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UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

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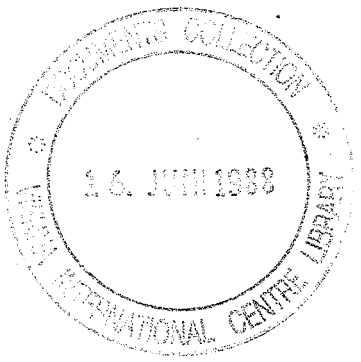
SPECIALIZED INSTITUTE FOR ENGINEERING INDUSTRIES

DP/IRQ/77/003/01-37

IRAQ



Terminal report

Prepared for the Government of Iraq
by the United Nations Industrial Development Organization,
acting as executing agency for the United Nations Development Programme

Based on the work of Stevan Buranj,
chief technical adviser

Backstopping officer: H. Fritz, Engineering
Industries Branch

United Nations Industrial Development Organization
Vienna

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Explanatory notes

The monetary unit in Iraq is the dinar (ID).

AIDO	Arab Industrial Development Organization
CAD	computer-aided design
CAE	computer-aided engineering
CNC	computer numerically controlled
COMFAR	computerized model for feasibility analysis and reporting
IPF	indicative planning figure
NC	numerically controlled
SIEI	Specialized Institute for Engineering Industries
TRM	tripartite review meeting

Mention of the names of firms and commercial products does not imply endorsement by the United Nations Development Programme or the United Nations Industrial Development Organization.

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ABSTRACT

In 1977, the Government sought technical assistance from the United Nations Development Programme (UNDP) in setting up and strengthening the Specialized Institute for the Engineering Industries (SIEI) which had been established in 1972 by Law No. 128. Following a preparatory technical assistance, the project "Specialized Institute for Engineering Industries" (DP/IRQ/77/003) was approved on 20 April 1978, and the United Nations Industrial Development Organization was designated as executing agency.

The primary function of the UNDP/UNIDO assisted project was direct support, with due attention to aspects of institution building. During the lifetime of the project, SIEI has succeeded to:

(a) Set up its physical facilities;

(b) Introduce and develop an adequate organizational infrastructure.

The chief technical adviser, who was assigned to the project from its inception, made the following main recommendations with a view to enabling SIEI to meet the new challenges from the engineering industry and to consolidate the benefits of the technical assistance provided under the present project:

(a) The established areas of specialization of SIEI should be deepened rather than expanded;

(b) The number of staff should be gradually increased;

(c) The recently elaborated long-term applied research and development programme should be executed with due adjustments to accommodate development trends in the industry;

(d) Should the requested phase II of the project not be approved by UNDP, the Government should find different resources in order to secure an implementation of that project;

(e) SIEI should seek contacts and co-operation with research institutes in industrially developed and developing countries, intensify already existing links with such institutions within Iraq, and ensure that its experienced staff gets acquainted with the latest developments in their field of specialization by sending them regularly to fairs, exhibitions and conferences.

INTRODUCTION

The Government of the Republic of Iraq established the Specialized Institute for Engineering Industries (SIEI) through Law No. 128 of 1972. SIEI started functioning in 1973, but on a rather limited scale.

Considering the important role that SIEI plays in the development process of the Iraqi engineering industry, the Government approached the United Nations Development Programme (UNDP) for technical assistance, with the following results:

(a) UNDP agreed to finance the technical development of SIEI from the indicative planning figure (IPF);

(b) The United Nations Industrial Development Organization (UNIDO) was designated as executing agency;

(c) A preparatory assistance project started in October 1977;

(d) The project document for the present project "Specialized Institute for Engineering Industries" (DP/IRQ/77/003) was signed on 20 April 1978;

(e) The implementation of the project started immediately.

The physical facilities of SIEI, which were financed by the Government, were completed at the end of 1982.

The work programme of SIEI, being closely linked to the requirements of the local engineering industry, the Institute had, from 1983 on, to cope with increasingly sophisticated assignments.

The activities of the project were completed by the end of June 1987. Consequently, this terminal report covers the period from 10 October 1977 through 30 June 1987.

Meanwhile the government authorities concerned requested UNDP to include a second phase of the project in the fourth cycle of the UNDP/IPF Country Programme covering the period 1987-1991, and UNDP agreed to it. Phase II of the project should have its main emphasis on applied research and development and, in view of the importance of these activities for the engineering industry, it was agreed to prepare a comprehensive study on an applied research and development programme for SIEI, which at the same time will constitute a basis for phase II of the project. Furthermore, it was agreed to start with the implementation of the most urgent activities foreseen for phase II.

As a consequence, the present project was extended through 31 December 1987, and that extension was financed from funds of the fourth cycle of the UNDP/IPF Country Programme, foreseen for phase II of the project.

In the meantime a comprehensive applied research and development programme for SIEI has been prepared which was accepted by the Government and UNIDO Headquarters. From the other urgent activities of phase II, only computer-aided design has started; all others have been postponed until the beginning of phase II of the project.

It is expected that the project document for phase II, completed in its final form, will be approved during the first half of 1988. Therefore, as to avoid any gap between the two projects and to continue the technical assistance in computer-aided design, the present project was once more extended, this time through 30 June 1988, with no additional UNDP inputs.

RECOMMENDATIONS

1. SIEI should continue its activities in all established fields of specialization. These fields of specialization should not be expanded, but rather deepened, with concentration on the applied research and development activities. The working system has to be continuously improved.

2. The number of SIEI's staff should be increased, as soon as the overall circumstances in the country will permit it. Such increase should be a gradual one in accordance with the existing manpower plan to ensure a smooth development of SIEI.

3. SIEI should adhere to the recently elaborated long-term applied research and development programme and adjust it in accordance with new technology trends and particular needs of the engineering industrial enterprises. This applies mainly to products and productions, while in other fields, such as quality control, techno-economic studies and industrial information, the development trends in the industrial world should be carefully followed and implemented, in SIEI as well as in the engineering industrial enterprises.

4. The Government has requested a phase II of the project, to be financed by UNDP/UNIDO, with the main objectives of developing the capabilities for applied research and development in fields of products and productions and to obtain some assistance to follow and introduce new trends in other fields. As such a project is vital in order to consolidate SIEI for future tasks, the Government should find other resources to implement it, if for any reason the requested project is not approved by UNDP/UNIDO.

5. SIEI should establish comprehensive working links with other institutions and research organizations in industrially developed and developing countries. The aim is to exchange experience, information, know-how and even technical personnel. Such links already exist with some institutions and universities within Iraq, but they should be intensified.

6. SIEI should introduce a system of regular visits to selected specialized fairs, exhibitions and international conferences. For a research and development institution it is of great importance that its experienced staff gets directly acquainted with the latest developments.

7. A realistic approach for the introduction of computer-aided engineering techniques in the engineering industry as a whole, and particularly in SIEI, should be found as soon as possible.

I. PROJECT OBJECTIVES AND FUNCTIONS

A. Development objectives

The development objectives, as specified in the project document, are as follows:

1. To develop the capabilities of the national technical staff for:

   (a) Engineering products design;
   (b) Tools design;
   (c) Prototypes and tools manufacturing.

2. To promote the application in the engineering industry of the latest:

   (a) Production technologies; and
   (b) Inspection and quality control methods.

3. To improve the industrial information and documentation system for the engineering industry.

B. Immediate objectives

The immediate objectives, as they stand after several modifications during the lifetime of the project, are:

1. To establish a Product Development and Design Department and to develop its capabilities, enabling it to:

   (a) Develop and design products needed by the engineering industry;
   (b) Introduce initial research activities;
   (c) Introduce internal standards for SIEI and the enginnering industry; and
   (d) Introduce computer-aided design (CAD).

2. To establish a Production Engineering Department and to develop its capabilities, enabling it to:

   (a) Improve and develop production technologies for the engineering industry and SIEI;
   (b) Design special tools needed by the engineering industry;
   (c) Manufacture prototypes, sophisticated components or component parts and special tools for either SIEI or the engineering industry; and
   (d) Introduce applied research activities.

3. To establish a Quality Control Department and to develop its capabilities, enabling it to:

   (a) Introduce a quality control system for the engineering industry;
   (b) Perform laboratory tests of materials as well as the measuring of tools and component parts for both, the engineering industry and SIEI; and
   (c) Introduce initial research activities in the field of materials and quality improvement.

4. To establish a Techno-economic Studies Department and to develop its capabilities, enabling it to:

   (a) Introduce a system of techno-economic analyses;
   (b) Produce various techno-economic studies for the industry and SIEI; and
   (c) Introduce a computerized model for feasibility analysis and reporting (COMFAR).

5. To improve the Industrial Information and Documentation Department and to develop its capabilities, enabling it to:

   (a) Run a well-organized library, classified according to the UDC system;
   (b) Introduce a permanent industrial information service for all users;
   (c) Establish a data bank for industrial information in the engineering field; and
   (d) Introduce microfilming technique.

6. To introduce specialized short-term training courses for qualified national staff of the engineering enterprises.

A comparison with part II.B "Immediate objectives" of the original project document shows that:

   (a) All originally foreseen immediate objectives are incorporated in the final version;
   (b) The immediate objectives have been arranged in six main groups, each one with precisely defined subitems;
   (c) In the course of the development of SIEI and following the demands from the engineering industries, some of the immediate objectives have been expanded by including items covering either more sophisticated or new techniques.

C. The engineering industries sector in Iraq

Place of engineering industries sector in the Development Plan

The Government of the Republic of Iraq is directing the country's development through development plans.

An overall growth of outputs in the industrial sector in general, and in the engineering sector in particular, has considerable priority in the Development Plan. It is expected that the engineering sector will play a substantive role in the substitution of imports and in supplying the market with products suitable for local conditions.

Consequently, the development of the engineering industries sector is oriented towards increased local manufacturing, an enlarged range of products, higher productivity and better economy.

Further plans for the development of the engineering industries sector concern the modernization and expansion of existing industries as well as the introduction of capital goods and automotive manufacturing industries.

At present, the aim of the engineering industries sector is to cover with its products, at least partially, the needs for the mechanization of

agriculture, electrification, road transport and widely used industrial goods. This is supported by semi-finished products in the engineering sector as well as steel and iron sheets and profiles in the metallurgical sector.

The socio-economic structure of the engineering industries sector

Ownership

Three different types of ownership exist in the sector:

(a) Public-sector enterprises owned and managed by the Government. These enterprises are capital intensive and consequently they are the biggest, producing goods which have considerable influence on the general development of the country. They are:

State Enterprise for Mechanical Industries

State Enterprise for Electrical Industries

- Electrical products factories
- Lamp factory

State Enterprise for Batteries

- Liquid batteries factories
- Dry batteries factories

State Enterprise for Automotive Industries

State Enterprise for Aluminium Semis

State Enterprise for Cables and Wires

Al-Qadessiyah Complex for Electrical Industries

- Ceiling fan factory
- Electric meter factory
- Electric iron factory
- Spark plug factory
- Transformer factory

Al-Nasser Complex for Mechanical Industries

- Special tools factory
- Metal structure factory
- Foundry for steel castings

Iron and Steel Complex

State Enterprise for Marketing and Maintenance;

(b) Mixed-sector enterprises with shared ownership and management between the Government and private entrepreneurs. These enterprises are usually of medium size, but with an appreciable production of widely used industrial products. The largest ones are:

Light Industries Company

Electronic Products Company

Bicycle Company;

(c) Private-sector enterprises owned by private persons. There is a great number of them, but usually with rather limited capacities and very rarely with up-to-date technologies. Consequently, the majority of those enterprises are having either piece or small serial productions. The few exceptions are having specialized work programmes.

