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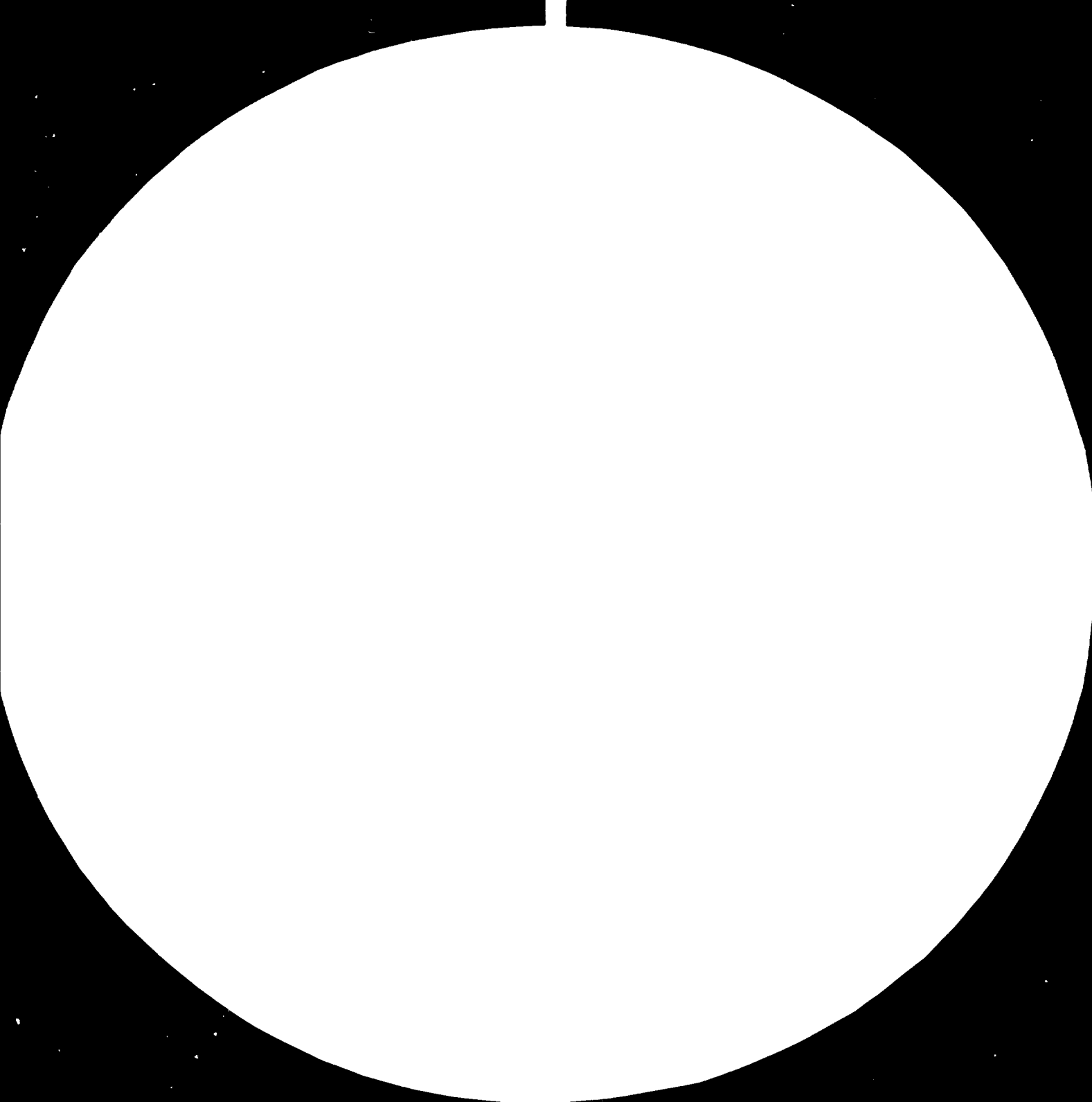

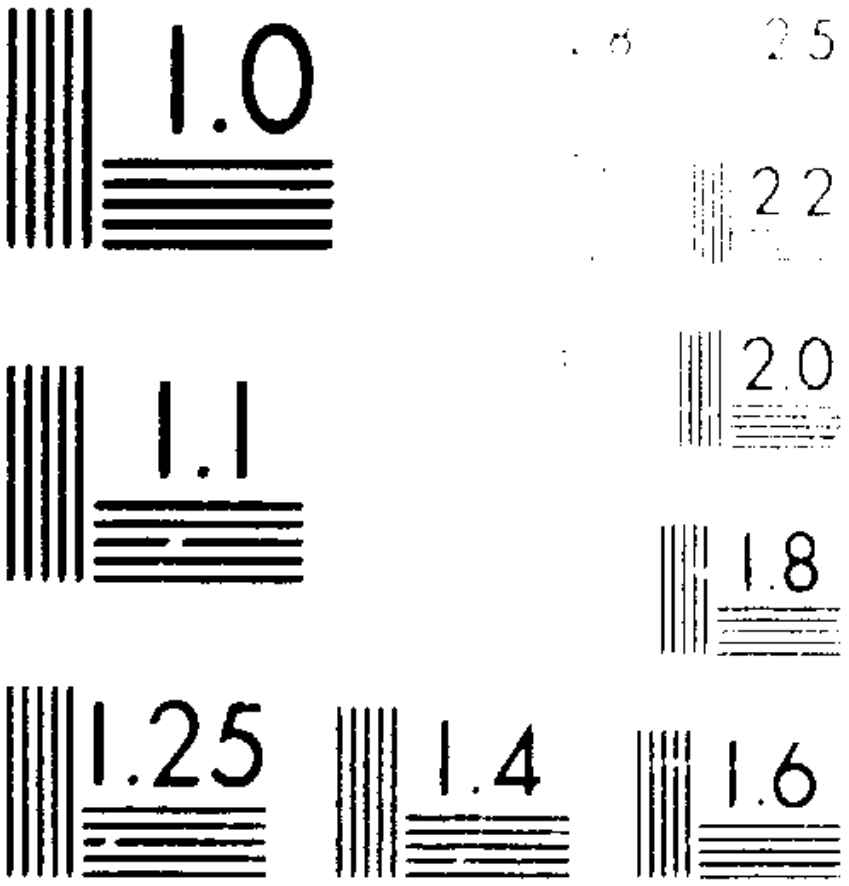
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TRANSFER OF TECHNOLOGY FROM PAKISTAN TO LIBYA

TECHNO-ECONOMIC FEASIBILITY STUDY FOR ESTABLISHMENT OF A PLANT FOR PUMPS, ELECTRIC MOTORS AND AGRICULTURAL IMPLEMENTS

PREPARED FOR

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

NATIONAL DESIGN & INDUSTRIAL SERVICES CORPORATION LTD.

TRANSFER OF TECHNOLOGY FROM PAKISTAN TO LIBYA

TECHNO-ECONOMIC FEASIBILITY STUDY FOR ESTABLISHMENT OF AN ENGINEERING PILOT DEMONSTRATION PLANT OR A COMMERCIAL PLANT FOR PUMPS, ELECTRIC MOTORS AND AGRICULTURAL IMPLEMENTS

PREPARED FOR

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

NATIONAL DESIGN & INDUSTRIAL SERVICES CORPORATION LTD.

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LAHORE - PAKISTAN

JULY : 1977

I N D E X

SUMMARY AND CONCLUSIONS

Summary and Conclusions.

1. The United Nations Industrial Development Organisation (UNIDO) requested the National Design and Industrial Services Corporation (NDISC) of Pakistan to undertake a study on the Transfer of Technology from Pakistan to enable the establishment in Libya of a Pilot Demonstration Plant for the manufacture of agricultural implements, Water Pumps and small Diesel Engines, primerily as motive power for the Pumps.

2. Since the requirement of small Diesel Engines in Libya is extremely limited, following discussions with UNIDO, it was decided to consider the manufacture of small Electric Motors for the Pumps, including manufacture of Monobloc units, instead of Diesel Engines.

3. The complete terms and conditions of reference of the consultants' team are detailed in Chapter I of the Project Report, and briefly represent the following:-

(a) An initial visit by the team to Libya to ascertain the interest of the Government authorities of the Libyan Arab Republic to the Project, and to collect base data for the project.

(b) To prepare a detailed technico-economic report for the Project.

(c) Following submissions of the report a visit from a senior Pakistani Government Official to Libya for discussions on the project with the Government of the L.A.R.

4. The team visited Libya, and after extremely cordial discussions with Libyan Government officials, a summary of which is contained in Annexures I and II to the draft report, it appears that the Government of Libya would be very interested in the establishment of the proposed project, and the transfer of technology from Pakistan.

5. The draft project report represents the complete techno-economic study of the proposed plant, and this is summarised below. The visit of the Government official to Libya will occur on the examination of the report by UNIDO and the Government of the L.A.R.

6. While the area of the Libyan Arab Republic is large (1.7 million KM^2), the arable land is only 1.9 million hectares, and currently the irrigated land is only about 300,000 hectares.

7. The major factor in the future development of agriculture is the availability of water. Since rainfall is scarce and the yearly average is less than 100 mm over 93% of the country's land surface, currently a large part of all water requirements are met from ground water, except in some coastal and sub-mountain areas where traditional dry-farming continues.

8. In consequence the Government of L.A.R. has ambitious plans for the increase in agriculture, and in future the increases must come from Irrigated acreages. Currently the country has 800 million hectares under crops, of which 168,000 ha are irrigated land. In 1980 the L.A.R. Government plans provide for 1.068 million ha under crops with 268,000 ha under complete irrigation.

9. The increase in cropped acreage and irrigation will require substantial amounts of agricultural implements and irrigation pumps.

