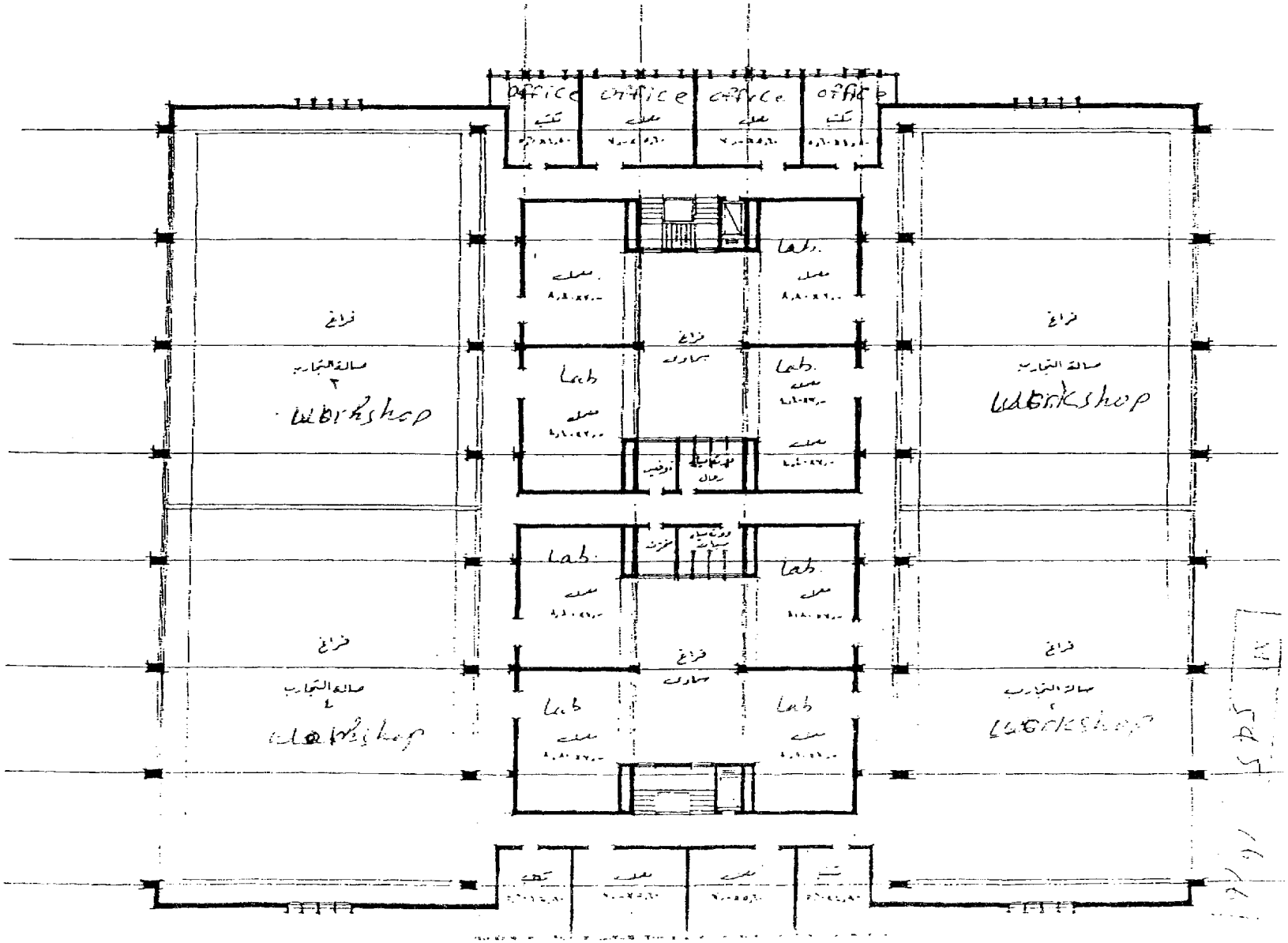
قطع طول ١:٢٠٠

New building for the project



مسقط الطابق الأرضي لمصانع التقارب والتعاون

Plan of the ground floor



Second & Third Floor

回答（その２）

MI	1/7

Fax Message

Res. Rep.	Deputy

Date : March 10, 1999

To :
MI
First Technical cooperation Division
Fax : 0081- 3-5352-5474

from : JICA Egypt Office
Mr. Mahmoud Abdel Halim
Tel : 20-2-574-8240
Fax : 5748243

Page (s) : (including this) 7

ATTENTION : Mr. Katsumata

TITLE :

Answer of Questionnaire for CMRDI Project

MESSAGE :

In reference to fax message dated (99.03.03) concerning the answer of the questionnaire for the Project on Development of Metallurgical Engineering Technologies in the Arab Republic of Egypt, please find attached the answer we recieved form Central Metallurgical Research and Development Institute (CMRDI).