Licenses

Nearly without exception, all public- and mixed-sector enterprises are working under licenses for products and production technologies. Most of them were even established on that basis. In the private sector the situation is opposite.

Without exception, all licenses, whether for products or production technologies, were up-to-date at the time of procurement. The same applies for the production equipment.

The licenses were from various origins, a fact which caused great difficulties for the overall economy of the engineering sector. The use of different national and factory standards made it compulsory to procure materials and parts from different sources.

Age of enterprises

The time at which engineering enterprises or their sections were set up has a great influence not only on the production technologies, machine tools and all other equipment, but even more so on the required capabilities of their manpower and the organization of production.

In the public sector of engineering industries the establishment of enterprises and sections started approximately 25 years ago and continued until now. Consequently, there are big differences in between old and new establishments.

In the mixed sector the situation is similar. Some of the enterprises were established even earlier than private ones.

The private-sector manufacturing enterprises are small and some of them were established a long time ago. As the products are usually very simple, the owner's interest in profitability determines the kind of methods and facilities used in manufacturing.

The market

The products of the engineering industries sector are mainly destined for the local market. This, however, does not prevent export orientation for those products which are surplus and which could compete on the international market with regard to performance, quality and price.

It should be noted that the local market is rather quality oriented.

Recent reorganization of the Iraqi industry

The Government has recently introduced fundamental changes in the whole industrial sector. The policy goals are an increase of outputs, a higher level of responsibility and initiative, a reduction of direct and indirect production costs as well as an encouragement of the private sector to foster a rapid development of the industrial sector. One of the measures taken to that end was the abolishment of the administrative management system of industry.

In the area where SIEI is operating, these changes are reflected by the abolition of the State Organization for Engineering Industries and the incorporation of engineering industrial enterprises as companies.

Common factors in the engineering industries sector

Import substitution

There are three main areas for import substitution - at present and for the future - in the engineering industries sector:

(a) Substitution of imported products by new, but locally developed ones;

(b) Substitution of imported, usually sophisticated, components and component parts by locally manufactured ones;

(c) Substitution of raw materials by locally, easier available ones or by such materials that ensure a better economy of production.

Quality

The market is quality oriented and the Government is encouraging such a trend. At present the quality level of locally manufactured products varies. Some of them, like dry batteries, electric meters, bicycles etc. are of excellent quality, while there are other products which are suitable, although their level of quality is not constant.

Manpower

There is a long-lasting lack of national skilled manpower, independent of the presently prevailing situation in the country. This is due to rather rapid development of the country in practically all fields of human activities. The lack of manpower is more obvious in the engineering industries sector, where a certain level of skills and experience is absolutely necessary.

These facts call for the adaptation of capital-intensive, contemporary technologies, permitting the achievement of good quality with a limited number of skilled workers.

Flexibility of production

The rate of production varies according to type of products and demand. The industries supplying the agricultural and road transport sectors have medium and low production rates. On the other hand, the production rate for industrial goods and spares is reasonably high and some of the industries produce in excess of the demand (fans, batteries, small electric motors etc.).

Inspite of those differences, there is a common need for a higher flexibility in production in order to achieve an optimal utilization of existing capacities and to be capable of introducing quick changes in the product range.

Productivity and utilization of capacities

The analyses of some factories showed that the overall productivity is not at the desired level. These findings can be generalized for most industries. Similarly, the utilization of manufacturing capacities leaves something to be desired. Only the assembly capacities are usually fully utilized.

Better results could be achieved either through higher productivity or through the introduction of new products with a similar production technology. A better utilization of capacities is imperative for the engineering industries sector.

Use of computer-aided engineering (CAE)

In some factories of the engineering industries sector up-to-date facilities such as numerically controlled (NC) and computer numerically controlled (CNC) machine-tools, computerized machining centres, industrial robots as well as facilities for computerized stock and production control, and, more recently even for computer-aided design (CAD) are in use. However, their effective use depends on the availability of well-trained staff.

It is imperative for the engineering industries sector to make use of these modern facilities, not only to keep up with world-wide developments, but also to be able to solve technical and manufacturing problems with more accurate results and assured quality.

Maintenance

Maintenance is still a major problem in the engineering industries sector.

In all enterprises some organized system of maintenance does exist, which is usually based on up-to-date methods and implemented by specialized maintenance units which are well staffed and equipped and have a stock of standard spares. Nevertheless, the results are still far from what is desired.

Economy in production cost

As explained before, the results of analyses of some enterprises indicate that the production costs are rather high and that possibilities for cost reductions are great. This conclusion is applicable to all enterprises.

Under the conditions prevailing in the engineering industries sector it is not easy to reduce production costs; however, since this is imperative for the country, all concerned authorities are paying special attention to the reduction of production costs.

D. Institutional setting of the project

The UNDP assistance has been rendered through a direct-support project with its main emphasis on expertise provided by international professionals

(through individual contracts and subcontracts) and on training (fellowships and study tours). The executing agency was UNIDO. The project was managed by a UNIDO chief technical adviser.

The government implementing agency was the Specialized Institute for Engineering Industries (SIEI), Baghdad, established by law 128 of 1972. SIEI is under the Minister of Heavy Industries and is governed by a Board of Directors. The Minister, or his representative under delegated authority, functions as Chairman of the Board. The executive chief of SIEI is the Director-General and concurrently the Vice-Chairman of the Board. He is assisted in his tasks by the Directors of Departments and by the Research and Development Consultative Council, comprised of national experts from SIEI and other specialized institutions.

SIEI has full authority and responsibility to achieve its objectives. It is budgeted from the Development Plan, and provides services to public, mixed and private enterprises. The Institute's service charges are in accordance with established rules and regulations.

Very good co-operation has been established between SIEI and various enterprises of the engineering industry. Consequently, some important assignments are executed in the form of projects with joint participation.

The services of the SIEI to other Arab States in the region, mainly in the area of training, and some joint projects, are rendered through the Arab Industrial Development Organization (AIDO).

E. Primary function of the project and main accomplishments of SIEI

The primary function of the UNDP/UNIDO assisted project was direct support, with due attention to aspects of institution building.

During the lifetime of the project, SIEI has succeeded to:

(a) Set up its physical facilities;

(b) Introduce and develop an adequate organizational infrastructure;

(c) Employ a staff of 150, in spite of prevailing unfavourable conditions;

(d) Introduce contemporary working methods;

(e) Upgrade the capability of its staff so that it can successfully cope with the demands of the engineering industry;

(f) Render effective technical assistance to enterprises in the engineering industries sector;

(g) Introduce some up-to-date technical systems to the engineering industries sector.

F. External factors

During the initial phase of the project, the following external factors (beyond the control of the project) had a negative influence on the achievement of the project objectives within the planned time:

(a) Availability of counterparts/national qualified staff in the required number and specializations;

(b) Very limited premises and facilities;

(c) Delays in the arrival of UNIDO experts due to procedures (nominations and official clearance by the Government) taking much longer than initially planned;

(d) The caution of the engineering industry towards the capabilities of SIEI.

Most of these constraints were overcome, at least partially, by mid 1980. The number of counterparts had been, although not sufficiently, but considerably increased. The manufacturing workshop and the laboratories had been completed and were fully equipped. UNIDO had eight experts in the field, and SIEI had already gained some confidence of the engineering industry. Unfortunately, the war which started in September 1980 adversely affected a rapid development of SIEI. As a consequence:

(a) The UNIDO team dropped to four experts, and it took nearly two years' efforts to reach the previous number;

(b) The main administrative building was completed and fully furnished only by the end of 1982;

(c) The rate of increase of counterpart engineers slowed down and the number of qualified workers dropped considerably.

In spite of these difficulties, SIEI continued to gain the confidence of the engineering industry so that in the fall of 1982 a new, more sophisticated approach for SIEI's services to the industry was officially introduced.

At present, at the end of the project, the number of SIEI's staff is nearly steady but far from the planned one, and there is definitely a lack of qualified workers.

Fellowships and study tours constituted a problem from the outset of the project due to: (a) difficulties in securing suitable training places, and, if they were obtained, then (b) the uncertainty as to whether the government authorities concerned would give their final approval.

G. Project design

Retrospectively, the project document could be criticized and considered defective in many respects, although at the time when it was prepared (fall 1977 and beginning of 1978) it constituted a factual document which could serve as a basis for a successful start.

The development and immediate objectives were stated explicitly and with clarity. However, during the lifetime of the project, the immediate objectives were regrouped and enlarged according to the actual needs.

The outputs were described explicitly, although today it could be criticized that there was no clear-cut distinction between project outputs and the outputs of SIEI. However, the fact that it was a direct-support project permitted, with the right mix of direct support and developmental emphasis and with due attention to many aspects of institution-building, to overcome the problem caused by the inadequate number of national staff.

Although the relation between inputs-activities-outputs-objectives was adequate, the fulfilment of quantified targets depended, of course, on the number of available staff, local and international.

In the view of the chief technical adviser, various assumptions made when designing the project were timewise overoptimistic.

H. Logic of the project

The planned outputs of the project are summarized below:

1. Establishment and/or development of all departments and sections of SIEI;
2. Products;
3. Technology, tool design and manufacturing;
4. Quality control;
5. Techno-economic studies;
6. Industrial information;
7. Specialized short-term training courses.

Under the first output it was planned to introduce an up-to-date organizational structure and corresponding working methods, as well as to increase the number of staff significantly and to provide all physical facilities, including premises, equipment, various tools, instruments etc. The aim was to have an organized, staffed and equipped SIEI which will be able to render adequate services to the engineering industries.

The magnitude, kind and quality of other outputs were defined by the range of services rendered to the industry, with a natural limitation depending on the number and ability of SIEI's staff at a given stage of development.

To produce the described outputs the following project activities were planned and used: consultations, technical guidance, supervision of work, joint participation in the execution of some particular items of the work plan, on-the-job-training, training courses, seminars and lectures, as well as fellowships and study tours.

The logic of the whole project can be represented by the following cause-and-effect chain:

(a) If the actual inputs of both parties, the Government and UNDP/UNIDO, are brought together and the activities are carried out as planned, then the desired outputs, in the form of the seven items presented above, are produced;

(b) If the outputs are produced and the external factors fulfilled, then the immediate (project) objectives are achieved, i.e. SIEI is well established and renders the desired services to the engineering industries sector;

(c) If the immediate (project) objectives are achieved, then the problems of the engineering industries sector are alleviated and a contribution to the achievement of the development objectives is made.