10, Since the farming in Libya is mechanised, agricultural implements required must be Tractor-Driven, and anxiliary equipment such as Trailers are required. The present demands for Agricultural Implements have been surveyed by the Consultants in Chapter 4 and projection made in Chapter 5. The demand may be summarised as follows:-

	Current Demand	Projection Demands	
	1976	1980	1985
Disc Harrows	3,000	9,000	13,000

Cultivators	1,250	4,500	6,700
Seed Drills	2,500	9,000	13,400
Levellers	3,000	4,500	6,700
Trailers	1,750	4,500	6,700
Diggers/Ridgers	2,500	4,500	6,700
Water Tanks	1,750	4,500	6,700
Rakes	1,500	4,500	6,700
Rotavators	1,500	4,500	6,700

11. Present demands and future projections have also been estimated for pumps in chapters 4 and 5. The pumps however can be classified under the terminology used in Libya as Centrifugal and Submersible. However the terminology "submersible" in Libya does not only mean submersible electrical pumps, but also deep-well turbine pumps. In fact nearly all the demand for so-called "submersible pumps" are for the latter type of pumps, as they require less maintenance.

12. The demands for pumps as estimated by different methods by the consultants may be summarised as follows:-

	Current Demand	Projection Demand	
	1976	1980	1985
Centrifugal Pumps)		14,148	20,000
"Submersible" Pumps)	16,000	9,432	10,770
TOTAL:-	16,000	23,580	30,770

13. On the basis of the above requirement of pumps, the demands of electric motors for pumps would be:-

	Current Demand	Projected Demand	
	1976	1980	1985
Upto 5.5 HP.	1,120	1,649	2,077
5.5 to 10 HP.	6,592	7,075	8,462
10 HP & above.	8,288	14,856	20,231
	16,000	23,580	30,770

14. In Chapter 6 of the report are outlined the current manufacturing facilities available in Pakistan, and in Libya. It will be seen that while substantial facilities exist in Pakistan for the manufacture of Agricultural Implements, Water Pumps and Electric Motors, there are only small manufacturing facilities for Agricultural Implements in Libya, and no facilities for the manufacture of Water Pumps or Electric Motors. Thus a base exists for the Transfer of Technology from Pakistan to Libya.

15. The suggested media of technology transfer from Pakistan is the know-how and production technology available with the Pakistan Engineering Company (PECO) and other public-sector organisations of the Board of Industrial Management (BIM) with the Engineering undertaken by the N.D.I.S.C., which is part of the B.I.M. The Libyan organisation to establish this plant is to be discussed with the Government of the L.A.R.

16. The Consultants (Chapter 7) initially considered a small Demonstration Pilot Plant with a capacity of only 300 Pumps, 300 Motors and 1450 Implements (the details of the type of implements are given on page 45) but the plant was to be designed to be a full-fledged commercial organisation, and site selection to be on this basis.

17. The Consultants examined (Chapter 8) five sites for the plant. With establishment of the steel plant at Misurata, and the proposed site of the forge-and-foundry plant at Sirte (both located on the coast between the major commercial centres of Tripoli and Benghazi), either of the locations would be satisfactory for the project. If the forge-and-foundry project is definitly to be established at Sirte, this location is preferable.

18. The pilot plant, and its extension to semi-commercial production, would require (chapter 9) about 280 staff and labour, including about 68 expatriates initially from Pakistan who would be reduced in 3 years as Libyan personnel become available.

19. In Chapter 10, the overall capital costs of the Pilot Demonstration Plant are estimated at $ 8.034 million, including the manufacture of all items, and facilities to increase to semi-commercial manufacture.

20. However (Chapter 11), if the plant is operated as a pilot plant, with the production mentioned in 16 above, the costs of manufacture are very high, and comparison with current Libyan prices (see page 84) shows the following for a few standard items:-

	Ex-factory Cost	Market price in Libya.
Centrifugal Pump 10 HP.	$ 1262	$ 225
Electric Motor 10 HP.	$ 2638	$ 217
Disc Harrow (7-disc)	$ 1960	$830 - $890

21. As these costs are impossibly high and as demands are substantially more than the projected costs, several alternatives are considered and compared (Chapter 11) and subsequently discussed (Chapter 12). The alternatives considered are:-

Alternative I - Full equipment without grouping of general Machine Tools with three sub-alternatives:-

(a) Pilot-Scale Production.
(b) Semi-Commercial Production.
(c) In view of the very high cost of production of motors, semi-commercial production without motors i.e. of pumps and agricultural implements only.

Alternative II - about 13% reduction in Capital Costs by grouping of general Machine Tools with the same three sub-alternatives:-

(a) Pilot-Scale Production.
(b) Semi-Commercial Production of all items.
(c) Semi-Commercial Production without motors.

22. The production capacities considered for the various alternatives (page 94) are:-

Alternative	Type of Production	Production in Nos. per year		
		Pumps	Motors	Implements
I -	Pilot Scale	300	300	1450
-	Semi-Commercial	1500	4800	5000
-	Semi-commercial without motors.	1500	-	5000
II -	Pilot Scale	300	300	1450
-	Semi-Commercial	900	2100	2900
-	Semi-commercial without motors.	1350	-	4350

23. The Capital Costs and Cost of Manufacture of the various alternatives which are detailed in Chapter 11, may be summarised as follows:-

	Capital Cost.	Production Cost $ per Kgm.		
	Million $	Pumps	Motors	Implements
Alternative I - Pilot Plant	8.03	8.41	20.29	3.24
- Semi commercial	8.03	2.52	2.56	1.17
- Semi commercial without motors.	6.86	2.87	-	1.23
Alternative II- Pilot Plant	7.48	5.82	7.35	4.30
- Semi commercial	7.48	2.80	2.61	2.20
- Semi commercial without motors.	6.70	2.93	-	1.39

24. These alternatives are discussed in Chapter 12. The conclusions reached are:-

(i) As the cost of manufacture of the pilot-scale is too high, semi-commercial operation must be adopted.

(ii) The cost of production of motors is still too high (see Chapter 12, page 102) the production of motors even at the higher projected levels is not economical. Unless, therefore, a demand for electric motors for other uses is also built-up, the production of electric motors should be postponed.

(iii) Without production of electric motors, the Capital costs (without Working Capital) of Alternative I are $ 6.86 million and for Alternative II $ 6.70 million, with about 10% less production. Therefore Alternative I, the complete installation of equipment, has been selected.

25. Using the Alternative I without production of motors, the cost of production of various items manufactured has been calculated as derived from a per Kgm basis on page 105. However these prices need adjustment amongst themselves as the sale-prices do not follow a per Kgm basis. Nevertheless comparison can be made with Libyan market prices for a few items:

	Manufacturing Cost	Market price in Libya
Centrifugal Pump 5 HP	$ 238	$ 185
Disc-Harrow, 7-disc	$ 745	$ 830 - $ 890
Trailer, 3T.	$ 2140	$ 1116

It will be noticed that while pump costs are still slightly higher, that of Agricultural Implements and auxiliaries are now reasonable.

26. In view of the higher cost of pumps, and the distinct preferance for imported equipment in Libya, some protection, subsidies or other means would have to be adopted to protect the Industry, if the semi-commercial basis is adopted. These are discussed in Chapter 13, and three alternatives suggested:-

(a) Increased Import Protection at 40% for pumps, and 10% for implements and auxiliaries. However this could increase all prices to the farmer.

(b) Subsidies to bring the plant to a break-even point. At full production (3rd year of operation) these would amount to approximately:-

Pumps	$ 710,000	per year
Implements etc.	$ 242,000	per year
TOTAL	$ 952,000	per year

(c) Pooling of prices between imports and local production, with local pumps sold cheaper. Since gradually

all imports and subsidies to farmers are Governnent controlled, this is definitely feasible, and represents the most practical approach. The cost increase for imported pumps, for instance, is very small(page 107).

27. In view of the possibility of dumping after local production begins, as has happened in other countries, alternative 26(c) above is considered to be the most practical.

28. While not in the Consultants' term of reference,following discussion with the Libyan Government, a fully commercial facility working on 2 shifts is considered separately in chapter 14.

29. This is designed for the following annual capacity (2-shift basis for pumps and electric motors but single shift for agricultural implements).

		(Nos.)
(i)	Pumps	9,000
(ii)	Electric Motors	28,800
(iii)	Agricultural Implements	5,000

30. The overall capital costs of the project are:-

	$ Million
Local Costs	8.98
Foreign Exchange	10.53
Total:	19.51

31. The cost of manufacture of all items are detailed in Table 14.1 (chapter 14) and some of the imported ones when compared to imported are as follows:-

	($ per item) Bigger Commercial Plant	C&F Imported Price
(i) Centrifugal Pumps 5 HP	155	185
(ii) Centrifugal Pump 10 HP	281	225
(iii) Deep Well Pump 10 HP	2,618	4,320
(iv) Electric Motor 5 HP	135	145
(v) Electric Motors 10 HP	251	217
(vi) Vertical Hollow Shaft Electric Motor 10 HP	416	429 (F.o.B.Karachi)

32. From the foregoing it will be seen that this represents a proper commercially viable project. However, in order to keep a reasonable return and to overcome the predilection for imports in the market, a 20% duty protection shall be given, or Government may consider subsidising the price at a point 15% below the price of the imported product.

33. In accordance with the request of UNIDO, the availability of local training facilities, and suggested training programme are discussed in Chapter 15.

34. In Chapter 16, the project implementation and suggestions for Libyan-Pakistan co-operation are discussed.

35. The Semi-commercial project schedule at the best execution schedule is given in Fig. 15.1 and the project can be theoretically completed in 12-14 months. However, an 18-months estimate is considered more realistic. The commercial project would take 22-24 months.

36. Three alternatives for joint Pakistan-Libyan co-operation by UNIDO were suggested:-

i. A joint-venture project.

ii. A 100% Pakistani Commercial venture with Libyan Co-operation.

iii. A 100% Libyan project with Pakistan Co-operation.