Best Regards

Annex 4 The list of existing equipment in CMRDI of the fields related to the project proposal

No	Field	Specification	Manufacture	Manufacture Country	Provider	Installed date	Operation	Maintenance	Availability
1	Casting	Induction melting medium frequency furnace (100/ 120/350Kg)	BBC Brown Boveri	Germany	C Royal Dutch	1988	A	A	A
2	Casting	Induction melting medium frequency fernnace (10Kg)	Inductotherm UNDP United nations Dvelopment program		C Royal Dutch	1988	A	A	A
3	Casting	Cupla melting furnace (ton/ hr)	CMRDI	Egypt	A	1992	B	C	C
4	Casting	Electro-slag melting furnace (15Kg/hr)	Eguptalum	Egypt		1993			
5	Molding	2 pairs of jolt/ squeeze molding machines international	Russia	Russia	Royal Dutch	1988	A	C	A
6	Molding	2 pairs of jolts/ squeeze molding machines	GEMCO son - mold	Holland	Royal Dutch	1988	A	B	A
7	Molding	2 sand mixer(8 t/hr/Kg)	Maschinen- enfabrick Gustav Eirich	Germany	C	1988	A	A	A
8	Shell molding	Semi- automatic shell mold machine(300 pound sand tank & 15"x 20" pattern size plate)'	Df Dependable foundry equipment Co. Inc.	TULATIO OREGON	C	1995	C	C	A
9	Shell molding	Dependable shell mold bonding press	Df dependable foundry equipment Co. Inc.	TUALATIN OREGON	C	1995	C	C	A

No	Field	Specification	Manufacture	Manufacture Country	Provider	Installed date	Operation	Maintenance	Availability
10	Investment casting	Wax injector machine	Mueller Phipps international	U.S.A	C U.S.A	1995	C	C	C
11	Investment Casting	Fluidizing chamber	"	"	C	1995	C	C	C
12	"	Slurry mixers	"	"	C	1995	C	C	C
13	"	4 mixers	CMRDI	Egypt	A	1995	C	C	C
14	Sand testing	Green compression strength	(G.F) George Fisher	U.S.A	C UNDP	1987 1987	A	A	A
15	Sand testing	Permeability	"	"	"	1987	A	A	A
16	"	Wet tensile strength	"	"	"	1987	A	A	A
17	"	Mixture (3Kg, 5Kg)	"	"	"	1987	A	A	A
18	"	Speedy moisture tester	"	"	"	1987	A	A	A
19	"	Thermal expansion	"	"	"	1987	A	B	A
20	"	Seave analysis instrument	"	"	"	1987	A	A	A
21	"	Sand testing furnace	"	"	"	1987	A	A	A
22	"	Drier	"	"	"	1987	A	A	A
23	"	Green compression strength	Sintokogio LTD.	J.I.C.A	B	1987	A	B	A
24	Quality control	Chemical analysis apparatus 4- base (Fe-Cu-Al-Ni)	A.R.L	Swiss	A	1987	A	A	A
25	"	Chemical analysis apparatus 3- base (Fe-Cu-Al)	Spectro	Germany	A	1995	A	A	A

No	Field	Specification	Manufacture	Manufacture Country	Provider	Installed date	Operation	Maintenance	Availability
26	Quality control	Optical microscope	PME Olympus	Japan	A	1986	A	A	A
27	"	Scanning Microscope (SEM	Joel	England	A	1996	A	A	A
28	"	Tribometer for measuring the wear resistance of castings)		Holand	(C) TNO	1988	A	A	A
29	Heat treatment	Electrical resistance furnaces ? Ø 1.5*2 m(up to 1100 C°)φ	Egyptalum	Egypt	A	1999	A	A	C
30	"	Salt bath furnace (300-600 C°)	C.M.R.D.I	Egypt	A	1999	C	A	C
31	Metal casting	CNC Lath machine two directions	Proftum 400S	Holand	(C) TNO	1992	A	B	A
32	"	CNC Milling Machine three direction X,Y,Z	Hartford	China	(C) TNO	1992	A	B	A
33	"	Conventional lath machine length 3m (full automation)φ			(C) TNO	1992	A	B	A
34	"	Universal milling machine max. diameter320 mm	TOZ		(C) TNO	1992	A	B	A
35	"	Table lathe	TOZ		(C) TNO	1992	A	A	A
36	"	Drilling machine drin hole form 1-40mm	Flon	Germany	(C) TNO	1992	A	A	A
37	"	Mechanical saw max. cut diameter 400 mm	C.M. (SCORTEGAGNA)	Italy	(C) TNO	1992	A	A	A