II. PROJECT IMPLEMENTATION

A. Project budget and UNDP inputs

The project budget and the UNDP inputs in United States dollars, are given by total of component as per the latest project revision "U".

Budget component line	Description	Original m/m	Original $ US	Latest revision m/m	Latest revision $ US
11-99	Sub-total international experts	506.0	2 586 000	576.7	3 918 303
19-99	Total personnel component		2 660 300		4 390 710
29-99	Total subcontracts		-		505 193
39-99	Total training component		297 000		202 511
49-99	Total equipment component		2 500		97 711
59-99	Total miscellaneous component		14 000		73 697
99-99	PROJECT TOTAL	506.0	2 973 800	576.7	5 269 882
101	Government cost-sharing contribution		-		370 250
999	Net UNDP contribution		2 973 800		4 899 632

For further details see the following annexes:

I. Brief survey of project documents and revisions;
II. UNIDO project staff;
III. List of fellowships and study tours;
IV. List of equipment provided through the project.

The reasons for the only shortfall in the UNDP inputs, which is in the training component, have already been explained in chapter I, section F "External factors".

B. Government inputs

The government inputs in Iraqi dinars, are given in the form as they appear in SIEI's Finance Section.

Description	Original (ID)	Latest revision (ID)
Equipment	1 381 990	1 471 496
Buildings	1 230 000	1 424 686
Running costs	2 088 000	3 536 119
Total until 31 October 1986	4 700 000	6 432 301
Approved budget for the remaining period	-	700 000
GRAND TOTAL	4 700 000	7 132 301

Further details are contained in the following annexes:

V. Organizational structure of SIEI on 30 June 1986;
VI. Staff of SIEI on 30 June 1986;
VII. Physical facilities of SIEI on 30 June 1986.

The shortfall in the government inputs occurred only in the number of staff, as already explained in chapter I, section F "External factors".

C. Implementation of activities

The UNIDO experts and consultants assisted the national qualified staff in the following main groups of activities:

(a) The development of SIEI and its working methods, by:

(i) Advising on the set-up, functions and initial operation of each specialized department or section;
(ii) Participating in the preparation of the work programme and work plans as well as suggesting additional requirements;
(iii) Introducing advanced working methods, sometimes in the form of manuals;

(b) The implementation of the yearly work plans, by:

(i) Consultations;
(ii) Technical guidance;
(iii) Supervision of work;
(iv) Participation in the execution of particular items of the work plans;

(c) Training, as part of the yearly work plan, by:

(i) On-the-job training as a main concern;
(ii) Assisting in the assessment of further training needs for national qualified staff, including proposals for suitable training programmes;
(iii) Giving advice in the preparation of materials for specialized training courses;
(iv) Preparing and delivering lectures or seminars in their own field of specialization.

The UNIDO experts proceeded according to work programmes or plans, which were usually prepared during the first month of their assignment, based on the latest job description, the yearly work plan of SIEI and on the actual situation with the direct counterparts. The work programme or plan for UNIDO consultants also included specific assignments that the consultant was required to carry out.

The UNIDO experts and consultants always had counterparts, and they were not directly involved in the work connected with the execution of SIEI's yearly work plan. The number of counterparts varied, depending on the type of work and the availability of national staff.

The UNIDO experts and consultants had always access to factories, fields, institutions etc. in connection with the work assignment of their respective counterpart group. Without exception, all visits were made together with counterparts.

In principle, the UNIDO experts and consultants had excellent working relations with their counterparts and their co-operation permitted them to fulfil their assignments. At a later stage, when the execution of some particular work assignments required the participation of third parties, either staff from a given factory or from other institutions, the co-operation was also most satisfactory. This positive attitude prevailed during the whole lifetime of the project, with very few exceptions only.

The management of SIEI and the national qualified staff always showed confidence and appreciation towards the team of UNIDO international professionals. Naturally, the level of confidence and appreciation depended on the level of knowledge of the UNIDO expert, and his ability and willingness to co-operate. During the lifetime of the project only one subcontracted expert was terminated before the expiration of the contract, for one expert the contract was not extended, and one expert's request for termination of his contract coincided with his request for medical evacuation.

The local UNIDO staff also always enjoyed a very good co-operation with SIEI's management and staff.

D. Monitoring of project implementation

Project progress reports were made regularly every six months, covering the periods 1 May to 31 October and 1 November to 30 April. Altogether 18 progress reports were made.

From the time of the introduction of the internal evaluation system performance reports by UNIDO, such reports were prepared each year, altogether four of them.

Tripartite review meetings with the participation of staff from UNIDO Headquarters were held three times, in January 1979, May 1980 and June 1983.

On the local level, although not officially called tripartite review meetings, regular meetings were held, at least twice a year, between:

(a) The Director-General of SIEI/head of the government implementing agency, sometimes even with the participation of the President of the State Organization for Engineering Industries who was at the same time the Chairman of the Board of Directors;

(b) The UNDP resident representative; and

(c) The chief technical adviser of the project.

All major issues concerning the progress and implementation of the project were discussed and relevant decisions made in those meetings.

The project was several times visited by staff from UNDP Headquarters, including the UNDP Deputy Administrator, the Director of the Regional Bureau for Arab States and the Chief of the Country Programme Division II. These visits were in addition to regular visits from international and local staff of the UNDP office at Baghdad.

The first in-depth evaluation of the project was carried out in December 1982. In February/March 1986 the project was again evaluated as part of the preparation for the UNDP/IPF IV Cycle Country Programme. A second in-depth evaluation of the project was made in March 1987.

Project internal evaluations were carried out twice, in November 1982 and in November 1984.

On the part of SIEI, the following system has been implemented:

(a) The yearly work plan of SIEI is prepared in close co-operation with the engineering industry and is finalized and approved by the Board of Directors before the end of the year. The staff of SIEI are being informed on the main outlines of the yearly work plan;

(b) The yearly work plan is divided into monthly work plans. In a meeting of SIEI's managerial and senior staff, held on the first Saturday of each month, the implementation of the previous month's work plan is reviewed and an effort is made to anticipate and solve any problems for the month in progress;

(c) The Board of Directors is regularly informed about the implementation of the work plan and takes corresponding decisions. This includes also the progress reports prepared by the chief technical adviser. The decisions of the Board of Directors are regularly approved by the Minister of Heavy Industries.

III. PROJECT RESULTS AND ACHIEVEMENT OF OBJECTIVES

A. Output No. 1 - The Specialized Institute for Engineering Industries

The latest summarized version of that output reads as follows:

> "Establishment and/or development of all departments of SIEI (1. Product Development and Design; 2. Production Engineering; 3. Quality Control; 4. Techno-economic Studies; 5. Industrial Information and Documentation)."

It should be noted that the Department of Finance and Commercial Affairs and the Department of Administration are working explicitly under Iraqi government juridictions and rules.

The original output underwent the following modifications:

(a) In 1979 the Techno-economic Section was enlarged to a department; and

(b) In 1982 the Administrative and Financial Department was divided into two departments.

Services

(a)	Planned:	Establish or develop the departments and institutionalize the work procedures;
(b)	Current status:	Completed.

Staff required

(a)	Planned:	Total 276, including 96 university graduates in engineering or other supporting fields;
(b)	Current status:	Total 150, including 83 university graduates in engineering and other supporting fields.

There is a shortfall in the number of senior qualified national staff and workshop personnel. This shortfall is due to external factors, described in chapter I, section F.

The national qualified staff are only working in their fields of specialization, and they are sufficiently trained for the tasks foreseen under the original objectives. However, for the new objectives, particularly for applied research and the use of computer techniques, they need further training. The turnover of national qualified staff is rather limited. A small number of national qualified staff, after having worked for some years in SIEI, was appointed to more important or higher-level positions in the Iraqi engineering industry.

The managerial staff is almost permanent and has a long experience. The Director-General and two departmental directors have been in SIEI as from the start of the project, while two others started at the end of 1979 and one in mid-1982. Very recently, during the finalization of this terminal report, the Director-General was transferred to lead one of the largest engineering industrial enterprises. A new Director-General has been appointed, but he has not yet taken up his office and the Director of the Quality Control Department is Acting Director-General.

It should be pointed out that the staffing situation in SIEI can be considered as very good under the prevailing overall circumstances in the country, and that this is an extraordinary exception, thanks to the wise personnel policy of the Government with regard to SIEI.

Premises and facilities

(a) Planned:
1. Main building for administration
2. Workshop
3. Laboratories;

(b) Current status:
1. Main administration building, about 6,000 m^2
2. Workshops, about 2,500 m^2
3. Laboratories, about 900 m^2
4. Research laboratories, about 1,800 m^2.

Equipment and supplies

(a) Planned:
1. Technical and office equipment
2. Workshops equipment
3. Laboratories equipment and instruments;

(b) Current status: Completed, with newly procured equipment and instruments. There are many additions.

Market and marketing

Services in this area are rendered mainly to public-sector and partially to mixed-sector enterprises. The yearly work plan is based on the industry's demands, on agreements and the engineering industry's development policy. The planned and the current status are identical.

Management and finance

SIEI is managed by an appointed Director-General and the Board of Directors. It is financed from the budget of the Development Plan. The planned and current status are identical.

General comment

SIEI is now a well-established institution. All foreseen specializations have been set up and they are functioning. The magnitude and quality of outputs varies, depending on accepted requests for services represented in the yearly work plan. SIEI is usually fulfilling its yearly work plans, although, with the originally foreseen number of staff, either the quantity of outputs or their quality could be increased. The emphasis is now on higher quality due to the fact that the industry's requests for services have undergone a substantial change towards more sophistication.

A list of some achievements of SIEI and of benefits gained by the engineering industries sector from SIEI is given in annex VIII.

B. Output No. 2 - Products

The latest summarized version of that output reads:

> "Prototype documentation, prototype testing, product design documentation, research testings and studies. Materials rationalization guides and internal standards. Introduction of computer-aided design (CAD) technique."

The original output was modified as follows:

(a) At the end of 1982 grouped and enlarged by adding applied research and materials rationalization guides;

(b) In the second half of 1985 by the initial introduction of computer-aided design (CAD) technique.

Services

(a) Planned:
- 4 prototype documentations and testings
- 4 product design documentations
- 4 research testings and studies
- 15 internal standards and materials rationalization guides
- On-the-job training in CAD;

(b) Current status:

(i) Prototype documentations and testing are produced in the magnitude and kind specified in the yearly work plan. Due to the kind of prototypes and manpower limitation, the yearly production varies;

(ii) Product design documentations are being produced. The extent depends on demand and their complexity;

(iii) Research testings and studies are proceeding and are considerably increasing;

(iv) The elaboration of internal standards and the updating of the materials rationalization guides are permanently progressing tasks;

(v) On-the-job training in CAD is proceeding with four engineers from SIEI and two from industry.