37. For the joint venture project, the UNIDO specified a 50:50 partnership. It is, however, suggested that instead of this Pakistan contributes all machinery and services for the project which can be provided from Pakistan, and Libya bears the rest of the expenses. The break-up of the semi-commercial and commercial projects on this basis would be as follows:-

Semi-Commercial Production (U.S.$)	Libyan Contri-bution	Pakistani Contri-bution	Total
Capital Costs	4,053,440	2,807,340	6,860,780
Working Capital	871,000	75,000	946,000
Cash reserve & Rounding off.	175,560	17,660	193,220
	5,100,000	2,900,000	8,000,000

Commercial Production	Libyan Contri-bution	Pakistani Contri-bution	Total
Capital Costs	16,410,000	3,100,000	19,510,000
Working capital	3,766,000	200,000	3,966,000
Cash reserves and Rounding off.	484,000	40,000	524,000
	20,660,000	3,340,000	24,000,000

38. The alternative of a 100% Pakistani commercial enterprise would not be feasible because of the necessity for Libyan Government intervention, the necessity for which is pointed out in Chapter 13, and discussed above.

39. The alternative of a 100% Libyan Government project is also discussed in Chapter 16. In this case only the Pakistani technical services would be required. However, it is suggested that, in any case, the Pakistan Engineering Company (PECO) should operate the project for, at least, 3 years.

1. INTRODUCTION

1.1 ACKNOWLEDGEMENT

The team is sincerely thankful to the host Ministry (The Ministry of Industry & Industrial Research Council), other Ministries in the Government of LAR, government officials, department heads, owners and managers of private and public sector organization, etc., for the hospitality, co-operation and assistance which it received during the course of survey work in the Project area both in and around Tripoli and Benghazi. It also wishes to express its thanks to the Dy. Resident Representatives of UNDP in Tripoli and his staff, and the concerned Division Heads at UNIDO & their staff for guidance, co-operation and hospitality.

1.2 BACKGROUND OF THE PROJECT

UNIDO has been actively engaged in extending its technical assistance programmes to the Third World countries for quite some time, especially to the Middle East & African countries, in the fields of agriculture and agricultural implement design, modification - adaptation by the use of intermediate & appropriate technologies. Following the second Industrial Development Symposium for Arab States in Kuwait in 1971 a "Regional Agricultural Engineering Institute" was proposed to undertake "Agricultural Machinery Development, Adaptation and Testing" to suit particularly the conditions prevailing in the Arab Region comprising Algeria, Egypt, Jordan, Kuwait, Lebnan, Libya, Morocco, Saudi Arabia, Sudan and Syria.

In 1974 an agreement was signed between UNIDO and the Governments of LAR and Pakistan to initiate a project called "Transfer of Technology from Pakistan to Libya" with active assistance from UNIDO. The first phase was to conduct a survey of Libyan conditions for preparation of a techno-economic feasibility study and project proposal for the establishment of an engineering pilot demonstration plant in Libya for manufacturing agricultural implements, pumps and small engines. For this purpose a Pakistani consulting organization was to be given the

contract for conducting the survey in Libya and prepare the Project report for submission to UNIDO.

Towards this end the National Design & Industrial Services Corporation(NDISC) was assigned the study which considered it essential to send a team of two engineering experts to Libya for conducting a field survey and preparation of a feasibility report. The terms of reference of the team are as follows:-

(i) Ascertaining the interest of the Government of Libya.

Within the framework of the Libyan Government's overall policy and promotion of local manufacture of suitable simple agricultural implements, pumps and small engines, rural industrialisation, introduction of appropriate production technology, and training of local personnel, the team shall ascertain the interest and concurrence in principle from the Government of Libya on establishment of an eventual demonstration manufacturing plant.

(ii) Product identification,specifications and demand analysis.

In consultation with relevant Government officials, local technical personnel and review of existing technical reports and documents, identify those agricultural implements, pumps and small engines which may have a potential for local assembly and manufacture. Such a "manufacturing potential analysis" is to be undertaken through a study of present imports, present demand and future demand based on plans for development of agriculture. The team shall detail the product design specifications and elaborate an appropriate manufacturing volume for each of the products. In addition, the team shall work out an "order of priority" for local manufacture.

(iii) Details of the demonstration manufacturing plant.

The team shall work out the details such as:

(a) Machine tools, jigs, fixture and dies requirement, including numbers and specifications which are necessary for the pilot plant and the cost;

(b) Material requirement (steel sections, plates, bars, etc. hardware, simple castings, etc.) which are required for an annual production volume including an appropriate inventory and total cost;

(c) Physical facilities required such as electricity, water, compressed air, repair and maintenance programme and cost involved;

(d) Allied facilities required such as prototype development, testing, inspection and quality control, marketing;

(e) Requirement of man-power including local counterparts and personnel;

(f) Overall techno-economic analysis including capital and working finances, viability of the project and techno-economic and social benefits.

(iv) Local counterpart organization and location.

In consultation with the Government officials, the team shall ascertain the local organization (government or semi-government or co-operative) which will be authorized to run the demonstration manufacturing plant. The team shall analyze its structure and recommend ways and means of effective implementation. In addition, the location/locations are to be identified for establishing such a plant (either establishing a new plant or strengthening and expansion of an existing set up).

(v) Preparation of a project report.

The team shall prepare a "project report" on demonstration manufacturing plant including location, preliminary layout of area, buildings and plant, machinery layout, process planning, physical facilities; financial requirements (capital cost and working capital); details of raw material requirement and cost, details of workshop machine tools and machinery requirement and cost; production programme, manpower requirement and organizational structure. Such a report should include detailed financial, techno-economic and training programme analysis, as well as time table for probable implementation. The project may be either for establishing a new plant or strengthening and expansion

an
of/existing unit. In this connection, the local production programme (product line, machine tools and other production machinery, product components, experts, etc.) may be in terms of financial aspects and may be divided into the following three groups:

(a) possible contribution from Government of Pakistan

(b) possible contribution from Government of Libya from domestic sources (land, building, counterparts, capital and recurring expenses)

(c) possible contribution from Government of Libya in terms of foreign exchange (convertable currency) for equipment and services to be procured from other sources from abroad.

(vi) Government of Pakistan's contribution.

Without any commitment on the part of the Government of Pakistan, the team shall detail the possible contribution by the Government of Pakistan regarding provision of (a) experts (b) equipment including machine tools and production equipment (c) raw material (d) critical components and (e) training facilities for the duration of the project on an annual basis. The team shall itemize each of the above contributions in financial terms.

(vii) Ascertaining Libyan's Government contribution.

The team shall ascertain from the Government the nature and magnitude of Government's contribution for establishing and operating the demonstration manufacturing plant. The items are land, building, infrastructure, working capital, selected components of capital cost, counterpart technical personnel and labour requirements and all other items necessary for marketing and extension. The team shall itemize each of the above Government contribution in financial terms.

(viii) Recommendation for implementation.

The team shall make relevant recommendations to UNIDO and to Governments of Libya and Pakistan on specific steps to be taken for

effective establishment of a demonstration manufacturing plant, start up, production programme and operation and organization, including input components such as experts, equipment and fellowships and magnitude of finance involved. In this connection, the implementation modality can be elaborated in the following alternatives:

(a) the project may be implemented as a pure investment project by the Government of Pakistan with specific contribution from Government of Libya;

(b) implementation through active equal participation both by Government of Libya and Government of Pakistan;

(c) Implementation as a 100% Libyan Government project with selected subcontracting elements with the Government of Pakistan;

The above three alternatives are to be elaborated and submitted in the report.

The second phase of the project is that NDISC shall provide the services of a Senior Official of the Government of Pakistan who has been authorized by the Government to conduct negotiations with the Government of LAR and UNIDO in the implementation of the recommendations of the experts team The terms of reference of the Senior Government Official are as under:-

i) Review the expert team's recommendations and discuss with relevant officials of the Government of Pakistan on the Project implementation in general and secure the Government of Pakistan's concurrence in principle to the proposed Government of Pakistan's contribution on the establishment and initial operation of the proposed pilot plant as a Pakistan/ UNIDO/Libya co-operative Project.

ii) Visit Libya for a duration of eight days and discuss with the relevant Government of Libya officials the implementation of the project with special reference to the contribution from

Governments of Pakistan and Libya. Secure concurrence from the Government of Libya on their contribution and implementation.

iii) Discuss with UNIDO officials the ways and means of implementation.

iv) Submit a short report on his discussion, findings and recommendations.

The third and last phase is the actual implementation of the project for the establishment of the plant as per follow-up programme given below:-

Based on the results of this study, it is proposed to initiate necessary action for establishment of a demonstration manufacturing plant, including plant construction, machinery installation, infrastructure and physical facilities installation, organization and operation, start-up, production of appropriate products and training of local personnel in all aspects of production technology, commercialization and management. Such a follow-up activity (establishment of demonstration manufacturing plant) will have to follow specific objectives:-

- Development of local technical competence;
- Training in all engineering aspects;
- Assist in the utilization of local raw material whenever feasible;
- act as a catalyst in local manufacture of suitable simple agricultural implements and tools and assist in future rural industrialization;
- development of local entrepreneurship,
- extend repair and maintenance services,
- develop a pilot demonstration scheme as the nucleus for future transformation into a viable commercial plant which could serve as a model for further establishment of such small plants in other rural areas.

1.3 TEAM MEMBERS AND ITINERARY.

1.3.1 Team Members.

(1) Mr. B.Y. Khan, P.Eng.

Senior Manager (Design),
NDISC, Lahore, Pakistan.
(Team Leader).

(2) Mr. Amanullah Mir,
Industrial Engineer,
NDISC, Karachi, Pakistan.
(Team Member).

Government Representative.

Mr. Javed Talat,
Joint Secretary,
Ministry of Production,
Government of Pakistan,
Islamabad - Pakistan.

1.3.2. Itenerary of the Team.

December 1976

8	Lahore/Karachi-Athens-Vienna
9 - 11	Briefing at UNIDO, Vienna
11 - 12	In transit.
12	Arrival in Tripoli, Libya.
13	Introduction and briefing with the Deputy Resident Representative of UNDP, Tripoli, Director of Industrial Research Centre (IRC), his concerned staff, and UNIDO expert assigned to IRC.
14 - 16	Preparatory work at IRC.
17 - 31	Visits, discussions and data collection, Tripoli.