UNDP = United Nations Development Program
TOZ = Tos CELAKOVICE
TNO = Metals Research Institute
production technology and materials research

List of Heat Treatment Equipment

Equipment, Source	Heating Zone, W*H*D mm*mm*mm	Heating Element, Type & Dimensions, mm	Remarks
1- Muffle furnace, (Gallenkamp, England), 1982.	230X200X400	NiCr- heating wires	Operate
2- Muffle furnace, (Gallenkamp, England), 1982.	190X130X350	NiCr- Heating wires	Operate
3- Muffle furnace, (Lotus, Egypt), 1970.	160X100X300	SiC-glowbars 10mmX450mmX 3.25 ohm	~~Not~~ operate
4- Tempering furnace, (Birlec, ...). England, 1980	Φ270X280	Heating wires	Operate
5- Salt bath with two crucibles, (Wild Barfield, England...), 1978.	(Φ160&Φ270)X200	Electrical resistance	Not operate under maintenance
6- Three zone furnace, (Birlec, England.), 1978.	Φ95X1200	SiC- glowbars 14mmX650mmX3.7 ohm	Not operate
7- Chamber furnace, (Lindberg, USA), 1975	200X150X400	SiC- glowbars 20mmX750mmX3.7 ohm	Not operate Changed to Super cantal wires
8- Chamber furnace, (Gallenkamp, England), 1970.	220X170X300	Super cantal wires	~~Not~~ operate
9- Box furnace, (Lindberg, USA), 1975.	140X170X300	TiC- glowbars U-shape	Not operate under maintenance

M1 5/7

7- Background and needs of technology transfer :

As mentioned before, this project aims at upgrading the facilities and technical potential of CMRDI in order to be able to meet the anticipated requirements of the newly privatized industries and newly borne joint venture companies in Egypt. Such industries require many services and technical support from national institutes such as CMRDI as well as other research institutes and universities. The newly established SMES generally adapt new and modern technologies and its main target is to become export oriented. It has to be competent in the international market. This will be heavily dependant on research and development activities to improve the quality, reduce the production costs, increase productivity, utilize local materials and innovate new products. Taking as an example the automotive industries in Egypt which is propagating fast, this industry heavily depend on SMES to provide high quality spare parts, many of it are of general use and need to be produced according to the designated international standards which requires good efforts for technical support in many areas such as die casting particularly for aluminum alloys, metal cutting and shaping , heat treatment and some parts have to be produced by powder metallurgy technique. Other industries as well will have the same demands and CMRDI is already receiving many requests for technology support in such areas. Regarding the die casting technology in Egypt, there is now three public sector companies which are using this technology since the sixties and about 4 other private companies started to utilize this technology for production of their own spare parts. However, the market is still very big and is opened to accept many other quality products made by die casting. Therefore, it has become important for CMRDI to master such technology in order to support the industries.
Regarding laser technology, many SMES are now considering to utilize this technology for metal cutting, welding and surface hardening. Therefore, CMRDI has started already to train the staff on laser technology and is conducting some research activities in these fields in cooperation with laser institute at Cairo University and some foreign institutions including Japan. Same thing is applied on implementing CNC cutting technology.

Several companies in Egypt are conducting different heat treatment regimes according to their actual needs for their existing products. However, many of these companies can not adapt its facilities for new products or conduct several tests to obtain certain properties through the heat treatment methods. It is very often, that CMRDI recreves many orders to develop a scheme for heat treatment on particular job or to improve the quality of some materials by heat treatment. However, the existing facilities at CMRDI are very

moderate and many of it are on laboratory scale and can not meet the requirements needed to support the industries for the development of the properties of industrial materials .