Staff

(a) Planned: 33 engineers and draftsmen;

(b) Current status: 19 engineers and one draftsman. Some of the research assignments are executed in teamwork with the staff of the end-user or of other institutions. Each of the national staff is sufficiently trained in his or her specialized field and is capable to:

(i) Design prototypes of simple or semi-complex engineering and electrical products; guidance is needed for more complex or sophisticated products;

(ii) Redesign or modify existing products;

(iii) Produce a complete product-design documentation;

(iv) Perform research tests and studies with varying quality, guidance being absolutely necessary for the more complex research and development assignments;

(v) Perform all required work connected with internal standardization and materials rationalization guides;

(vi) Use the HP-150 computer (one of the trainees knows how to prepare some simple software).

Methodologies

(a) Planned: Up-to-date;

(b) Current status: The design is up-to-date, with recent introduction of CAD. Testing is up-to-date with new (not planned) research laboratories and facilities.

General comment

The kind of services provided depends on the requests received from the end-users. The services are generally accepted by them. Newly designed or redesigned products as well as alterations to existing products are usually gradually or partially introduced by the end-users, depending on the complexity of the product as well as on the end-users' overall possibilities. The same applies for internal standardization and materials rationalization guides.

C. Output No. 3 - Technology, tool design and manufacturing

The latest summarized version of that output reads:

> "Technology documentation and tool design for all prototypes. Technology improvement and corresponding tool design for ongoing production in factories. Manufacturing of prototypes, special tools and sophisticated components. Introduction of applied research activities. Maintenance in SIEI."

The original output was modified as follows:

(a) In 1979 chemical technology was added;

(b) At the end of 1982 grouped and enlarged by adding maintenance;

(c) In mid-1985 addition of applied research activities.

Services

(a) Planned:

(i) Manufacturing of four prototypes with relevant documentation;
(ii) Design and manufacture of 15 special tools;
(iii) Manufacturing of six sophisticated components with relevant documentation;
(iv) Eight technology services to industry;
(v) Introduction of applied research activities;
(vi) Maintenance in SIEI;

(b) Current status:

(i) The number and kind of prototypes being manufactured is defined in the yearly work plan, and documentation for their manufacture is usually produced;
(ii) Special tools (jigs, fixtures, press tools, moulds of medium complexity and measuring fixtures) are designed in the foreseen number, in some years even more. Special tools of appreciated quality are being produced, however, recently with delays due to a lack of manpower, particularly of skilled workers. There is also collaboration with some factories in the manufacture of tools;

(iii) Sophisticated components are made according to drawings that are either provided to or modified by SIEI. There is collaboration with some factories. The quality is good, while the quantity depends on the complexity of the components and the availability of manpower. For simple or semi-complex components the yearly output is higher;

(iv) Technology services to industry are rendered on a regular basis;

(v) Applied research has been introduced in mechanical, chemical and materials engineering technology;

(vi) Maintenance in SIEI is regularly proceeding;

Staff

(a) Planned: Total 108, 40 of them engineers and technicians and 68 workshop personnel;

(b) Current status: Total 49, 29 of them engineers and technicians and 20 workshop personnel. To reduce the negative effects of understaffing, SIEI has succeeded, from time to time, to get skilled workers from outside to complete certain urgent manufacturing work. For applied research studies, sometimes, a team is formed including staff of SIEI, the end-user and the respective faculty or another institution. The national staff is sufficiently trained in his or her specialized field to be able to:

(i) Prepare manufacturing technology documentation for prototypes, sophisticated components, and all kinds of special tools;

(ii) Design special tools such as jigs, fixtures, small and medium-size press tools, moulds and measuring fixtures of semi-complexity as well as simple equipment and manufacturing aids;

(iii) Render technology services to industry in the form of direct support (e.g. modification of some operations and, rarely, of commplete manufacturing processes, introduce new toolings, suggest additional machine-tools and equipment etc.);

(iv) Render high-level applied research services in chemical technology (e.g. preservation of sponge iron, modification of chemical components in dry batteries, surface treatment of aluminium etc.). Render applied research services in materials engineering technology (e.g. nodular cast iron, heat treatment, use of cokeless coupoles etc.). Render simple services in mechanical technology (e.g. study of durability of cutting tools, study ways of increasing productivity etc.). However, applied research being still at the introductory stage, except for chemical technology, guidance and technical assistance is very much required for each advanced or sohpisticated task;

(v) Maintain the ordinary physical facilities, while direct assistance is needed for sophisticated equipment or instruments.

Methodologies

The planned and current status are identical, i.e. they are up-to-date.

General comment

All services are for end-users, including the manufacturing of prototypes. As the outputs are of good quality, all services are accepted and used. Tools and technology improvements are introduced into production. The

sophisticated components are used for the intended purposes. The prototypes are used for tests or research activities. The applied research aims at an increase of productivity.

D. Output No. 4 - Quality control

The latest summarized version of that output reads:

> "Quality Control Manual. Quality control system for enterprises. Materials testing. Measuring of tools and component parts. Research testings and studies in the field of materials and quality improvement".

The original output was modified as follows:

(a) At the end of 1982, grouped and inclusion of research testings and studies in the field of materials;

(b) At the end of 1985, inclusion of research studies in quality improvement and market quality research.

Services

(a) Planned (yearly): Quality Control Manual
2 quality control systems for enterprises
3 materials research studies
2 quality improvement research studies
15 materials testings
25 measuring activities;

(b) Current status:

(i) The basic part of the Quality Control Manual has been completed and its implementation in the factories is proceeding. This is, however, a continuous task, because improvements and modifications have to be made all the time;

(ii) Quality control systems for enterprises are elaborated regularly, but the yearly magnitude depends on the complexity of the tasks;

(iii) A varied number of materials research studies is prepared per year, depending on the subject matter;

(iv) The promotion of quality improvement in factories as part of quality improvement research studies is regularly proceeding. As of 1985, a "Quality week" in the engineering industry has been introduced;

(v) Materials testings are considered regular work, where the number depends on demand;

(vi) Measuring activities are proceeding with the addition of regular check-ups for, and calibration of, measuring tools and instruments;

(vii) Summaries of reports on quality problems in the public-sector engineering enterprises are prepared monthly, and a yearly study includes recommendations for improvements.

Staff

(a) Planned: Total 31, 26 of them engineers and technicians;

(b) Current status: Total 14, all engineers and technicians. For various assignments, a team is formed of staff of the Quality Control Department, the end-user and sometimes of other institutions working in that field. Each of the national staff is sufficiently trained in his or her specialized field to be able to:

(i) Use and implement in factories the Quality Control Manual, and the high-level experienced staff is capable to improve and enlarge it;
(ii) Follow and transfer the most up-to-date trends in the field of quality control which could be useful for the Iraqi engineering industries sector;
(iii) Perform destructive and non-destructive materials tests, and to a limited extent sophisticated fatigue and scanning microscope testings;
(iv) Measure sophisticated tools, mainly measuring and cutting tools, and take other measurements on the three-dimensional measuring equipment;
(v) Initiate market quality research studies, where guidance is still required;
(vi) Prepare materials research studies;
(vii) Perform the required inspections.

Methodologies

(a) Planned: Up-to-date;

(b) Current status: The most up-to-date.

General comment

All services are either for end-users or for other departments of SIEI. All services are utilized with very positive effect. On the initiative of this Department, a yearly "Quality week" has been officially introduced in the industrial enterprises with very positive effect. Recently, in collaboration with the industry, the Department started organized work on "quality marketing".

E. Output No. 5 - Techno-economic studies

The latest summarized version of that output reads:

> "Pre- and feasibility studies. Project appraisals. Market studies. Industry analyses, including cost reduction and productivity studies. Internal studies, including work plan evaluation. Introduction of COMFAR as helping instrument".

While in the original project document only a small section was foreseen, that output was increased in 1979 to be formed as Department, and in 1985 the introduction of COMFAR, was added.

Services

(a) Planned (yearly): 2 pre- and/or feasibility studies
2 project appraisals
2 market studies
1 industry analysis
2 internal studies and work plan evaluations;

(b) Current status: The capability and capacity to produce the planned outputs exist, but the quantity very much depends on the subject matter of the studies.

Staff

(a) Planned: 6 engineers and economists;

(b) Current status: 8 engineers and economists. Several studies are carried out by teams composed of staff of the Techno-Economic Studies Department and corresponding staff from either end-users or relevant institutions. The national staff is sufficiently trained to cope with the planned services, naturally everyone within the limits of his or her personal experience and capability. Often, the Department itself is functioning as one team to prepare certain studies. For more sophisticated studies, such as cost-reduction and social-benefit studies, further guidance is required.

Methodologies

(a) Planned: Up-to-date, with use of UNIDO's Manual;

(b) Current status: Up-to-date, with use of UNIDO's Manual and COMFAR.

General comment

All services are provided to the end-users. All services are taken into consideration by the enterprises or by the Government authorities concerned, when planning further actions.

F. Output No. 6 - Industrial information

The latest summarized version of that output reads:

> "Technical Library in UDC system with up-to-date technical books and publications. Regular industrial information service to the engineering industry and other users. Computerized Engineering Industry Information Data Bank. Microfilming, publications".

The original outputs were modified at the end of 1979 by introducing the Computerized Data Bank and microfilming.

Services

(a) Planned:

(i) Technical Library in UDC system;
(ii) Regular information service to the engineering industry and other users;
(iii) Computerized Data Bank;
(iv) Microfilming;
(v) Publications;

(b) Current status:

(i) Technical Library in UDC system established and functioning;
(ii) Regular information service is proceeding;
(iii) Data Bank established with terminal link to the computer, and it is in regular use;

(iv) Microfilming established and it is in normal use;
(v) Publications are proceeding.

Staff

(a) Planned: 30, with various graduations;

(b) Current status: 14, among them 11 university graduates. The national staff is sufficiently trained to deliver the planned services.

Methodologies

Planned and current status are identical, i.e. up-to-date.

General comment

Industrial information to end-users is provided either on request or through a regular, daily, information service. It is difficult to estimate the effects of these services.

G. Output No. 7 - Specialized, short-term training courses

The summarized version of that output reads:

"Specialized, short-term training courses for staff of the engineering industry".

Services

(a) Planned (yearly): 5 specialized, short-term training courses per year;

(b) Current status: The number of training courses is much higher and, in adition, there are seminars and lectures. On the average there are yearly 8 specialized, short-term training courses, and 12 lectures or seminars.

Recently a regional training course in quality control has been introduced.

Staff

(a) Planned: 3;

(b) Current status: 1, which is sufficient with a reorganized system of work.

Methodologies

According to the planned procedure, which is being implemented, the concerned technical department should:

(a) Prepare the content of the lecture, which should be approved by the Director-General;

(b) Prepare the handouts, including drawings, sketches etc. in a sufficient number of copies;

(c) Organize the delivery of lectures, mainly by using its own staff, but also by inviting other lecturers. In the latter case, the lecturer has to prepare his or her lecture.

The Training Section invites the participants and takes care of all facilities required for the course or seminar. Participants are selected jointly by the concerned technical department and the Training Section. Recently, all training courses are in Arabic language. The language used in seminars or lectures is either Arabic or English, depending on the working language of the lecturer.

The UNIDO experts and consultants fully participated in this activity when it started. Recently they are only giving lectures or holding seminars.