January 1977

1 - 9	Visits, discussions and data collection, Tripoli-Benghazi.
5 - 6	Benghazi - visits to Government Departments, Private and Public Sector Organizations, and farms in Jebel Akhder area.
9	Debriefing at UNDP Tripoli with the Deputy Resident Representative and departure from Libya.
10 - 11	In transit.
12	Arrival in Vienna.
12 - 14	Debriefing at UNIDO and submission of a short preliminary report.

14 Departure for Karachi via Abu-Dhabi.

July 1977

Visit of the Pakistan delegate to Vienna and Tripoli. During the stay at Tripoli and visit to Benghazi the team made it a point to visit as many officials and places as was possible in a normal working day. Visits were paid to and discussions held with the ministries of Agriculture, Industry, Planning, Commerce, Al-Faatah University Faculties of Mechanical and Agricultural Engineering, importers and dealers in agricultural machinery, engines & electric motors both in public & private sectors, all the relevant departments/sections of various ministries, Research Centres, Training institutions, factories and workshops, small, medium and large farm of coreals, fruit and vegetables, both government run and privately owned.

The Government representative later visited Libya in July 1977 and met the officials of the LAR ministry of industries, the FAO Advisor in Libya, the UNIDO Resident Representative and the Project Co-ordinator and the Project Manager of the Agricultural Research Council. In discussions with the Libyan authorities, the latter emphasised the need for an examination of a commercial Unit, as well as a pilot demonstration unit. The Consultants agreed to do this and this is now added to the report as separate chapter.

Annexure I summarises the discussions which took place with various individuals and organizations, and the general conclusions reached in regard to the Project, in those discussions.

The team was particularly gretified at the interest shown at all levels of the L.A.R. in the project, and the cordial discussions which took place.

Annexure II gives a full list of the Institutions visited and individuals interviewed by the Pakistan Team.

2. AGRICULTURAL PRODUCTION AND FUTURE PRODUCTION TARGETS.

2.1 GENERAL FEATURES

2.1.1. Topography.

Barring the coastal plain virtually the entire Libyan region is arid. It has different types of soils which vary from district to district. Generally the soils are calcareous or silicocalcareous with the western coastal area having a reddish coloured high sandy soil. The eastern side is mainly composed of heavy clay soils.

The Libyan Arab Republic can be divided into five geographical regions on the basis of climate, rainfall and altitude.

These are:-

- Coastal zone or coastal valleys.
- The Gefara Plain located between the green coastal belt and the mountains.
- The Gebels (Gebel Nefusa in north-west and Gebel Akhdar in the north-estern part).
- Desert (sub-desert, rock-desert and sand-seas located in the south).

2.1.2. Climate and Rainfall.

The climate in Libya is mediterranean in the coastal belt and varies in the interior on account of the influences of Sahara desert and mediterranean sea. Generally rainfall is low in the country, and the average rainfall varies from 200 to 600 mm with the heaviest occuring in the north-western coastal areas of Tripoli (Gebel Nefusa & Gefara Plain) and in the north-eastern area of Gebel Akhdar. Rainfall average is less than 100 mm per year over 93% of country's land surface. Appendix 1 shows the annual rainfall in each zone during 1973 and 1974 and a general picture upto 1972.

2.1.3. Population.

The total population of Libya is estimated at 2.4 million out of which about 20% is engaged in the agricultural sector.

PEOPLE'S SOCIALIST LIBYAN ARAB REPUBLIC

RAINFALL DISTRIBUTION (mm)

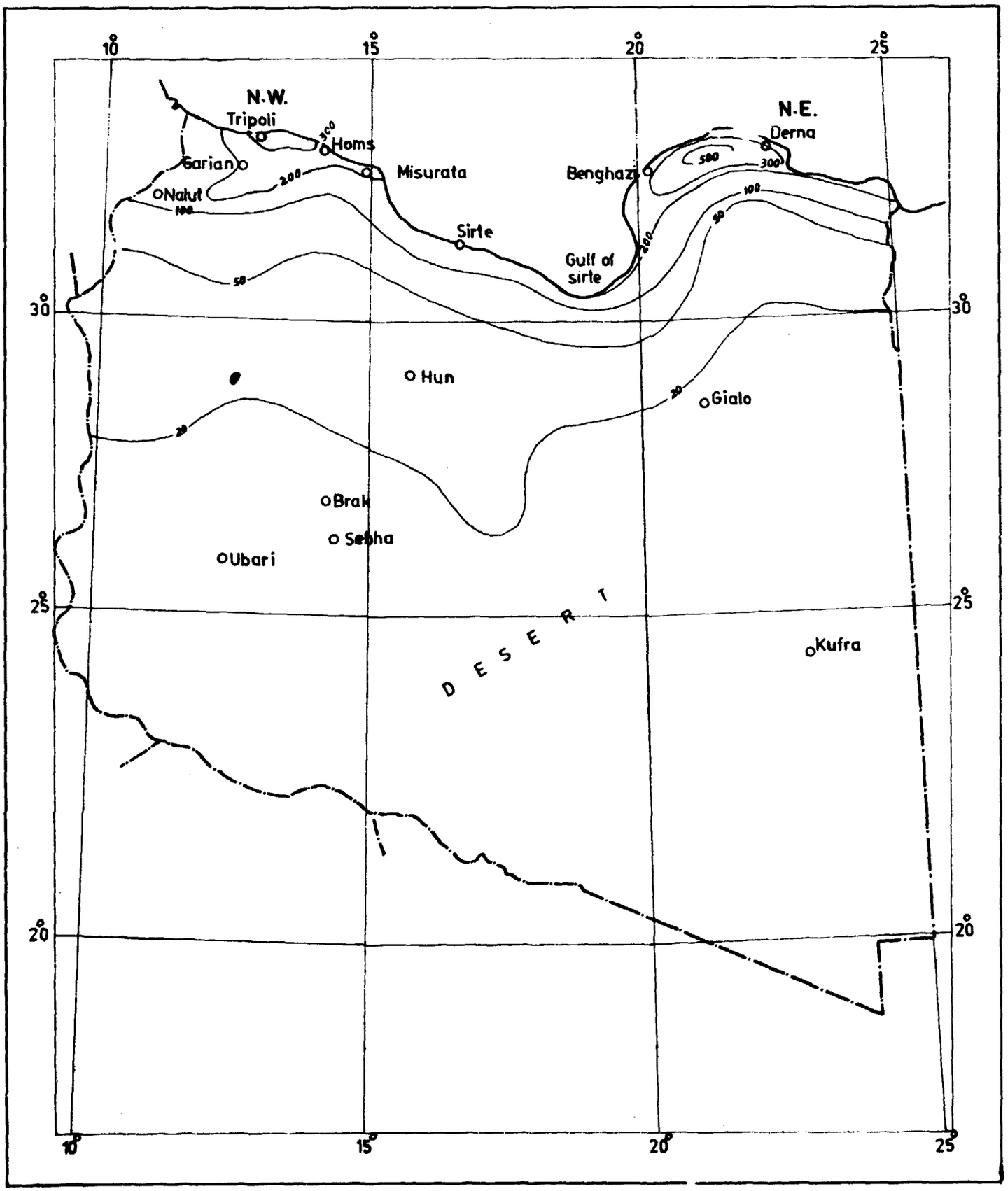

FIG. 2_1

SOURCE ; Department of meteorology

N.D.I.S.C.

SCALE (APPROX.)
0 100 200 300 400 500 Km

2.1.4 Area.

The total area of Libya is 1.7 million KM^2 out of which about 1.9 million Ha is arable land and 200,000 Ha is irrigated. The highest rainfall is recorded in the northern Tripoli and Benghazi regions, and these areas are the only ones where the average yearly rainfall is more than 250-300 mm, which is a minimum for sustained rainfed agriculture.

Apart from the irrigated area, the country has sufficient land with different levels of rainfall where dry farming is being done. The general farming zone has annual rainfall ranging between 250-600 mm. and the semi-arid zone having an annual rainfall in the vicinity of 150-250 mm which is suitable for ranch management and development of forestry. The arid zone with a low rain-fall of 100-150 mm. can possibly be used for pastures.

2.1.5 Water Resources.

Water is the biggest constraint in Libya for the development of agriculture. While most of the population & agriculture is concentrated within a narrow strip along the mediterranean coast, most of the water potential is located in the deep south in the desert area. At present 99% of the water used for human consumption and agriculture comes from the ground. This source of supply for agriculture will continue to remain as the largest one, but sources other than ground water cannot be ignored as these are used in area where ground-water reserves are not adequate. Details of all water resources are given in Appendix 2 but are briefly described below.

(i) Rainfall

Rainfall is very scarce and the yearly average is less than 100 mm over 93% of country's land surface. Moreover, there is an extreme variation in rainfall from year to year and from place to place (Appendix 1).

(ii) Surface Run-Off.

Bulk of the water run-off evaporates and seeps into the wadi beds or in the zones along the foot of mountains.

(iii) Ground Water.

There are four principal ground-water system in Libya based on

recharging by direct infiltration of rainfall. These are as follows:-

- Gefara System
- Western System
- Gebel Akhdar System
- Eastern System

Since ground-water is the main source for agriculture in the irrigated areas, the over-exploitation by tubewells has steadily resulted in lowering the underground water table in the coastal belt. This disturbance in the recharge-discharge cycle has upset the natural balance in certain areas by salt water intrusion.

(iv) Desalted Water.

Water is also available from desalination plants to a limited extent primarily for industry. The production of fresh water from desalinat plants in the proximity of sea in the coastal belt is being done at 6 plants (total 79,400 M^3/day) while 7 more plants are under construction (total 77,800 M^3/day).

(v) Treated Waste-Water.

Sewerage-treated water is another limited source for agriculture and industry. The water from this source can be recovered from important towns such as Tripoli, Benghazi, Misurata etc.