Reference to performance evaluation of the materials, it has been previously stated that CMRDI should play such important role for SMES who can not afford to have fatigue testing, creep testing stress corrosion cracking, corrosion fatigue and other testing methods. Meanwhile, such facilities are very important for all research and development activities conducted by CMRDI staff.

The items (1)C (5) (6) and (7) are not intentially declined in the latest proposal, however, it was proposed that the existing mini project will cover these items. However, CMRDI still requests JICA's support in such important areas.

8- Methodology for technology transfer is supposed to be through :-

1- Supporting CMRDI library with necessary books, journals and technical reports in these respective fields.

2- Training CMRDI staff through Japanese experts at CMRDI .

3- Training of staff in model companies in Japan.

4- On-the-job training in CMRDI and Egyptian companies.

5- Supporting CMRDI staff in helping Egyptian companies by solving some industrial problems or developing new products or technique.

6- Providing necessary equipment and facilities at CMRDI .

9- Regarding the priority of each field mentioned in item 7, it is very difficult at present stage to distinguish one or another since they are all very important to Egyptian industries and African countries as well. Also, CMRDI as an R & D institute should be ready to face any request and solve encountered problems since it is the only national institute in the field of metallurgy in Egypt and its main duty is to support Egyptian industries. Therefore, it can be suggested to postpone the answer on this question until the JICA mission meets the staff at CMRDI and watch the actual posstion of CMRDI in order to discuss such priority according to the size of the project.

回答（その３）

Fax Message

Res. Rep.	Deputy

Date : March 25, 1999

To :
MI
First Technical cooperation Division
Fax : 0081 - 3-5352-5474

from : JICA Egypt Office
Mr. Mahmoud Abdel Halim
Tel : 20-2-574-8240
Fax : 5748243

Page (s) : (including this) **3**

ATTENTION : Mr. Katsumata

TITLE :

Answer of Questionnaire for CMRDI Project

MESSAGE :

In reference to your fax message dated (99. 03. 17) concerning the answer of the questions No. 3 , 18 & 19 of the questionnaire for the Project on Development of Metallurgical Engineering Technologies in Egypt, please find attached the answer of the questions No. 3 & 18. For the question No. 19, we shall receive the answer after the holiday of the greater feast in Egypt (27th to 30th March)

Best Regards

2- Relationship with other bi-lateral and multilateral aid agencies

A - Relation with TNO :-

- Technology transfer of Ductile Cast iron production at 8 foundryshops in Egypt. (1983 – 1985).

- Establishment of expremental foundryshop at CMRDI (1986 – 1990)

- Sponsership program for training of Sudanese engineers on foundry technology (1986 – 1987)

- Establishment of metal cutting workshop at CMRDI (1993-1994)

- Establishment of Tribology Lab at CMRDI (1984).

B - U.S. aid :

All cooperation with US aid was done through scientific research projects done by CMRDI staff and financed by American side. These projects are :

- Activation of bentonite .

- Production of Phosphoric acid .

- Local raduction of water treatment chemicals .

- Production of TiO_2 from elmenite Ore .

- Production of Alumnina for Aluminium industries .

18 – Egyptian Countreparts :

Name	Sex	Age	Speciality	qualification
Dr. Abdul Monen El Batahgi	M	45	Laser Tech.	Dr. Eng.
Dr. Mohamad Abdul Rahman	M	42	Heat Treatmemnt	Dr. Eng.
Dr. Mohamad Hanafi	M	40	Sheet Metal Forming	Dr. Eng.
Mr. Mohamad Ramadan	M	31	Casting Technology	Eng.
Mr. Khaled Hafez	M	31	Mat.Characturization	Msc.
Mr. Hamed Abdel Alim	M	31	Mat. Characturization	Msc
Mr. Nader El Buguri	M	30	Precision Casting	Msc.
Mr. Hassan Ahmed	M	30	Metal Shaping	Msc.