General comment

Staff from the engineering industry constitute the main group of participants in the training courses, seminars and lectures. SIEI is receiving an increasing number of requests for additional specialized training courses. However, SIEI can accept such requests only if they fit into the frame of its own limited training programme.

IV. UTILIZATION OF PROJECT RESULTS

A. SIEI as a technical institution assisting in the development of the engineering industries sector

Today SIEI has an important role in the engineering industries sector and has established working relations with all major public- and mixed-sector enterprises by providing to them essential technical assistance. That assistance started on a moderate level which was limited to industrial information, trouble-shooting in manufacturing operations, minor studies and research into quality problems.

Gradually the technical level of assistance was raised and the services became more diverse. SIEI rendered adequate assistance in product design, prototype testing, optimal utilization of materials, manufacturing technologies, special tools design, manufacturing of prototypes, special tools and sophisticated parts, quality control, materials testing and techno-economic studies, and it offered regular industrial information services as well as specialized short-term training courses. The results of implemented assistance were throughout satisfactory.

However, as the engineering industry is rapidly developing and undergoing substantive changes, an increasing number of requests is received for technical assistance in areas requiring a more sophisticated approach, such as an overall improvement of the industry's outputs and closely connected or interrelated applied research. The policy goals of engineering industry to which high importance is attached, are: considerably improved or new products, higher productivity, better utilization of capacities, higher quality, decrease in need for skilled manpower and much higher economy of production. Although requests for services in these areas are on a much higher and more sophisticated technical level than before, SIEI has to cope with them; results, therefore, vary due to the lack of experience.

Parallel, most of the earlier introduced types of technical assistance are continuing as regular routine collaboration between SIEI and the engineering enterprises, but on a lower scale so as to give more room for the new kind of requests.

B. Specialization and development of capabilities

From the very beginning SIEI followed the principle of specialization, which started with the establishment of the planned departments and sections, immediately after signing the project document. The work programme of each department was clear and the duties and responsibilities were strictly divided. The necessary technical forms and procedures were gradually introduced, following careful studies of advanced ones in comparison with those already used in the engineering industries sector.

Having a clearly specialized function and work programme as well as established technical forms and procedures, the development of the capabilities of the national technical staff remained the main concern of both, the management of SIEI and the team of UNIDO experts and consultants. The policy towards the national technical staff always was, and remained such that everyone should in his or her field of specialization excercise self-confidence and enjoy job satisfaction. Consequently, only very few of the national qualified staff transferred from the originally started specialization to another one.

The specialization and development of capabilities within SIEI had a certain, although indirect, influence on similar developments in the engineering industries sector. The technical forms and procedures are similar, some guides (materials rationalization) are the same, some manuals (quality control, quality insurance system, metrology assurance system) are either the same or very similar, and UNIDO's Manual for the Preparation of Industrial Feasibility Studies is in common use. Through specialized training courses and particularly through team work on assignments, some positive experiences of SIEI were also transferred to the staff of engineering enterprises. Moreover, some experienced national technical staff who spent longer periods in SIEI are now in high executive positions in engineering enterprises.

The above shows that SIEI had success with the specialization and the development of the capabilities of its national technical staff, and that it also had - although limited - a positive influence on the specialization and development of technical staff in engineering enterprises.

C. Direct support to the engineering industries sector

This subject has already been detailed in chapter III "Project results and achievements of objectives" and a list of some achievements of SIEI is given in annex VIII. In addition, there are 18 semi-annual progress reports which contain further details.

All these materials show that SIEI had mainly been working for and with the engineering industries by assisting them either in solving their current problems or in the development of products, in the introduction of up-to-date production technologies and in ensuring quality and economy. Therefore, SIEI has made its contribution to the efforts of the whole engineering industry towards achievement of the government development objectives.

V. FINDINGS

The UNDP/UNIDO project has succeeded to render adequate technical assistance in strengthening the capabilities of SIEI, enabling it to serve the Iraqi engineering industry through:

(a) Direct support in solving current technical problems or in improving products, production methods, productivity, quality and economy;

(b) Consultancies for further development;

(c) Narrowly specialized training for technical staff.

SIEI is well organized with a well-established and up-to-date working system, which, together with the excellent physical facilities provided by the Government, permit to produce outputs of the required quality level.

The demands for services from the engineering industries have undergone a substantial change towards more sophistication, following:

(a) An increase in their own technical capabilities which limit, but do not eliminate, the need for assistance from SIEI for presently ongoing productions;

(b) Aims to meet the demand for specific products which should have acceptable quality and price;

(c) The wish to maintain self-reliance for further development of products and production methods.

The capability of SIEI's technical staff has reached a satisfactory level. They can easily cope with the originally foreseen demands, and, in most of the specializations, even with a good part of the new, more sophisticated demands, although with some initial difficulties. However, in areas where experience in applied research and development are a prerequisite, further development of SIEI's technical staff is absolutely necessary and has to be supported by experienced researchers. The same applies to the efficient use of computer-aided engineering techniques.

The kind of outputs delivered depends on the demands and the industry's development policy. Measuring their quality is difficult, due to their diversity. Generally, the outputs are of good quality, some even very good. The highest level of quality is achieved in quality control and chemical technology, and the results in design and manufacturing of special tools or components are also very good. As product development and design is a rather difficult field, the quality of outputs varies. Techno-economic studies are of appreciable quality, and the industrial information services are prompt and precise, thus satisfactorily serving the users. The quality of training courses is very good; naturally, the content is adapted to suit the level, knowledge and experience of the participants.

The magnitude of outputs is in accordance with SIEI's approved yearly work plan. It is a combination of demands, capacity and capability of the present staff as well as of priorities in the engineering industry's development policy.

The main shortfall in inputs is in number of staff of SIEI, which is due to the prevailing overall circumstances in the country. The quantity of outputs would be larger, or the outputs would have a higher level of sophistication if SIEI had more highly qualified experienced staff and skilled workers. However, this shortfall is an imposed external factor and the government authorities concerned have exercised all possible efforts to minimize its impact. In this respect, SIEI is a very positive exception in Iraq.

The second shortfall is in fellowships and study tours. This was compensated by intensive on-the-job training and by the fact that SIEI has a well-developed human resources management policy and programme.

The outputs are normally utilized by the end-users, either fully or partially, depending on the kind of output and the overall possibilities of the end-users. If some outputs have not been used so far, and if they are good and acceptable, then they will be implemented later on. Only a few outputs will not be utilized at all, due to some changes in industrial policy which occurred during the preparation, or if results showed that other solutions would be preferable.

Although the contribution of SIEI was rather limited, it was still important for the development of the engineering industries in Iraq, which was the main development objective of the UNDP/UNIDO assisted project.

The immediate objectives, which were expanded, have all been fulfilled, with some modification in terms of quantity only.

It could be considered that SIEI's capacities and capabilities are consolidated for future services to the engineering industry except for specializations where applied research and development activities are required. However, the latter was no objective, neither in the original nor in the amended project document.

There is an urgent need to introduce to the engineering industry as a whole, and particularly to SIEI, computer-aided engineering techniques. Although several attempts have been made by the concerned government authorities, the results are not satisfactory, except in supporting fields. Recently this subject has been studied again.

The task of SIEI and the UNDP/UNIDO project was only to train a limited number of SIEI's designers in the use of computers for simple drawings and simple software. That task has been completed.

The management of SIEI and all the staff were very co-operative towards the project management and the team of UNIDO experts, and the government authorities concerned always supported SIEI and were very keen on a successful and smooth co-operation between the project management, UNDP through its office at Baghdad and UNIDO Headquarters.

UNIDO made every effort to support the implementation and development of the project through as much as possible prompt actions and useful advice.

The UNDP office at Baghdad closely followed the implementation and development of the project and was always ready to act on requests from either the Government or the project management.

The team of UNIDO experts was guided for maximal collaboration with the national staff and achieved - with very few exceptions - a successful mix of direct support and developmental emphasis.

The overwhelming environmental conditions (theory-oriented education, habits, climate etc.), together with staffing problems (mostly newly graduated staff, lack of experienced staff and skilled workers) and the time-consuming UNDP/UNIDO/Government official procedures had, naturally, some influence on project implementation and development.

The overall circumstances in the country from 1980 onwards had considerably slowed down, but not stopped, the increase of national qualified staff.

All these factors, combined with extra efforts exercised by SIEI's leadership and the project management permitted to achieve the described results.

Annex I

BRIEF SURVEY OF PROJECT DOCUMENTS AND REVISIONS

"A" - Preparatory assistance project document, signed August 1977

Duration: 6 months

UNDP input incorporated in project document "B".

"B" - Project document signed 20 April 1978

Duration: 5 years

UNDP input $US 2,973,800

"C" - Mandatory revision signed 12 June 1978

Rephasing of deliveries only.

"D" - Project revision signed 7 June 1979

Major changes based on TRM of 31 January 1979:

1. Introduction of the Techno-Economic Studies Department instead of a Section and consequent introduction of post No. 11-13, industrial economist;

2. Introduction of the Standardization Section and consequent introduction of post No. 11-14, expert for internal (factory) standards;

3. Cancellation of post No. 11-07, industrial designer;

4. Introduction of additional 12 m/m of fellowships;

5. Rephasing of deliveries.

New project budget $US 2,986,803, i.e. UNDP inputs increased by $US 13,003.

"E" - Project revision signed 9 July 1980

Major changes based on TRM of 4-5 May 1980:

1. Introduction of new, higher-rate proforma costs for experts and training;

2. Introduction of project cars with drivers;

3. Introduction of post No. 11-15, instructor/foreman for tools manufacturing;

4. Rephasing of deliveries.

New project budget $US 3,499,196, i.e. UNDP input increased by $US 512,393.

"F" - Mandatory revision signed 31 January 1981

Rephasing of deliveries only.

"G" - Mandatory revision signed 7 July 1981

Rephasing of deliveries and extension of the project's duration through 31 December 1983 due to delays in deliveries caused by war circumstances.

"H" - Project revision signed 1 September 1981

Major changes based on actual situation with deliveries of project inputs:

1. Introduction of budget line 20, sub-contract for services of three experts on posts No. 11-08, 11-15 and new post 11-16, expert for press tools and moulds design;

2. Increase on budget line 30, training, due to increase of proforma costs and tuition fees;

3. Duration of project extended through 30 June 1984;

4. Increase on budget lines 13, 15 and 16 due to increase in actual costs and extension of project's duration.

New project budget $US 3,931,302, i.e. UNDP input increased by $US 432,106.

"I" - Mandatory revision signed 25 February 1982

Rephasing of deliveries only.

"J" - Mandatory revision signed 7 June 1982

Rephasing of deliveries and extension of the project's duration through 31 December 1984.

"K" - Mandatory revision signed 25 May 1983

Rephasing of deliveries, extension of the project's duration through 31 March 1985 and correction of proforma costs.

New project budget $US 3,934,839, i.e. UNDP input increased by $US 12,536.

"L" - Mandatory revision signed 10 July 1983

Correction of actual and proforma costs only.

New project budget $US 3,965,039, i.e. UNDP input increased by $US 21,200.