2.2 AGRICULTURAL CROPS.

The main agricultural crops in Libya are as follows:-

- Wheat
- Barley
- Fruit
- Vegetables
- Legumes & Oilseeds
- Fodder
- Olives

2.3 LAND HOLDINGS.

The total number of land holdings in the agricultural sector is about 140,000 Ha, out of which about 30% are under 5 Ha. It has been estimated that almost 50% of the total farms are under 10 Ha. The smaller

PEOPLE'S SOCIALIST LIBYAN ARAB REPUBLIC

LOCATION OF THE MAIN WATER CONSUMER AGRICULTURAL PROJECTS AND TOWNS

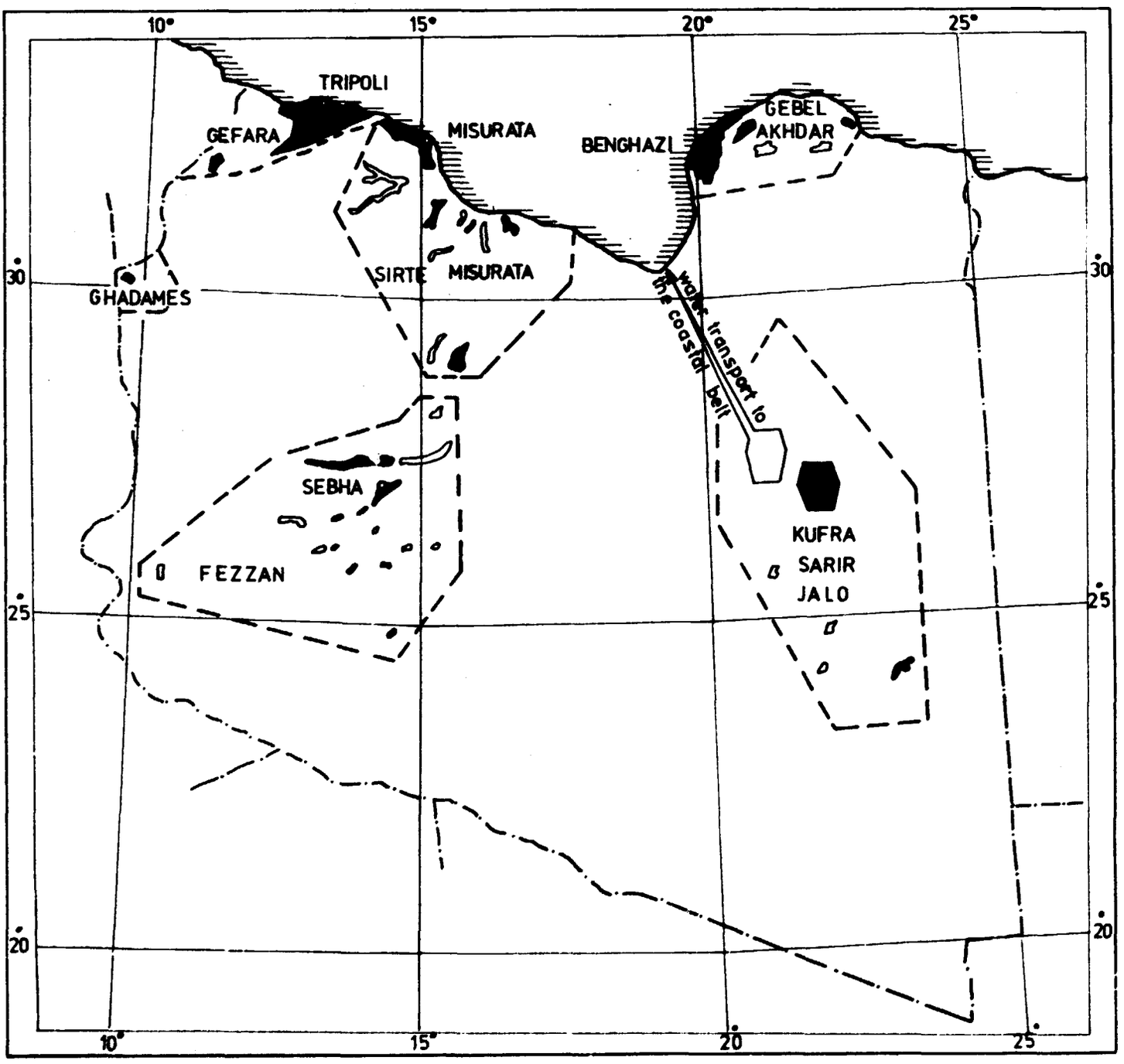

FIG. 2-2

- Main towns
- Limit of development region
- Agricultural development areas (existing or under implementation)
- Agricultural development areas under study

N.D.I.S.C.

SOURCE; General water authority

0 100 200 300 400 500 Km

farms are mostly on irrigated land. The newly-reclaimed farms are larger and vary in size but generally the irrigated areas have farms ranging from 6 to 24 Ha. The size of farms in the rainfed area ranges from 50 to 200 Ha.

2.4 FARMING PATTERN.

4 separate types of farming co-exist:-

(a) Native Farms, represented by small irrigated oasis patches, and dry-zone farms based on cereals and highly extensive stock-breeding.

(b) Mediterranean-type Farms with dry-cultivation of olives, grapes and cereals.

(c) Mechanised, modern, irrigated farms.

(d) Mechanised, cereals-based, modern, dry farms.

In the western parts farming is done on both Mediterrean-type and mechanised irrigated farms, while in the eastern parts mostly mechanised modern dry-farming is in vogue with some Mediterranean-type farming.

2.5 AGRICULTURAL CROP PATTERN

There is only one cereal crop in a year such as wheat or barley. Vegetables are grown round the year. Wheat/barley is sown till the middle of January at the latest, preferably in December, since the rainfall is generally during late December & January. Harvesting is done in June & July.

2.6 AGRICULTURAL AREAS & PRODUCTION

2.6.1 Past Area & Production under Agriculture.

Barley covers the largest area in the agricultural sector followed by wheat, olives, fodder, fruits and others. It is largely grown in the Mohafadas of Derna, El-Khalij, Homs & Zawia. Similarly wheat is mainly grown in Gebel Akhdar, Benghazi & Zawia areas. Appendix 3 shows the area and production of agricultural crops from 1970 to 1974. Appendix 4 shows the agricultural area and production by each Mohafada in 1974.

2.6.2 Present Area under Agricultural Production.

There has been notable improvement in the agricultural sector in the last Three Year Plan which ended in 1975. Out of the total plan's allocation of LD 566 million ($1870 million) for agriculture, an amount of LD 527 million ($1740 million) was spent on development in agriculture. The

targets set for agricultural production were only partly met at the end of the Plan in December 1975. It has been estimated that at the end of the Plan, out of the projected targets of 105,000 Ha of irrigated land and 275,000 Ha of dry-farming land, about 35,000 Ha of irrigated land and 108,000 Ha of dry-farming land were developed. This means that the actual achievement compared to the targets was 33% and 40% for irrigated and rainfed areas respectively.

The present area under agricultural crops and the estimated agricultural production in 1976 are given in Tables 2.1 and 2.2.

TABLE 2.1

LIBYA-PRESENT AGRICULTURAL AREA COVERED BY CROPS IN 1976

('000 Ha)

Crop.	Irrigated.	Dry Farming.	Total
Wheat	29	190	219
Barley	32	280	312
Vegetables	30	-	30
Fruits	18	35	53
Legumes & Oilseeds	16	-	16
Fodder	55	16	71
Olives	16	70	86
Other crops	2	11	13
TOTAL:	168	602	800

TABLE 2.2

LIBYA-ESTIMATED PRESENT AGRICULTURAL PRODUCTION IN 1976

Commodity.	Production ('000 Tons)
Wheat	156
Barley	224
Vegetables	670
Fruits	140
Legumes & Oilseeds	27
Olives	124
Fodder	889
Other Crops	9.5

2.6.3 Projected Area under Agriculture and Production.

The Libyan Government has allocated sizeable funds in the Five Year Plans (1976-80) in the agricultural sector to achieve self-sufficiency in food. The funds ear-marked for agricultural development for the next five years are over LD 1226 million ($4050 million) which constitutes over 17% of the total outlay of 5-Year Development Plan. The development in the agricultural sector includes numerous agricultural inputs and extension programmes such as farm-mechanization, increased fertilizer and pesticide usage, improved seeds, and additional reclaimed land. The projected areas for various crops in 1980 has been estimated in the Five Year Plan, as given in Table 2.3.

TABLE 2.3

LIBYA - PROJECTED AREA UNDER AGRICULTURAL CROPS IN 1980

('000 Ha)

Crop.	Irrigated.	Dry Farming.	Total.
Wheat	70	285	355
Barley	32	300	332
Vegetables	33	-	33
Fruits	22	78	100
Legumes & Oilseeds	20	-	20
Fodder	72	35	107
Olives	17	90	107
Other Crops.	2	20	22
	268	808	1076

The projected agricultural production in 1980 and increase by percentage from 1975 have been estimated in Table 2.4.

Contd..P/

TABLE 2.4

LIBYA-PROJECTED PRODUCTION OF AGRICULTURE COMMODIES IN 1980

Commodity.	Projected Production ('000 tons)	Increase in production from 1975 to 1980 (1975=100)
Wheat	336	314
Barley	245	113
Vegetables	825	133
Fruits	255	196
Legumes and Oilseeds	42	175
Olives	148	123
Fodder	1321	214
Other crops.	14	175

The achievement of the production targets laid down above will greatly help the country in attaining near self-sufficiency in various commodities. Table 2.5 shows the projected production, demand and the shortfall to be met through imports for agriculture commodities by 1980.