4 CMRDI研修コース実績

97/7. – 98/6

الدورات التدريبيـــــــة

عنوان الدورة التدريبيه	No. of trainees
Mineral Processing	12
Pyrometallurgical Processes for Extraction of Non-Ferrous Metal	4
Principles of Metallography	4
Non - Destructive Testing Techniques	34
Heat Treatment Technology of Metals and Alloys	28
Metal Working and Mechanical Testing	5
Welding Technology and Welding Metallurgy	57
Metallurgy of Cast Iron	5
Steel Casting	-
Recycling of Industrial Wastes	16
Steel Alloys	25
Steel making and Ferroalloys Production	-
Metal Cutting Technology	40
Ore Evaluation Using Different Physical Tools and Methods	20
Principles of Hydro- and Electrometallurgy	15
Casting Design of Iron and Steel Castings.	-
Continuous Casting of Carbon Steel	-
Roll Pass Design	2
Sintering	15
Welding of Carbon Steel	4
Total	296

List of organizations of the Trainees

1- Egypt Electric Power Authority

a) Mid-Delta Electric Power Zone
b) South Upper Egypt Electric Power Zone.
c) South Cairo " " Station.
d) North " " " "
e) West " " " "
f) Shoubra Elkhima " " "

2- Abu Qir Fertilizers and Chemical Industries Co.

3- El Nasr " " " " Co.

4- El Nasr Coke and Base Chemicals Co.

5- El Nasr Petroleum Co.

6- Assiut " ".

7- Alexandria National Iron and Steel Co.

8- Egyptian Refractory Co.

9- Arab organization for Industrial is station .

10- General Organization for Import and Export Control.

11- Portsaid Engineering CO.

5　エジプト自動車部品産業の関連資料

①　企業の活動状況

Activities in Automobile Feeding Industries

Local/import price	Total assets	Capital in Million L.E	No. of Labors	No. of Companies	Activities	No.
+30 %	41.8	49.5	2478	12	Pressed Sheets	1
	1.5	28.5	1715	10	Supports, Other metallic parts	2
		1.6	237	4	Fiber glass	3
	43.1	46.4	2131	8	Tires	4
+20 %		24.5	5661	5	Radiators	5
		1.2	577	5	Exhaust tubes	6
		4	160	2	Cables, Hand brake, Fuel, Bonnet	7
	312.2	20.07	866	7	Stickers, Trade marks	8
+20 %	83.8	32.9	1844	6	Glass	9
	11.8	20.3	700	10	Filters	10
+10 %		6	267	2	Harness	11
	445.4	52.5	3515	4	Electric cables	12
	0.03	1	220	2	Impact absorber	13
Equal		3.1	257	5	Plastic parts	14
		23.05	525	8	Brake discs	15
		3.5	66	2	Front lamps	16
	1.2	3.1	317	5	Rear lamps	17
+30 %		6	41	3	Air condition	18
		2.2	50	2	Metallic wheels	19
			984	1	Shock absorber	20
+30 %	2	2.9	210	3	Radio cassette	21

جدول رقـــــم (١٦)

Supplementary Feeding Industries

بيانات أنشطة الصناعات المغذية للسيارات

Price over Imports Assets Capital

مسلسل	النشاط	عدد الشركات Number	عدد العاملين Labor	رأس المال مليون جنية	اجمالى الاصول مليون جنية	مقارنة الاسعار بين المحلى والمستورد
١	اعمال مكبوسات الصاج Pressing Body	١٢	٢٤٧٨	٤٩,٥	٤١,٨	+ %٣٠ ٣٠٪
٢	الدعامات والاجزاء المعدنية الاخرى	١٠	١٧١٥	٢٨,٥	١,٥	
٣	فايبر جلاس	٤	٢٣٧	١,٦		
٤	كارتشوك	٨	٢١٣١	٤٦,٤	٤٣,١	
٥	راديايترات Radiator	٥	٥٦٦١	٢٤,٥		+ %٢٠ ٢٠٪
٦	شكمانات	٥	٥٧٧	١,٢		
٧	كابلات دبرياج وفرامل اليد والبنزين والكبود	٢	١٦٠	٤		
٨	حليات استيكر وعلامات تجارية	٧	٨٦٦	٢٠,٠٧	٣١٢,٢	
٩	زجاج سيارات Glass	٦	١٨٤٤	٣٢,٩	٨٣,٨	+ %٢٠ ٢٠٪
١٠	فلاتر	١٠	٧٠٠	٢٠,٣	١١,٨	
١١	ضفائر كهربائية Harness	٢	٢٦٧	٦		+ %١٥ ١٥٪
١٢	اسلاك كهربائية	٤	٣٥١٥	٥٢,٥	٤٥٥,٤	
١٣	اكصدامات	٢	٢٢٠	١	٠,٠٣	
١٤	اجزاء بلاستيك Plastic parts	٥	٢٥٧	٢,١		متعادل Simil
١٥	تيل فرامل ودبرياج	٨	٥٢٥	٢٣,٠٥		
١٦	فوانيس امامية	٢	٦٦	٣,٥		
١٧	فوانيس خلفية	٥	٣١٧	٣,١	١,٢	
١٨	تكييف سيارة A/C	٣	٤١	٦		+ %٣٠ ٣٠٪
١٩	جنوط	٢	٥٠	٢,٢		
٢٠	مساعدين	١	٩٨٤			
٢١	راديو ـ كاسيت Radio	٣	٢١٠	٢,٩	٢	+ %٣٠ ٣٠٪