"M" - Project revision signed 15 May 1984

Major changes based on TRM of 12 June 1983 and the government request for extension until phase II of the project starts.

1. Duration of project extended by 12 months, through 31 March 1986;

2. Rephasing of deliveries in accordance with government requirements for consolidation of introduced activities, completion of some ongoing activities and preparation for more sophisticated activities in future, as interim objectives;

3. Introduction of government cost-sharing contribution for 1984, and 1986 in Iraqi dinars totalling to equivalent of $US 295,826 plus $US 41,416 as support cost.

New project budget is $US 4,608,115 and the UNDP input is $US 4,312,289 i.e. UNDP input increased by $US 347,250.

"N" - Draft project revision for discussion only, finalized as project revision "O".

"O" - Project revision signed 22 May 1985

The Project Revision "M" had partially solved the extension of the Project with interim objectives due to financial constraints. This revision is complementary, with the following major changes:

1. Duration of project extended by 9 months, through 31 December 1986;

2. Reinforce post No. 11-06 as product designer/CAD;

3. Increase of government cost-sharing contribution for 1986 in hard currency by $US 74,424 plus $US 11,130 as support cost.

New project budget is $US 4,967,038 and the UNDP input is $US 4,596,788 i.e. UNDP input increased by $US 284,499.

"P" - Mandatory revision signed 9 December 1985

Rephasing of deliveries only.

"Q" - Mandatory revision signed 16 June 1986

Rephasing of deliveries and extension of post No. 11-01 chief technical adviser for transition period between two projects following decision that phase II of the project will be managed by the national project director.

"R" - Mandatory revision signed 30 October 1986

Rephasing of deliveries, specifying the extension of post No. 11-01 through 30 June 1986 and including deliveries of training aids on budget line 40 "Equipment" instead of training.

"S" - Project revision signed 3 March 1987

Revision made following postponement of phase II of the project and necessity to complete the work programme of two already serving experts. Major changes:

1. Extension of posts Nos. 11-02 product design specialist and 11-06 product designer/CAD through 30 June 1986;

2. Increase budget line 16 by $US 10,000 to cover the cost of project appraisal/formulation mission for phase II of the project.

UNDP contribution increased by $US 103,630 on account of the phase II project budget.

New project budget is $US 5,070,668, and the UNDP input is $US 4,700,418.

"T" - Mandatory revision signed 27 May 1987

Rephasing of deliveries only.

"U" - Project revision signed 4 July 1987

Revision made following postponement of phase II of the project and requirement to render technical assistance in (a) elaboration of future applied research and development policy and programme; (b) continuation of CAD activities; and (c) implementation of some urgent actions.

UNDP contribution increased by $US 199,214 on account of the phase II project budget.

New project budget is $US 5,269,882 and the UNDP input is $US 4,899,632.

Project completion date is 31 December 1987.

"V" - Mandatory project revision signed 25 November 1987

Rephasing of deliveries and extension of the project's duration through 30 June 1988.

No changes in objectives and project budget.

Annex II

UNIDO PROJECT STAFF SERVING DURING THE LIFETIME OF THE PROJECT

A. Experts

Item No.	Post No.	Post description	Incumbent		Duration of assignment	
			Name	Nationality	From	To
1	11-01	Chief technical adviser	Buranj, Stevan	Yugoslavia	Oct. 1977	(Dec. 1987)
2	11-02	Product design specialist	Lundberg, Andres	Finland	Oct. 1979	Oct. 1980
3		Researcher	Grecenko, Alexandre	Czechoslovakia	Jan. 1986	June 1987
4	11-03	Production engineering specialist	Mitlaender, Walter a/	Fed. Rep. of Germany	Aug. 1979	April 1980
			Wenstrom, Conrad b/	United States	Sept. 1980	Nov. 1980
5						
6		Researcher	Buehler, Robert	Fed. Rep. of Germany	Sept. 1981 and July 1985	June 1985 and Dec. 1986
7	11-04	Quality control specialist	Terelius, Gustav M.	Sweden	July 1978	Sept. 1980
8			Morozov, Boris	USSR	Dec. 1982	Dec. 1983
-	11-05	Industrial information and documentation specialist	Not filled c/			
9	11-06	Product designer/computer-aided design	Wojcikiewicz, Antony	Poland	Aug. 1985	(Dec. 1987) or (June 1987)
-	11-07	Industrial designer	Not filled d/			
10	11-08	Tool and die designer	Yanishevsky, Boris	Bulgaria	Feb. 1979	March 1981

continued

Annex II (continued)

Item No.	Post No.	Post description	Incumbent Name	Incumbent Nationality	Duration of assignment From	Duration of assignment To
11			Putnik, Dusan	Yugoslavia	Sept. 1981	March 1985
12	11-09	Heat treatment and mat. eng. specialist	Mallik, Assit K. e/	United Kingdom	March 1980	Aug. 1980
13			Balakrishnan V. f/	India	Feb. 1982	Feb. 1984
14	11-10	Tool production engineer	Mols, Adrian J.	Canada	April 1979	April 1980
15	11-11	Inspection engineer	Ipacs, Miklos	Hungary	Feb. 1981	Feb. 1982
16		Laboratories	Wood, Floyd	United States	May 1983	April 1984
-	11-12	Consultants - see separate list under B.				
17	11-13	Industrial economist	Garga, Desh R.	India	Aug. 1979	Jan. 1985
18	11-14	Expert for internal (factory) standardization	Wernhoff, Carl A.	Sweden	March 1980	April 1981
19			Bhagowalia, Balbir	India	Jan. 1982	June 1985
20	11-15	Instructor/foreman for tools manufacturing	Devanur, Salathiel f/	India	Feb. 1982	Feb. 1984
21	11-16	Press tools and moulds designer	Rudra Murthy, P. f/	India	Feb. 1982	Nov. 1982
			B. Consultants			
1	11-12/1	Internal standardization	Stimec, Vladimir	Yugoslavia	6 Sept. 1978	28 Nov. 1978
2	11-12/2	Industrial information	Hofer, Bruno	Austria	1 Oct. 1978 12 Oct. 1979	20 Oct. 1978 19 Oct. 1979
3	11-12/3	Electric iron design	Cumming, James G.	United Kingdom	6 Sept. 1979	6 Dec. 1979

continued

Annex II (continued)

Item No.	Post No.	Post description	Incumbent		Duration of assignment	
			Name	Nationality	From	To
4	11-12/4	Industrial information, data bank	Adams. Hubert	United Kingdom	20 July 1980	17 Aug. 1980
					13 Dec. 1980	31 Dec. 1980
					17 July 1981	26 Aug. 1981
					14 Oct. 1981	27 March 1982
5	11-12/5	Preventive maintenance	Steffens, Jurgen	Sweden	24 April 1981	20 May 1981
6	11-12/6	Bus body design	Gavrilovic, Ljubisav	Yugoslavia	10 April 1982	5 July 1982
7	11-12/7	Computer-aided design (CAD)	Bossak, Maciej Antoni	Poland	26 May 1983	23 Aug. 1983
					9 Jan. 1984	31 Jan. 1984
8	11-12/8	Computer-aided manufacturing (CAM)	Zietarski, Stanislaw	Poland	21 July 1983	30 Aug. 1983
9	11-12/9	Fatigue testing	Orstadius, Urlik K.	Sweden	5 March 1985	1 May 1985
10	11-12/10	Quality control	Terelius, Gustav M.	Sweden	30 April 1985	5 July 1985
11	11-12/11	Agricultural implements research	Guidobono-Cavalchini A.	Italy	22 May 1985	14 July 1985
					27 Nov. 1985	23 Dec. 1985
12	11-12/12	COMFAR, computer system analyst	Novak, Robert	Austria	26 May 1985	13 June 1985
					1 Nov. 1985	7 Nov. 1985
13	11-12/13	COMFAR, financial analyst	Gajecki, Ryszard	Poland	30 May 1985	28 June 1985
					3 Nov. 1985	18 Nov. 1985
14	11-12/14	Small electric motor design	Nair, Ramon	Canada	30 Jan. 1986	22 March 1986
		C. Administrative support personnel				
1	13-01	Secretary	Alaman, Lubna M.	Iraq	1 Nov. 1977	7 April 1978
2	13-01	Secretary	Pius, Layla M.	Iraq	25 May 1978	12 Nov. 1979

continued

Annex II (continued)

Item No.	Post No.	Post description	Incumbent		Duration of assignment	
			Name	Nationality	From	To
3	13-01	Bilingual secretary	Saeed, Lutfia M. R.	Iraq	27 Aug. 1979	31 July 1987
4	13-05	Administrative clerk	Al-Sheikh Maya, Feryal	Iraq	6 Sept. 1980	31 Jan. 1981
5	13-06	Secretary	Al-Hilawi, Amal	Iraq	1 March 1982	31 Oct. 1982
6	13-03	Driver	Al-Shemmary, Ali Radif	Iraq	23 Sept. 1979	28 Feb. 1982
7	13-04	Driver	Al-Roubayee, Ali Jessam	Iraq	1 Nov. 1979	31 July 1987
8	13-05	Driver	Abbas, Hussein Hamza	Iraq	9 Feb. 1982	8 March 1982
9	13-05	Driver	Abdullah, Kassim Farid	Palestinian	8 March 1982	31 Jan. 1983
10	13-05	Driver	Ahmed, Tawfiq Saleh	Palestinian	12 Jan. 1983	31 Dec. 1986

a/ Evacuated for medical reasons, without return.

b/ Resigned due to war circumstances.

c/ Post cancelled due to availability of an expert under bilateral agreement.

d/ Post cancelled as not important due licence based manufacturing in Iraq.

e/ Evacuated for medical reasons, without return.

f/ Under subcontract with HMT(I) - India.