TABLE 2.5

LIBYA-AGRICULTURAL COMMODITY POSITION BY 1980

Commodity.	Requirement (%)	Local Production(%)	Imports (%)
Wheat	100	74	26
Barley	100	100	-
Vegetables	100	100	-
Legumes	100	100	-
Fruits	100	92	8
Olive Oil	100	54	46

3. CURRENT USE OF AGRICULTURAL IMPLEMENTS, PUMPS & ENGINES.

3.1 AGRICULTURAL IMPLEMENTS

Agricultural implements can be classified into 4 basic categories, namely Hand Tools, Hand-operated Implements, Animal-drawn Implements and Tractor-drawn Implements, and each grouping covers the following:-

3.1.1 Hand Tools.

- Spades
- Shovels
- Pickaxes
- Hoes,
- Rakes/Forks,
- Sickles,
- Knives & Matchets
- Weeders,
- Steel Baskets,
- Grader Tools, etc.

3.1.2 Hand-operated Implements

- Garden Ploughs,
- Small Cultivators,
- Hand Pumps,
- Seeders,
- Planters,
- Harrows,
- Sprayers,
- Dusters,
- Threshers,
- Winnowers,
- Shellers,
- Decorticators,
- Seed Treaters,
- Wheel Barrows, etc.

3.1.3 Animal-drawn Implements.

- Ploughs,
- Cultivators,
- Hoes,

- Harrows,
- Ditchers,
- Ridgers,
- Diggers,
- Seed Drills,
- Planters,
- Levellers,
- Fertilizer Spreaders,
- Mowers, etc.

3.1.4 Tractor-drawn Implements.

- Mounted Ploughs,
- Mould-board Ploughs,
- Disc Ploughs (also called Disc Harrows sometimes),
- Reversible Disc Ploughs,
- Sub-soilers,
- Cultivators,
- Rotavators,
- Rotary Hoes,
- Hoeing Tool Bars,
- Offset Tool Bars,
- Rotary Weeders,
- Levellers,
- Harrows & Bar Harrows,
- Seed Drills,
- Cotton & Maize Drills,
- Grass Seed Drills,
- Seed-cum-Fertilizer Drills,
- Fertilizer Distributors,
- Potato Planters, (semi-automatic),
- Sprayers,
- Dusters,
- Potato & Root-Crop Diggers (Harvesters),
- Post-hole Diggers,
- Ditchers,
- Mowers & Forage Harvesters,
- Balers,
- Trailers,
- Water Tanks, etc.

3.2 AGRICULTURAL IMPLEMENTS GENERALLY USED IN LIBYA.

Since agriculture in Libya is completely mechanised the use of hand-operated implements is very insignificant, and the usage of animal-drawn agricultural implements is entirely unknown in the country. In view of this the various implements currently in use in this country are completely tractor-drawn.

Tractors are mainly imported from Massey-Ferguson (45 & 65 HP), John Deere(48 & 70 HP) and International Harvester. The principal agricultural implements commonly imported in Libya are discussed below:

3.2.1 Disc Harrows (Disc Ploughs)

Generally disc harrows with 3,4,7 and 9 discs are used in the country. However, the most commonly used are harrows with 3 & 7 discs. The main supplier of disc harrows is Nordi from Italy. Locally-made disc harrows from General Industries Company, Tripoli, with 3 & 7 discs are also used in the country. The common types currently used in the country are as follows:-

Nordi (Italy)	7 CDI 54
I.H. (France)	8 H 1/5 90 and 1 H 1/5 90
Massey Ferguson (Britain & Australia)	28 and 34
Scimela (LAR)	7 discs.

In the Gabel Akhdar project, disc harrows with 16 discs (John (Shearer, Australia) and 28 discs (America Athen 54) are being used.

3.2.2 Mouldboard Plough

Only two makes namely Massey Ferguson and International Harvester are generally used in the country. The models imported are:-

Massey Ferguson (France)	40/2, 41/2 and 41/3
International Harvester (France).	320/2 and 320/3

3.2.3 Cultivators/Tillers

The following types are mainly used:-

Tillers:	Massey Ferguson (Australia)	38/9, 38/13
	International Harvester(France)	30/11
Cultivator:	International Harvester(France)	55

3.2.4 Fertilizer Spreader

This equipment is generally from Godam of France and Teknaimpex of Italy with models K74 and 52P2-5 respectively.

3.2.5 Rotary Hoes

The most popular types are as follows:-

- Giradi (Italy) 211501 P
- H.Rotavator(Britain) P60 & PG 70

3.2.6 Post-hole Diggers

The following makes and types are generally used in the country.

- Praima (Italy) 24"
- Napier and Bross(Australia). 12"-15"
- Massey Ferguson (U.S.A.). 18"-24"

3.2.7 Rakes.

This equipment is mainly from Messey Ferguson and International Harvester.

3.2.8 Seed Drills

The seed drills commonly used in the country are of the following types:-

Massey Ferguson	Model 30
Betinson	Model 30
Nordi	Model HMX 15-17
Alis Chalmers	Model 214
Bastilidis	Model E 18

In the Gebel Akhdar area, seed drills from Australia namely Tyne Combine and Howard Bugshaw are being used.

3.2.9. Mowers.

These machines are mainly imported from Massey Ferguson (Britain), International Harvester(France), Cubota(Japan) and BCS(Italy). The following models are most common:-

MF 32/7 (Mowers)

IH 3100 and 4113 (Mowers and Rotary Mowers)

Cubota HE 305 (Self-propelled Mowers)

B.C.S. (Self-propelled Mowers).

3.2.10 Balers.

Standard balers or compactors are used for baling fodder & straw. The most common types are Massey Ferguson Model 20/8 and International Harvester Model 440 and 422.

3.2.11 Land Leveller

Land levellers are generally imported from the following suppliers:-

Rossito, Italy.

Massey Ferguson, Australia.

3.2.12 Trailers

Trailers of various makes are imported in the country as shown below:-

Badorani	Italy
Riscard	Italy
Peter	U.K.
Sismon	Egypt.

In addition General Industries Co., in Libya also makes trailers.

3 .3 WATER PUMPS

Two basic types of water pumps namely centrifugal and submersibles (which include deep well turbine pumps) are used in Libya for agriculture and domestic use. Centrifugal pumps are mainly used for water distribution and submersible pumps for lifting underground water.

Internationally the technology "submersible pumps" generally means submersible electric pumps and other pumps which are located at the water level, but driven by turbines located at the well-head are called deep well turbine pumps. In Libya nearly all pumps used for deep wells are turbine pumps but since these are also called submersible pumps in Libya, this technology has been retained, it being understood that the majority of such pumps are deep-well turbine pumps(over 90%).

There are over 30 countries from where the pumps are imported but Italy contributes more than 50% of the total imports. The most popular brands are as given below:-

Atturia, Lowara, Marrelli, Ferrari, Banilli-Rotos	Italy
KSB, Ritz	West Germany
Guinaro	France

3.3.1 Type of Pumps

The centrifugal pumps presently being used in the country range from 3 to 40 HP but 5.5 to 10 H.P. constitute the main share of the demand.

The submersible pumps, which as mentioned above are deep well turbine pumps,are generally in the range of 10 to 15 HP. These are installed in the areas where the underground water table is 50-100 meters. Large-sized submersible pumps of 50-70 HP are installed in some of the large agricultural development projects.

3.4 SMALL DIESEL ENGINES

There is a very limited use of small diesel engines for pumps in the country on account of abundant availability of electric power. Diesel Engines, however, for power generation are imported and the power rating generally ranges from 10 to 150 KVA. The main supplier of diesel generators are Caterpillar, Jumlag (Austria), Perkins (U.K.).

Diesel engines for a few engine-driven pumps are mainly imported from Blackstone, Lister and Peter of U.K.

4. PRESENT DEMAND OF AGRICULTURAL IMPLEMENTS, WATER PUMPS AND ENGINES. ....

4.1 AGRICULTURAL IMPLEMENTS

Since the whole agriculture in Libya is mechanized, the discussion about the agricultural implements will pertain to tractor-drawn equipment only. In order to assess the present demand of agricultural implements it will be necessary to examine the local production and imports in the recent years.

4.1.1 Local Production

There is virtually no local production of agriculture implements in the country and even small tools such as spades, shovels and axes etc. are imported. However, there is one establishment namely Messrs. General Industries Co., Tripoli, which is manufacturing disc horrows, trailers and water tanks. The present production level is small in view of easy availability and preference for imported equipment. The present production of disc harrows, trailors, and water tanks from the local plant are given below.

Agricultural Implements.	Present.Production (Nos).
- Trailers (3t, 3.5t and 5t)	350
- Water Tanks (1500 Lit, 2000 Lit & 3000 Lit).	200
- Disc Harrows (7 discs).	500

4.1.2 Imports.

The import of agricultural implements is not classified item-wise in import statistics, with the result that the quantum of each implement and equipment cannot be separately ascertained. Moreover, the imports are generally given in weight and not in numbers.' The Central Department of Census & Statistics have classified these commodities under the following groupings:-

- Agricultural Tractors,
- Trailors & other Vehicles Not Motorized,
- Tractor-drawn Implements,
- Motorized Hand Tools (Non-electrical),

TABLE 4..

PAST IMPORT OF AGRICULTURAL TRACTOR-DRAWN IMPLEMENTS BY GENERAL COMPANY, TRIPOLI.

Agricultural Implements.	Imports(Nos)	
	1974	1975
- Balers	122	170
- Mowers (rotary & self-propelled).	85	285
- Seed Drills	151	44
- Fertilizer Spreaders	110	12
- Rakes	7	55
- Diggers	126	284
- Rotary Hoes/Rotavators	590	208
- Disc Horrow/Ploughs.	611	248
- Mouldboard Ploughs	99	560
- Tillers/Heavy cultivators	254	305
- Trailers	-	550
- Land Levellers.	-	414

(b) Fannia, Tripoli.

This Government-owned company is the sole importer of agricultural machinery from Messrs. John Deere. Their recent imports of agriculture machinery during 1975-1976 has been of the following order:-

Agricultural Machinery.	1975	1976
- Balers	100	150
- Disc Harrows	200	200
- Cultivators	50	-

(c) Nasreddin Nahas Company.