② 企業リスト（連絡先）

FILTERS

NO	Name of Company	Site	Tel - Fax
1	Islamic Co. for Feeding Industries (Fedeco)	10th of Ramadan City-industrial Area B2	Tel:015-362254 363180 Fax:015-363354
2	Bear Filter Egypt	Mit Halfa:Kalyoub	Tel:202-2157832 Fax:202-2154847
3	International Company for Engineering Industrials. (FILTRAC)	Office:258 Shoubra St Cairo Egypt	Tel:2035589 Fax:202-2035589
4	AUTOMOTIVE FILTERS IND Co. (Afico Filters)	10th of Ramadan City-industrial Area B2	Tel:015-362130 362150 Fax:015-362251
5	The Arab Co. Manufacturing of Filters (FAC)	Borg El Arab EL Gadeda City-Alexandria Parc 1-B2-No 6 2nd Industrial Zone	Tel:203-4937241 Fax:203-4937941

EXHAUST SYSTEM

NO	Name of Company	Site	Tel - Fax
1	Engineering Company For Exhaust Systems	6th October City 2nd Industrial Zone	Tel:011-331091 011-330657 Fax:011-330793
2	EL ETIHADIA	391 El Hourria Road-Moustafa Kamel Alex.	Tel:03-4948884 491-2666 Fax:03-4918960
3	Alex Co. For Metal Products	El Nozha-Alex.	Tel:03-4208493 4208492 Fax:03-4203166
4	Engineering Co. for Exhaust Systems "Elzakaziki"	134 Gesr-El-Bahr Str.Shoubra	Tel:5561465

VEHICLES GLASS
(Windshield - Backlight - Windows)

NO	Name of Company	Site	Tel - Fax
1	10th Of Ramadan Factory For Glass Products (Dr. Griech)	10th Of Ramadan City Block 24/3 Industrial Zone A-1	Tel:015-410003, 4,5,6 Fax:015-410001
2	Glass Manufacturing Group	El Khanka-Kalyoub Egypt	Tel:02-698224 3400107 Fax:02-4698543
3	Sicro Misr Co.	Abbassia-Cairo	Tel:02-4830151 4834199 Fax:02-4834199
4	Aman for Vehicles Glass	6th October City 2nd Industrial Zone Land No.47	Tel:011/2401406 Fax:011/2401486
5	Hemco for vehicles Glass	Cario-Alex Road Kalyoub-Egypt	Tel:2156577 Fax:2157540
6	Refatkom For Vehicles Glass	Smoha-Alex.	Tel:03-4202074 Fax:03-4200225

Seats & Trimmings

NO	Name of Company	Site	Tel - Fax
1	Aliaa Factory For Car Trimming	20 A.El Wahab st. from makram ebieed Cairo	Tel:2978937 Fax:2735482
2	Mabica	37 El Ahrar St. Mohandesin-Cairo	Tel:3615053 Fax:3615053
3	Vehicle Components Industries (V.C.I)	4th industrial Zone Sadai city	Tel:5702711 Fax:5700505
4	Taki Vita Co.	El Fordos St From Ahmed Saied Abassia	Tel:2822222
5	Technopol Egypt	10th of Ramadan City A-1, P.O. 212	Tel:015-410502 Fax:410500
6	Development Projects Co. S.A.E. (DPCO)	Km 17, Maadi-Katameya Way	Tel:5172101 Fax:5172101