Annex III

FELLOWSHIPS AND STUDY TOURS

Item No.	Description of fellowship or study tour	Duration (months)	Name of fellow	Country of training	Duration From	Duration To
1	Industrial information and documentation	6	Khattab, Zuhair	USSR (4 months) India (2 months)	April 1979	Oct. 1979
2	Study tour of Director of Quality Control Department	3	Abduljebbar, Ismail	Sweden	March 1980	June 1980
3	Testing of agricultural implements	6	Gulli, Khaled Wilson	United Kingdom	May 1980	Oct. 1980
4	Quality control and inspection	6	Sarsam, Refah M.	United Kingdom	June 1980	Dec. 1980
5	Industrial information and documentation	6	Naamo, Jelal	United Kingdom	Nov. 1980	May 1981
6	Industrial information and documentation	4	Ahmed, Iqbal	United Kingdom	June 1981	Oct. 1981
7	Partial study tour of the Director-General	1	Abbas, Abid Ali Sahib	United States	July 1981	Aug. 1981
8	Study tour of Director of Industrial Inf. and Doc. Dept.	3	Al-Imari, A.K.A.F.	India (1 month) United Kingdom (1 month) United States (1 month)	Aug. 1981	Nov. 1981
9	Techno-economic studies	4.5	Jassim, Amjad	United Kingdom	Nov. 1981	April 1982
10	Process planning for tools manufacturing	6	Al-Ani, Batool Nassir	Switzerland Fed. Rep. of Germany	Jan. 1982	July 1982
11	Design and manufacturing of Jigs and fixtures	6	Al-Ani, Yassa Rafeek	Switzerland Fed. Rep. of Germany	Jan. 1982	July 1982
12	Design and manufacturing of press tools	6	Al-Obaydi, Hooda	Switzerland Fed. Rep. of Germany	Jan. 1982	July 1982
13	Heat treatment	3	Al-Shibli, Yehya Thamer	Fed. Rep. of Germany	April 1982	July 1982
14	Partial study tour of the Director-General	0.5	Abbas, Abid Ali Sahib	Japan	May 1982	May 1982
15	Quality control	6	Al-Sheikhly, Kawla	Sweden	July 1983	Dec. 1983
16	Technology of plastics	2	Al-Azzawi, Affaf	Austria	Oct. 1983	Nov. 1983

continued

Annex III (continued)

Item No.	Description of fellowship or study tour	Duration (months)	Name of fellow	Country of training	Duration From	Duration To
17	Study tour of Director of Production Engineering Department	1.5	Al-Khozaee, Adnan	Sweden (3 weeks) Fed. Rep. of Germany (3 weeks)	Nov. 1983	Dec. 1983
18	Study tour for CAD/CAM	0.8	Abbas, Abid Ali Sahib, Director-General	Poland (1 week)		
19	Study tour for CAD/CAM	0.8	Dewachi, Abdul-Illah, Exec. Director, IPC	Fed. Rep. of Germany (1 week)	Jan. 1984	Jan. 1984
20	Study tour for CAD/CAM	0.8	Al-Ramadan, HAM Computer Manager, EICO	United Kingdom (1 week) (including UNIDO Headquarters)		
21	Material testing, quality control	6	Youssif, Meha Yacoub	Sweden	Sep. 1984	Feb. 1985
22	Product design	3	Sehab Abdul-Karim	United Kingdom	June 1985	Aug. 1985
23	Study tour for techno-economic studies	0.5	Ismail Al-Mandelawi Department Director	UNIDO Headquarters (2 weeks)	March 1986	March 1986
	TOTAL	82.4				

Annex IV

EQUIPMENT PROVIDED THROUGH THE PROJECT

A. Equipment handed over to SIEI

Item	Quantity	Description	Condition
1	1	Calculator HEWLETT-Packard model HP-25A	Fair
2	1	Typewriter electric editor 4/46 cm, Elite Olivetti No. E 18 1077617	Bad
3	1	Project record and playback Caramete Singer	Fair
4	1 set	COMFAR on APPLE III, composed of 1 APPLE III PC, 256 KB memory capacity with internal disc-drive plus one RAM disc W 128 K	returned to Vienna for repair
		1 monitor III	Good
		1 APPLE hard disc, profile III (5mb cap) with interface	Good
		1 Epson matrix printer type FX 100 with interface card	Good Good
		1 Disc-drive F APPLE III (2nd)	
		1 power control unit for APPLE III computer	Now fair (after replacement)
5	1 set	Training aids: video programme JURAN on quality improvement, composed of:	Good
		16 colour video cassettes 1/2 inch, VHS, PAL system with full JURAN programme in English language	Good
		1 Leader's Manual Workbook	
		1 JURAN, Quality Control Handbook	
		1 JURAN, Managerial Breakthrough	
		1 JURAN/GRYNA, Quality Planning and Analysis	
		1 JURAN, Management of Quality	
		1 JURAN, Upper Management and Quality	
		1 JURAN, selected papers	
		1 visual aid masters	
		1 workbook	
6	1 set	Statistical quality control training aids, composed of:	Good

Item	Quantity	Description	Condition
		1 model WD-5 Qunicunx 1 NP-5 narrow distribution pin block 1 AC-5 carrying case 1 QT-5 training cassette (VHS in PAL) 1 SBL-2000 sampling box	
7	1 set	Films on video cassettes (VHS in PAL) as training aids, composed of: 1 Roadmap for change 1 Management's five deadly diseases 1 Total quality control	Good
8	1 set	Maintenance and repair kit for APPLE III computer, consisting of English manual, circuit board scheme, service parts (25 IC's) and 3 exchange modules	Good
9	1 set	NICO battery set 12V 6.5 for interrupted power supply EP-201 (2 pcs.)	
10	1 set	Addition to HP-150 computer composed of: 1 HP-45915A HP-HIL interface and 384 K memory accessory board 1 HP-4660A Mouse 1 Hp-45449D Fortran by Microsoft 1 HP-47956A AutoCad	Good
11	1 set	Dynamometers, composed of 1 PIAB dynamometer type NM, art. No. 30031, 20 KN 1 potentiometer, art. No. 301018 1 PIAB dynamometer type NQ, art. No. 30041, 50 KN 1 potentiometer, art. No. 301009 2 m intermediate cable 4 m intermediate cable 1 chart recorder 6 paper rolls for recorder	Good
	B.	Cars remaining UNDP property, but at the disposal of SIEI for phase II of the project	
1	1	Volvo 240 GL, standard fitting Chassis No. 1244233 G 1148401 Engine No. 552 Registration No. UN 216	Good

Item	Quantity	Description	Condition
2	1	Volvo 240 GL, standard fitting Chassis No. 1244233 G 1148983 Engine No. 583 Registration No. UN 217	Good
3	1	Toyota station wagon, 6 cylinders, with power steering, radio, heater and airconditioning Chassis No. 112-653156 Engine No. 3363502 Registration No. UN 178	Bad
4	1	Toyota station wagon 2.8 CC 1983 Chassis No. 112-653270 Engine No. 3400309 Registration No. UN 98	Bad

Annex V

ORGANIZATIONAL STRUCTURE OF SIEI
(Status of 30 June 1987)

BOARD OF DIRECTORS

CHAIRMAN

DIRECTOR-GENERAL

DIRECTOR-GENERAL

OFFICE OF THE DIRECTOR-GENERAL

Confidential Unit
Secretariat

RESEARCH AND DEVELOPMENT CONSULTATIVE COUNCIL

1. DEPARTMENT OF PRODUCT DEVELOPMENT AND DESIGN

Division of Engineering Products Design
Division of Mechanical Research
Division of Electrical Research
Standardization Section

2. DEPARTMENT OF PRODUCTION ENGINEERING

Division of Technology
Division of Tool Design
Heat-treatment and Materials-engineering Section
Division of Chemical Technology
Services (Maintenance) Section
Manufacturing Workshops

3. DEPARTMENT OF QUALITY CONTROL

Division of Quality Control
Division of Laboratories

(a) Materials Section
(b) Metrology Section

Division of Market Quality Research

4. DEPARTMENT OF TECHNO-ECONOMIC FEASIBILITY STUDIES

Economic Studies Section
Technical Studies Section

5. DEPARTMENT OF INDUSTRIAL INFORMATION AND DOCUMENTATION

Technical Library
Information and Documentation Division
Publication and Editing Section
Technical Services Division

6. DEPARTMENT OF FINANCE AND COMMERCIAL AFFAIRS

Accounting Division
Stores division
Commercial Section
Internal Audit Section

7. DIVISION OF ADMINISTRATION

Personnel Division
Legal Section
Training Section
Services and Reception Division

Annex VI

STAFF OF SIEI
(Status of 30 June 1987)

A. Distribution by Division

Division	Number of staff	
	Per project document	On 30 June 1987
Office of the Director-General	3	2
Division of Product Development and Design	34	20
Division of Production Engineering	108	49
Division of Quality Control	31	14
Division of Industrial Information and Documentation	35	14
Division of Techno-economic Feasibility Studies	3	8
Division of Finance and Commercial Affairs	17	12
Division of Administration	45	31
Total	276	150

B. Distribution by qualification

University graduated engineers	84	62
Other university graduates	20	21
Others	178	67
Total	276	150

Annex VII

PHYSICAL FACILITIES OF SIEI
(Status of 30 December 1987)

1. Size

Total compound area	approx. 35,000 m^2
Total built area	approx. 11,200 m^2

2. Main administration building

(a) Basement, ground floor and four floors, centrally cooled and heated building, with a total area of — approx. 6,000 m^2

(b) Distribution

(i) Ground floor: reception, lecturing rooms, services and restaurant;
(ii) First floor: offices of the Director-General, Division of Administration, Division of Finance and Commercial Affairs, UNIDO chief technical adviser;
(iii) Second floor: Division of Product Development and Design, Division of Quality Control, lecturing room;
(iv) Third floor: Division of Production Engineering and Division of Techno-economic Feasibility Studies, lecturing room;
(v) Fourth floor: Division of Industrial Information and Documentation with all technical services;

(c) Working facilities

(i) All excellently furnished;
(ii) All technical offices equipped with up-to-date drawing equipment;
(iii) Computers:
- HP150 and Olivetti PC for CAD;
- APPLE III for COMFAR;
- Terminal with phone connection for Engineering Industry Data Bank;
(iv) Photocopying and drawing-copying equipment and one separate photocopying machine;
(v) Fully equipped microfilming section;
(vi) Word processor and typewriters;
(vii) Technical library with reading room;
(viii) Audio-visual and other training facilities, including TV and video recorders;
(ix) Telephone exchange;
(x) Fully equipped restaurant and medical services room.

3. Maufacturing workshops

(a) One-level building, centrally cooled and heated, with annexes, total area — approx. 2,500 m^2

(b) Distribution

(i) Built-in annexes: offices, toolstore and tool grip, services room, lavatories etc.;
(ii) Other annexes: air-conditioned premises for precision-machining and jig-boring, specialized workshops, heat-treatment workshop and material issuing store;
(iii) Central part: machining and assembly-fitters workshops;

(c) Working facilities and equipment

(i) Fully equipped mechanical workshop for manufacturing prototypes and special tools such as dies, jigs, fixtures and plastic moulds. Equipment composed of standard and special machine-tools, including horizontal boring and grinding machines;
(ii) Fully equipped precision-machining and jig-boring shop, including up-to-date jig-boring and grinding machines with numerical and/or audio control.
(iii) Equipped auxiliary workshops for sharpening, sheet-metal work, welding, wood-work and maintenance;
(iv) Equipped heat-treatment workshop with two furnaces, one salt-bath furnace and minimal forging facilities;
(v) Material-issuing store with material-cutting shear;
(vi) Well stocked store for tools and spare parts;
(vii) Measuring tools and instruments;
(viii) Electric power from main supply; in case of failure there is a sufficiently powerful stand-by unit.

4. Laboratories

(a) One-level building with air-conditioning (cooling and heating), divided by partitions according to requirements, total area approx. 900 m^2

(b) Distribution

(i) Material-testing laboratories including separate partitions for X-ray and scanning microscope;
(ii) Measuring laboratory
(iii) Photo laboratory;
(iv) Instruments maintenance;
(v) Offices;

(c) Working facilities and equipment

(i) The material-testing laboratories concentrate on mechanical tests and are equipped with corresponding up-to-date sophisticated machines and instruments. There are facilities for fatigue tests, X-ray tests, scanning microscope tests, destructive and non-destructive material tests;

(iii) The measuring laboratory is excellently equipped and has all up-to-date facilities for the testing of measuring tools and instruments. Beside those, there is a three-dimensional measuring equipment with computerized reading;

(iii) The photo laboratory is very well equipped and serves the laboratories and other Departments of SIEI;
(iv) Other necessary working facilities are available and the working conditions are excellent.