This is one of the largest private importers of agricultural machinery in the country. The level of imports in 1975-76 for the Tripoli area has been as follows:-

The relevant groupings namely Trailers & Tractor-drawn Implements cover the agricultural implements and equipment under study. The imports of agricultural implements (tractor-drawn) and trailers and other vehicles are given in Table 4.1.

TABLE 4.1

LIBYA-IMPORT OF TRACTOR-DRAWN IMPLEMENTS,TRAILERS & OTHER EQUIPMENT

	TRAILERS & OTHER EQUIPMENTS		Tractor-drawn Implements	
Year.	Quantity.	Value(000 LD)	Quantity.	Value(000 LD)
1964	393	653	685	182
1965	503	481	813	234
1966	531	512	1035	353
1967	5143	998	850	290
1968	2912	1179	1331	481
1969	1895	1399	887	391
1970	893	428	499	241
1971	2617	360	815	341
1972	1904	2016	6919	2124
1973	1804	2614	2012	1023
1974	2652	4825	5081	3311

Source: Department of Census & Statistics.

Since the information available from the Statistics Department was inadequate as to the number and type of agricultural implement imported in the country, the consultants visited the leading importers of Agricultural Implements in Tripoli and Benghazi.

(a) General Company For Farm Equipment & Agricultural Necessities.

This is a Government-owned company engaged in the import of agricultural machinery on national basis. Prior to 1976, the import of agricultural implements was not exclusively limited to public sector companies but every person with a commercial licence could import anything in any number. However, inspite of numerous importers in the country, the General Company was one of the principal commercial importers of agricultural implements. The imports of the tractor-drawn implements by the General Company, Tripoli Branch for 2 years is given in Table 4.2.

Agricultural Machinery.	1975	1976
- 7-Disc Ploughs	300	200
- Trailers	75	44

General Comments on Import Figures.

It may be mentioned that the imports of agricultural machinery by the principal importers stated above represent only a part of requirement for the Tripoli area. The import figures indicating the requirement for Benghazi area or for new development projects were not presently available. Also there was no consolidated data available which could indicate the quantum of imports of each tractor-drawn implement on national basis. In order to establish the present requirement of tractor-drawn agricultural implements, reliance had to be put on the broad estimates by commercial importers, farmers or the Ministry of Agriculture. In view of this the present demand for tractor-drawn implements is based on the following two methods.

4.1.3 Estimates by Commercial Importers.

Based on their experience some of the leading importers of agricultural implements in Tripoli and Benghazi have assessed the existing demand of tractor-drawn implements as given in Table 4.3.

TABLE 4.3

LIBYA-PRESENT DEMAND ESTIMATES OF TRACTOR-DRAWN IMPLEMENTS

Agricultural Machinery.	Present Demand(Nos).
Disc Harrows (Disc Plough)	3000
Cultivators	1000
Seed Drills	2000
Levellers	3000
Rakes	1500
Trailers	2000
Ridgers/Diggers	2000
Rotarators	2000
Water Tanks	2000

4.1.4 Demand Related with Number of Tractors.

The other method to ascertain the requirement of tractor-drawn implements is the relationship with the number of tractors. Depending on the degree of agricultural mechanization the number of each principal implement can be fixed per tractor. It is, therefore, pre-requisite that before fixing the number and the type of tractor-drawn implement, the number of tractors has to be established first. It is difficult to estimate the present requirement of tractors in Libya as the yearly imports of tractors have considerably risen in recent years as shown below. This is attributed to the bulk requirement of tractors in various agricultural development projects for reclaiming land and a greater emphasis on mechanization for improved agriculture farming.

Year.	Imports of Tractors(Nos).
1970	524
1971	1182
1972	2086
1973	2465
1974	3894
1975*	4942

*(Computed from 6 months' figures).

The examination of the above import figures shows a high level of import of tractors which in terms of H.P. per Hectare is extremely high for a developing country like Libya. As a matter of fact the present modernization in agriculture is as good as in any developed country of the world. This conclusion has been drawn after assessing the present population of tractors. It is estimated that the total number of tractors imported from 1964 to 1975 is about 23,700. Assuming that 25% of this total number of tractors has been written off due to wear and tear in the 11-year period, the balance works out to be about 18,000 at the end of 1975. For a total cultivated area of 7,91,000 Ha in 1975 one tractor covers about 40 Ha. This was equivalent to 1.375 H.P. per Ha based on 55 H.P. for a tractor (which is the mean of 65 & 45 H.P. tractors generally imported in Libya). It may be mentioned that this is a very good level of farm mechanization as the H.P./Ha in highly mechanized agricultural countries is in the vicinity of 1.2 - 1.6 HP/cultivated Ha.

This means that already there are sufficient number of tractors in the country for the existing cultivated area. In other words the increase in the number of tractors will not be as large as has been in the last 4-5 years.

However,if service facilities are not increased, the number of tractors going out of usage will progressively increase.

4.1.5 Requirement of Tractor-drawn Implements.

For the purpose of estimating the present demand of tractor-drawn implements, a requirement of 3000 tractors per year is assumed which represents the additional tractors required for new land.

In addition to this tractors are being replaced, but the tractor-drawn implements have a much longer life than the tractors. An examination of table 4.1 will show that between 1964 and 1974, 8971 million LD worth of import was made, but out of this 6458 million LD was imported between 1972 and 1974 alone, indicating that implements are generally relatively new and replacement of implements currently can be ignored. However in future years replacements would have to be considered.

The number of implements for new tractor required is indicated in Table 4.4 based on discussion with importers etc.

Using this as a basis, the annual demand of implements is estimated in the last column of Table 4.4.

TABLE 4.4

PRESENT DEMAND OF TRACTOR-DRAWN IMPLEMENTS RELATED TO THE NUMBER OF TRACTORS

Tractor-drawn Implements.	Assumed Number of Implement per Tractor	Present Annual Demand (Nos).
Disc Harrows	1	3000
Cultivators	0.5	1500
Seed Drills	1	3000
Levellers	1	3000
Rakes	0.5	1500
Trailers	0.5	1500
Diggers/Ridgers	1	3000
Rotavators	0.5	1500
Water Tanks	0.5	1500

4.1.6 Consolidated Demand for Implements.

In order to arrive at the present demand of tractor-drawn implements the two sets of demands in Table 4.3 and Table 4.4 are consolidated and average figures are worked out as given in Table 4.5, which represents the estimates for current demands for implements.

TABLE 4.5

PRESENT AVERAGE DEMAND OF TRACTOR-DRAWN IMPLEMENTS

Disc Harrows	3000
Cultivators	1250
Seed Drills	2500
Levellers	3000
Trailers	1750
Diggers/Ridgers	2500
Water Tanks	1750
Rakes	1500
Rotavators	1500

4.2 WATER PUMPS

4.2.1 Local Production

There is no local production of water pumps in the country as the entire demand is met through imports.

4.2.2 Imports

Water pumps are imported by the Government-owned commercial companies (such as the General Company) and various other private importers for farm equipment and agricultural necessities.

(i) General Company for Farm Equipment

This company is one of the largest single importers of water pumps and constitutes 25-30% of the total imports in the country. It may, however be mentioned that the level of import in 1976 was considerably lower on account of inventory build-up in 1975 followed by the nationalization of the company in late 1976. The import of water pumps by the General Company is given below:-

Type of Pumps.	Make.	H.P.	Number Imported
(a) Tripoli Branch			
- Submersible Pumps	(Atturia	15-20	150
	(Lowara	15-20	200
	(Marelli	15-20	500
	(Guinaro	5.5-25	500
- Centrifugal Pumps	-	5-20	500
-	-	5.5-10	500
(b) Benghazi Branch			
- Subersible Pumps	-	-	148
- Monobloc Centrifugal Pumps.	-	-	442
		TOTAL:-	2940

As stated above the imports by the Company could have been in the vicinity of 4000-4500 water pumps under normal conditions.

(ii) Private Importers.

Probably the largest private importer of water pumps is Messrs. Nassireddin Nahas. The number of water pumps imported by this company in 1975 and 1976 was as follows:-

Centrifugal Water Pumps.	1975	1976
(3 to 7.5 H.P.)	2300	1964

Apart from the above mentioned Company, there are other importers as well in the private sector who import water pumps.

(iii) Total Import of Water Pumps.

The total imports of liquid pumps (water & industrial) from 1965 to 1974 and 1975 (3 months) has been recorded by the Census and Statistical Division as given in Table 4.6.

TABLE 4.6

LIBYA - PAST IMPORTS OF LIQUID PUMPS(1)

YEAR.	Number of Imported "Liquid" Pumps
1965	6353
1966	8429
1967	12401
1968	9609
1969	10421
1970	10042
1971	20439
1972	18736
1973	15529
1974	29158
1975(2)	7393

(1) The term "Liquid Pumps" is used in the Libyan trade statistics to distinguish from gas compressors, which are called "pumps for gasses".

(2) Taken from 3-month import statistics.

The import of all types of pumps is from over 32 countries. Appendix 5 shows import of "liquid" pumps from all countries for a 12-year period from 1964 to 1975 (6 months). However, the country-wide imports of pumps in the past 10 years can be summarised as follow:-

Italy	53%
W. Germany	13%
U.S.A.	10%
U.K.	9%
France	4%
Other Countries	11%
Total:-	100

4.2.3 Overall Share of Water Pumps in Total Imports.

According to the views of various importers of these pumps for liquids, the share of water pumps in the recent import years has

been around 85% and the balance of 15% has been chemical pumps required in the Chemical/Oil Industry. Based on this assumption the import of water pumps in the last 5 years (the period of considerable rise in demand) can be worked out as under:-

Year	Import of Water Pumps
1971	17,373
1972	15,925
1973	13,199
1974	20,534
1975(computed for full year).	12,568

4.2.4 Distribution Pattern By Type & Horse Power.

The share of centrifugal & submersible pumps in the overall imports has been in the ratio of 50:50 in the recent past. However, during the last 2 years the pattern has shifted more in favour of submersibles as compared to centrifugal pumps on account of falling water table in the coastal belt. The present distribution pattern by type as indicated by various importers is in the order of 60% for submersible pumps & 40% for centrifugal pumps.