BATTERIES

NO	Name of Company	Site	Tel - Fax
1	National Plastics Co.	Elomrania-El Sharkia-Giza	Tel:20-2-727601 Fax:20-2919494
2	Egyptian Plast And Electric Manufacture Co. "VARTA MASR"	Victoria-Alex	Tel:03-5349531 Fax:03-5340889
3	General Co. For Batteries	Dar El Salam Cairo	Tel:02-3447679 3912421
4	Chloride Egypt Co.	Kilometer 28 Cairo-Alex. Desert Road Industrial Zone, Abu Rawash-Giza	Tel:02-5727100, 5688655 Fax:02-3831709

TYRES

NO	Name of Company	Site	Tel - Fax
1	Transport & Engineering Co. "Trenco"	38 Smouha St Alex.	Tel:03-4204277 Fax:03-4214538
2	Alex For Tyres Co.	El Ammeria El Nahda Alex.	Tel:03-4482473 4482474 Fax:03-4482475

HARNESS

NO	Name of Company	Site	Tel - Fax
1	Egyptian international cable harness Co. (cofaram)	6th of october city zone 3, Block 233	Tel:02-2907509 (3 lines)
2	Industrial Development of Automotive Components Co. (idaco)	6th October City industrial Area	Tel:011-332461 Fax:011-332460

Sheet Metal Works
(Fuel Tanks, Torsion Bars, Seat Adjusters, Wipper Arms, Brackets, Hood Lock, ...)

NO	Name of Company	Site	Tel - Fax
1	Industrial Control Co.	Port Said St-Cairo	Tel:820692 2826377
2	A.o.I Air Craft Factory	K 24 Cairo Alex Agricultural Road	Tel-Fax:782408
3	Abou Yourself Engineering Office	Dar El Salam-Cairo	Tel-Fax:3934699
4	Franke Sami Co.	Almaza-Cairo	Tel:4187757 Fax:4187756
5	Helwan Factory For Vehicle Prepration	6th October City 1st industrial Zone	Tel:011-330370 Fax:011-335046
6	Hisbenic Egyptian Co.	El America	Tel:03-971099
7	Ind. Engineering Co.	Sadat City	Tel:049-200033 040-3401059
8	El usor Factory For Metals	El Ameria	Tel:03-4498118
9	Inter. Co. For. Developed Industry S.A.E.	6th of October City	Tel:011-335092 011-335093
10	United Co. For Light Industries (Pilco)	6th of October City	Tel:011-3367706
11	Egyptian Co. For Light Industries (Misriat)	6th of October City	Tel:011-331772 Fax:011-330688

PEDALS

NO	Name of Company	Site	Tel - Fax
1	Helwan Factory For Vehcile Prepration	6th October City 1st industrial Zone	Tel:011-330370 Fax:011-335046

Rubber Components
Fuel, Water & Pressure Hoses - Profiles and others

NO	Name of Company	Site	Tel - Fax
1	Egyptian-French Rubber Manufacture Co. (Sifica)	Tanta-Gharbia	Tel:040-349117- 344824 Fax:040-344877
2	El-Kady Co., for industries & Commerce	Industrial Zone K 18 Cairo-Ismallia Road	Tel:2979063 Fax:2979363
3	Marso For Chemicals	10th of Ramadan. 1A. Block 34/3	Tel:015-490276 015-410503 Fax:02-4261554
4	Alex. Co. For Rubber, Plastic & Metal Production	El Baklia El Mansoura El Dakahlia	Tel:05-690932

Coil & leaf Spring

NO	Name of Company	Site	Tel - Fax
1	Springs & Transport Needs Manufacturing Co.	Al America-cairo	Tel:2579635 Fax:2560485
2	Central Spring Co.	8 Shambileon st Cairo	Tel:5754863

Rear Combination Lamps & Assortments

NO	Name of Company	Site	Tel - Fax
1	Auto Lamp Egypt	19 Damascuss ST. Roxy Factory:10 th of Ramadn B3-120	Tel:4555966 2586722 Fax:2565554
2	Engineering Industrial Co. For Industries	First Industrial Zone Sadat City	Tel:049-600033 Fax:049-600534
3	Akl Factories	El Mansoura Taksim Ibn Batouta	Tel:050/328118 Fax:050/327000
4	International Co. For Complementary Industries	10th of Ramadan	Tel:015-364245

BRAKELINING & PADS & CLUTCHLINING

NO	Name of Company	Site	Tel - Fax
1	Misr Brake Co.	10th of Ramadan	Tel:362682 Fax:260379
2	United for Fabrication & Development Co.	6th of october. City 2nd Industrial Zone	Tel:011-330519 Fax:011-330549
3	Springs & transport needs Manufacturing Co.	Elameria-Cairo	Tel:2579635 Fax:2560485