5. Research laboratories

(a) One-level centrally cooled and heated building, devided into three parts, and one annex, total area approx. 1,800 m^2

(b) Distribution

(i) Mechanical Products Research Laboratory;
(ii) Electrical Products Research Laboratory;
(iii) Chemical Technology Research Laboratory;
(iv) The annex houses the technical offices;

(c) Working facilities and equipment

(i) The Mechanical Products Research Laboratory is moderately equipped with some instruments for measuring various performances of engines, tractors and agricultural implements. The instruments include engine dynamometer, fuel injection testing, three-point linkage dynamometer, vibration and wheel-load measuring equipment;
(ii) The Electrical Products Research Laboratory is also moderately equipped with various instruments for measuring the performances of electrical motors, electrical equipment tester for automotive products etc.
(iii) The Chemical Technology Research Laboratory is fully equipped with chemical laboratory equipment and the required measuring instruments.

Annex VIII

MAJOR ACHIEVEMENTS OF SIEI AND BENEFITS DERIVED BY THE ENGINEERING INDUSTRIES SECTOR

All work completed by SIEI during the period of UNDP/UNIDO technical assistance is detailed in the semi-annual progress reports. This annex contains only a few examples to demonstrate the kind and importance of the assistance rendered as well as the mode of implementation. The examples are grouped by subjects and limited in number, to show the variety of tasks.

Agricultural machinery and implements

1. Heavy-duty disc harrow, fertilizer sprayer, subsoiler and ridger for rice fields. Redesigned to suit local conditions. Prototypes manufactured and tested. Design documentation submitted to manufacturer and implementation.

2. Multipurpose compound agricultural machine for soil preparation and seeding operations. This machine is to increase productivity considering local soil conditions. Prototype developed using already manufactured elements; underwent for lengthy field tests. Tests recently positively completed. Product design in process.

3. Mechanization of all agricultural operations for date palm trees. Importance due to (a) in Iraq exist 18,135,000 productive palm trees but with average yield of only 13.9 kg per tree and (b) old-fashioned way of plantation. In preliminary studies eight implements have been foreseen. Prototypes for tractor-mounted lifting platform (in three versions), cutter for branches (in two versions) and sprayer/pollinator designed, manufactured and tested under actual field conditions. Results are satisfactory. Product documentation, when completed, will be given to manufacturer for serial production.

4. Prolongation of the effective working life of soil-engaging parts of agricultural implements. An important applied research project requested by the manufacturer. Methodology study completed and long-lasting work in progress.

5. Various tests on request by enterprises or authorities, e.g. cooling of tractor engine under extreme local climatic conditions (heat and dust), and testing of seed-drill cultivators.

Work on other products; completed and introduced in manufacture

1. Design of various aluminium sections.

2. Redesign of inner part of refrigerator.

3. Replacement of steel sheets by aluminium sheets for aircoolers.

4. Alteration of materials used for the body of the "Reem" bus.

5. Prototypes of solar water heaters and solar water-desalination units, for experimental work at the Solar Energy Institute.

6. Prototypes of table and stand fan as well as small exhaust fan developed and tested, but not yet manufactured.

Standardization of materials and typical parts, prepared in co-operation with specific engineering enterprises and close guidance during their introduction

1. Material guides prepared:

Volume 1: Steel in wrought form (in two parts)
Volume 2: Dimensions of steel products
Volume 3: Non-ferrous materials, winding wires, copper conductor cables, cast iron, cast steel
Volume 4: Non-metallic materials - paper, wood, rubber, textiles, electrical and thermal insulating materials

Some typical results are:

(a) Steel specifications reduced from over 500 to 200;

(b) Non-ferrous materials specifications reduced from 172 to 118;

(c) Steel product sizes reduced from 1,415 to 1,000.

2. Standardization of hexagonal bolts and nuts.

3. Standardization of fasteners for trucks and busses.

Manufacturing process engineering

Production operation studies, design of special tools, their manufacturing and introduction of zero-batch production:

- Progressive piercing/banding die for frame of fan;
- Set of tools for manufacturing jaws for lathe chucks;
- Universal die set with 21 exchangable inner dies for manufacturing aluminium discs from 100 mm Ø up to 290 mm Ø;
- Universal fixture for assembly of bodies of aircoolers;
- Two pneumatic fixtures for welding of upper and lower parts of the columns for the body of the "Reem" bus;
- Progressive dies for top of 1G and 2G dry batteries;
- Progressive dies for chain of bicycles;
- Pneumatically operated moulds for die casting of + and - terminals of liquid batteries;
- Progressive die for heat reflector in TV sets;
- Two compound dies for piercing and bending, two cutting dies, device for compact rolling and two side blades for cable manufacturing;
- Prototype development of a large-type vehicle axle and mounting brackets with seven large-size special tools;
- Standard-type quick-clamping drilling jig, size 100 x 125 mm;
- Device for handling heavy dies;
- Cutting-off die set for corner radii of 2, 3, 5, 6, 10, 15, 20, 25 and 30 mm.

Process planning and operation/tooling studies with guidance for implementation of results

- Tool maintenance and manufacturing workshops redesigned and determination of additional equipment for four enterprises (Al-Quadessiyah Industrial Complex, Mechanical Industries, Electrical Industries and bicycle factory);
- Improvement of plant for production of swaged electricity poles (production process, plant layout, handling and toolings);

- Low-cost automation for three assembly lines of liquid batteries (partially introduced only);
- Practical guide for cutting data of high-speed steel and carbide metal cutting tools;
- Repair welding of hardened and tempered steel for reconditioning of cutting edges, wear points and surface on press tools and forging dies;
- Performance comparison study of HSS tools and titanium nitride (TIN) coated HSS tools;

Heat treatment and materials engineering

- Improved heat-treatment process for supporting ring, nails and butt-welded taps;
- Performance tests of punches and dies treated by T.D. process (Japan) for increase of tool life;
- Development of high impact strength steel castings for replacement of steel forgings (material specification and heat-treatment process only);
- Heat-treatment handbook (for engineers, foremen and operators);
- Introduction of S.G. nodular cast-iron process on the existing facilities of the foundry;
- Study for replacement of conventional cupola with cokeless cupola in cast-iron foundry.

Chemical engineering

- Introduction of plastic coating and phosphoring by spraying;
- Improvement of finishing process for fluorescent bulb covers;
- Introduction of new zinc electroplating process for spark plugs;
- Addition of chemicals to basic paints to increase corrosion resistance of painted iron alloys;
- Replacement of imported paint for transformers by local one;
- Project for reduction of manufacturing cost of dry batteries by changing the composition of lead-antimony alloy. During the first phase, antimony content was reduced from 6 per cent to 4.5 per cent and in second phase to 3 per cent;
- Project on the protection of sponge iron (inhibition of re-oxidation) in a newly built pilot plant. The developed process has been patented (Federal Republic of Germany, United Kingdom and United States of America).

Quality control manual and its implementation in factories

- A comprehensive non product-specific quality control manual is being prepared and the Arabic version has been distributed to all concerned engineering industrial enterprises;
- Based on the quality control manual a product-specific quality control system is being developed and implemented for some products, factories and even complete enterprises (e.g. ceiling fan factory; manufacturing of new tourist bus; bicycle factory; lamp factory; State enterprise for electrical products etc.);
- Appreciating the achievements in quality control and realizing the importance of the quality issue, the concerned authorities introduced a "quality week" in the engineering industries sector and recently extended it to the entire industrial sector.

Metrological certification system and its implementation in the engineering industries sector

- A comprehensive metrological certification system has been elaborated, whereby the Metrology Laboratory of SIEI serves as a central place for high-precision measuring of so-called "master pieces" belonging to factories;
- An agreement has been reached with the Central Organization for Standardization and Quality Control - the government sole official authority - to transfer its responsibility and authority for the measuring of "master pieces" in the engineering industries sector to SIEI. The implementation of this agreement is proceeding as permanent work, obligatory for all enterprises.

Other quality control and laboratory tests - routine assignments

- Monthly reports on quality problems in the public-sector engineering enterprises are received, studied and actions recommended; yearly, a comprehensive report on the quality situation is issued, including recommendations for further action;
- Material testing, including fatigue endurance limit tests, are carried out, upon request, on a regular basis.

Techno-economic studies - preparation, implementation or actions taken in accordance with findings

- Identification and prefeasibility studies for the establishment of a factory for special tools. The outcome is a very modern special tools factory, already in operation;
- The industrial analysis for the dry batteries factory continued with a project for the reduction of the manufacturing cost, including a change of the lead-antimony composition;
- Co-operation with Arab Industrial Development Organization (AIDO) in the establishment of capital goods industries in the Arab States continued, recently with an identification study for the establishment of a capital goods industry in Iraq;
- Techno-economic study on a multi-purpose compound agricultural machine; an internal feasibility study had shown positive indicators and work on the development of the machine continued;
- The results of a prefeasibility study for the manufacturing of cardboard cartons for the engineering industries sector was negative; consequently, the authorities concerned took no further action.

Industrial information service to industry

- A well stocked technical library, classified according to UDC system, exists, and a Library's bulletin is being issued regularly. The library is open to all industries and private persons;
- An engineering industries data bank, linked by a terminal to a computer, is in operation and its service is at disposal;
- The daily industrial information service to the engineering industries sector is a regular routine work. Besides, there are services on request.

Training

As an example the training courses and lectures held during the period May to October 1986 are listed:

Training courses

Subject	Duration (Working days)	Number of participants
Basic course in quality control	8	45
Use of engineering drawings (a training course for operators)	6	15
Heat treatment of alloy steels	6	32
Quality control (a training course for operators)	6	14
Specially designed training in quality control for university graduates from chemical and mineral industries	6	17
The tenth course in quality control	6	15
Information and data bank for engineering industry	10	22
Non-destructive testing	6	22

Lectures

Use of computer for search in data bank and use of the MINISIS system for answering inquiries;

Patents as means for transferring information;

Annual programme for quality improvement of products;

Structure and role of information services presented to the users of industrial information;

Importance of industrial information, its automation and cost;

Disposition of nickel-phosphor alloy;

Sponge iron as a raw material to produce ductile cast iron;

Non-traditional machining processes.

Work completed during 1987

- Chair for disabled; prototype designed, manufactured and tested. Product and production documentation in process;
- Read pressing implement, as completely new implement connected with hydraulic system of locally manufactured tractor "Antar". Technical solution developed, prototype documentation completed, prototypes manufactured and field test in progress;
- Wear-measuring equipment-tester. A new solution to replace the soil-bin invented earlier. Design and manufacturing of very sophisticated equipment completed. Performance tests positively completed. Use of equipment-tester started.