Horns

NO	Name of Company	Site	Tel - Fax
1	International Group for industrialization	6 October city industrial zone 3, No 230	Tel:335841- 335840 Fax:335842
2	IAMCO	77 Ramsis St. Cairo	Tel:760142 Fax:779967

Wheel Discs

NO	Name of Company	Site	Tel - Fax
1	Helwan Factory For Engineering Industries (99 Military Factory)	Ain Helwan-Cairo	Tel:5552384 Fax:782668
2	Motors & Die casting Co. (S.A.F)	24, 46 Safa St. Tanta. Egypt	Tel:040/350404 Fax:040/348949

Hand Brake, Cluth and Fuel Cables

NO	Name of Company	Site	Tel - Fax
1	Engineering Co. For Industrialzation	Sadat City First Industrial Zone	Tel:049-600023 Fax:049-600534

SPARK PLUG

NO	Name of Company	Site	Tel - Fax
1	The Egyptian Co. For Mechanical, Precision Ind. (Sabi)	Mostorod Kalyoubia	Tel:2202883 2202755 Fax:2200559

PAINTS & COATINGS

NO	Name of Company	Site	Tel - Fax
1	El ganumal Co. for Paints & Chemicals industries.	Paints 8 Chemicals Industries Co	Tel:011-330480 Fax:011-330737

CASTING, FORGINGS

NO	Name of Company	Site	Tel - Fax
1	Helwan For Casting Co. (9 military Factory)	Helwan-Cairo	
2	El Nasr Co. For Forgings	Helwan-Cairo	Tel-Fax:790798
3	Amreya Metal Co.	k21-Alex.-Cairo Road Amereya-	Tel:03-4481250 Fax:03-4482101

Shock Absorbers

NO	Name of Company	Site	Tel - Fax
1	Helwan Factory For Engineering Industries (99 Military Factory)	Ain Helwan-Cairo	Tel:5552384 Fax:782668

GASKETS

NO	Name of Company	Site	Tel - Fax
1	Mido Factory for Gaskets	Elattareen Alexandria	Tel:03-4937464
2	El-Deek Factory For Gaskets	El Borsa Str El Tawfikia-Cairo	Tel:5754922
3	Essam Moustafa El Sharkawy Co	Nabil El Wakad St Mansheyet Naser Cairo.	Tel:2979065

Radiators

NO	Name of Company	Site	Tel - Fax
1	Termer Radiator Cores Manufacturing & Trading Co.	Mostorod Shoubra El Kheima	Tel:02-3418618 Fax:02-3418618
2	Maadi Co. For Engineering Industries (54 Military Factory)	Kornish El Nile-Cairo	Tel:02-3501855
3	Egyptian Co. For Auto Refrigeration	Industrial Zone Three 6th October City	Tel:3039384 Fax:3445237

Radio Cassette

NO	Name of Company	Site	Tel - Fax
1	Egyptian electric and electronic compound (E.E.E.C)	10th of Ramadan Part 13/A1	Tel-Fax:3497851 3787588
2	International Co. for electronic devices	Sadat City 3th Zone part 5/1/B	Tel:3914658 3909611 Fax:3907181
3	Engineering Industrial Co. (E.I.C)	10th of Ramadan city-industrial zone A/1	

AIR CONDITIONS

NO	Name of Company	Site	Tel - Fax
1	Egyptian German Air Treatment Co. (Egat)	6th of Octoer 62 Lcbanon Street Dokky Cairo	Tel:3451000 Fax:3468014
2	Power Egypt Corporation	179 El Orouba St. Heliopolis Cairo	Tel:2667372 2607665 Fax:2667661
3	El Fotouh For Industrial Development (Auto cool)	4 El Marwa St. Roxy	Tel:4550637 Fax:2577112
4	Egyptian Company For Auto	Industrial Zone Three 6th October City	Tel:3039384 Fax:3445237

Fire Extinguisher

NO	Name of Company	Site	Tel - Fax
1	Bavaria Egypt Co.	El Salam city-Cairo	Tel:5918043 Fax:15913762

Molding & Dccorative Accessories

NO	Name of Company	Site	Tel - Fax
1	Profile Mac Egypt Co.	10 of Ramadan City	Tel:5758050 Fax:768093