Regarding the distribution of water pumps by H.P. the following pattern is fairly realistic:-

		H.P.	Percentage
(i)	Centrifugal Pumps.		
	Less than	5.5	10%
		5.5	35%
		7.5	35%
		10	18%
	More than	10	2%
(ii)	Submersible Pumps.		
	Less than	5	5%
		5-10	10%
		10-15	70%
	More than	15	15%

4.2.5 Present Demand of Water Pumps.

The total number of water pumps imported during the 5 years from 1971 to 1975 has been calculated at 79,600 and the average yearly import works out to 16,000 pumps. This figure can be accepted as the present demand of the country which is quite in line with the estimates of various importers of water pumps,especially the General Company for Farm Equipment. The break-up of this demand estimate by each type and H.P. has been worked out as follows:-

Water Pumps.		Present Demand(Nos).
(a) Centrifugal Pumps.		
Less than	5.5 H.P.	640
	5.5 H.P.	2240
	7.5 H.P.	2240
	10 H.P.	1152
More than	10 H.P.	128
		6400
(b) Submersible Pumps.		
Less than	5 H.P.	480
	5 - 10 H.P.	960
	10 - 15 H.P.	6720
More than	15 H.P.	1440
		9600
	TOTAL(a+b)	16000

4.3 ELECTRIC MOTORS.

The present demand of electric motors for pumps would be the same at 16,000 as is for water pumps. The demand distribution by H.P. is estimated as follows:-

Electric Motors for Pumps BY H.P.		Present Demand (Nos).
Less than	5	1120
	5 - 10	6592
	10 - 15 and above.	8288
	Total:	16,000

5. FUTURE DEMAND FOR AGRICULTURAL IMPLEMENTS, WATER PUMPS AND ELECTRIC MOTORS.

5.1 AGRICULTURAL IMPLEMENTS.

In view of shortage of manpower and abundant resources the Libyan Government has made considerable allocation for increased inputs and a greater emphasis has been laid on mechanization of agriculture. Therefore the demand for tractor-drawn implements is bound to increase in future as the quantum of agricultural mechanization increases, more land is reclaimed and more development programmes are implemented.

For projecting the demand of tractor-drawn implements it is necessary to examine the past growth in demand, the present situation and the new agricultural projects in the 5-year Development Plan. It may, however, be mentioned that the past pattern of import of agricultural implements has been very erratic and no precise growth rates can be evolved for the demand projection. It will, therefore, be more realistic to estimate the future demand of tractor-drawn implements in relation to the future demand of tractors and changes, if any, in the number of implements per tractor.

5.1.1 Projected Demand for Tractors.

There are various demand estimates for the future demand of tractors in the country and the estimates vary from 3,300 to 12,000 by 1980. The present growth rate in the recent years (1972 to 1975) has been about 33% per year cummulative. As mentioned in the earlier chapter there was a phenomenal rise in the imports of tractors primarily due to Government's anxiety for rapid farm mechanization as various large land reclamation and agricultural projects were under implementation. While the Government has extensive programmes till 1980 for agriculture and land reclamation, the future demand for tractors has to be viewed within certain constraints. It is an accepted fact that there is already a sufficient number of tractors for the land and any additional imports in the future has to match with the actual requirement for new land. The Consultants anticipate that the following additional requirement of tractors in 1980 and 1985 would be possible keeping in view the additional land to be brought under cultivation and the replacement of old tractors, basing on the same level of mechanization at one tractor for 40 Ha.

	1980	1985
Aditional land to be cultivated by 1980 and 1985.	357,000 Ha (As per Five Year Plan).	536,000 Ha*
No. of Tractors for new reclaimed land in 5 years.	8,900	13,400
No. of Tractors for new reclaimed land per year(A).	1,780	2,680
Total No. of tractors in the projected year.	26,900	40,300
Yearly Replacement for old tractors @10% of total tractor population(B).	2,690	4,030
Total Projected Yearly Requirement of Tractors in 1980/1985(A+B).	4,470	6,710
Say	4,500	6,700

*Estimated with a larger emphasis on development of irrigated areas.

It should be pointed out that 10-year life for tractor is high, and under conditions in developing countries can be as little as 5 years. Therefore the above estimate is conservative. On the other hand it assumes that new targets for developed land will be met. This may be optimastic. However the two would tend to balance each other.

5.1.2 Projected Demand for Tractor-drawn Implements.

Based on the projected demand of tractors estimated above the demand for tractor-drawn implements can be worked out, by fixing the number of implements per tractor. It is assumed after discussions with agriculturists, importers and farmers that the present ratio of implements per tractor (Table 4.4) will improve in future for improved and organized farm mechanization. Based on these ratios as a relationship with tractor, the demand for selected tractor-drawn implements can be estimated as given in Table 5.1.

Normally the life of implements would be longer than that of a tractor, but since only a 10% replacement of tractors has been assumed, and where old tractors are replaced by new ones, there is a tendency to import new implements also, it is assumed that new implements would be

required with each replaced tractor. This is also partly due to the relatively low level of current maintenance and tendency to discard implements with minor faults, rather than to repair them.

TABLE 5.1

DEMAND PROJECTION OF TRACTOR-DRAWN IMPLEMENTS AS RELATED TO TRACTORS NUMBER.

Tractor-drawn Implements.	Expected No. Per Tractor.	Projected Demand (Nos). 1980	1985
Disc Harrows	2	9000	13,400
Cultivators	1	4500	6,700
Seed Drills	2	9000	13,400
Levellers	1	4500	6,700
Rakes	1	4500	6,700
Ridgers	1	4500	6,700
Rotavators	1	4500	6,700
Trailers	1	4500	6,700
Water Tanks	1	4500	6,700

Apart from the above mentioned tractor-drawn implements there would be requirement of some other agriculture implements as given below:-

- Balers,
- Mould-board ploughs,
- Rotary weeders,
- Maize Drills,
- Wheat Threshers,
- Sub Soilers,
- Planters,
- Mowers,
- Grass Seed-Drills,
- Diggers (Post hole),
- Ditchers, etc.

5.2 WATER PUMPS.

As the search for water continues in the country, the demand for water pumps will obviously grow in future. In order to estimate the projected demand for water pumps the following methods have been followed:-

5.2.1 Demand Projection Based on Annual Growth Rates.

For estimating the future demand for pumps, the past pattern of growth, primarily the historical imports can be one of the possible methods. However, the past pattern of imports is somewhat erratic due to a variety of reasons. During the course of discussion with various importers of water pumps, an annual growth rate of 10-15% was suggested. The Consultants have assumed that the growth rates at 12% per year (cummulative) from 1976 to 1980 and 10% (cummulative) per year thereafter will be realistic for demand projection. Therefore, the future demand estimate for water pumps (both centrifugal and submersibles) would be as given in Table 5.2.

TABLE 5.2

DEMAND PROJECTION OF WATER PUMPS AT 12% CUMMULATIVE YEARLY GROWTH.

Year.	Demand of water pumps (Nos).
1975	16,000
1980	25,200
1985	40,580

Based on the above estimates the future demand for water pumps in 1980 and 1985 would be:-

1980	25,200
1985	40,580

5.2.2 Demand Projection of Water Pumps Estimated by Industrial Research Centre.

IRC has projected the yearly demand for water pumps in Libya as shown below:-

1980	23,000
1985	30,000

5.2.3 Demand Projection of Water Pumps by Distribution of Types.

The Five Year Development Plan envisages the installation of one water pump per Ha of irrigated land by 1980. From 1964 to 1975 about 140,000 pumps have been imported and since the irrigated average in 1975 was 168,000 Ha, this target has virtually been reached. The irrigated area

will increase from 168,000 Ha in 1975 to 268, 000 Ha in 1980 i.e. an increase of 100,000 Ha. This could at best increase by another 100,000 Ha by 1985. Therefore, the future demand for water pumps in 1980 and 1985 on the basis of one water pump per irrigated hectare is estimated as under:-

Y e a r.	Demand of Pumps per year		
	New Water Pumps (at 1 pump/new ha)	Replacement Pumps(1)	Total
1976-1980(inclusive)	20,000	10,500	30,500
1981-1985(inclusive)	20,000	18,000	38,000

(1) Based on 7½% of the pumps in the initial year.

It is probable that the figures as given on this basis are on the high side, as there is likely to be a lag in the actual installation of pumps.

5.2.4 Final Demand Projection For Water Pumps.

Combining these three sets of demand projections the final estimates as averages for 1980 and 1985 are estimated to be as under:-

Year.	Average Demand of Water Pumps.
1980	26,200
1985	36,200

It may be pointed out that the above-mentioned projection of demand includes a sizeable share of requirement arising from inadequate maintenance facilities in the country on account of lack of technical skill. However, in the context of a massive training programmes underway in numerous technical training institutions/centres, the maintenance facilities are definitely going to improve in the years to come. By improved maintenance facilities in the country the overall requirement of water pumps could easily be reduced by at least 10% in 1980 and 15% in 1985 respectively. This means that the net demand for pumps, after taking into account improved maintenance in 1980 and 1985, would be:

1980	23,580 Pumps
1985	30,770 Pumps

5.2.5 Projected Demand of Water Pumps by Types.

The future demand of centrifugal and submersible pumps (meaning mainly deep well turbine pumps) will depend upon the irrigation system, the ground-water table, water resources and methods of exploitation. If the present trend of increased usage of submersible pumps continues in view of falling water table in the coastal belt, then the quantum of deep-well pumps will be more compared to centrifugal pumps. The present ratio of 60% submersibles and 40% centrifugals could possibly change to 65% and 70% for submersible types with 35% and 30% as the share for centrifugal pumps in 1980 and 1985 respectively. However, in case more water is located in the desert then the distribution net-work could involve increased requirement of centrifugal pumps. Based on the first assumption of continued falling water table, the demand pattern for submersible and centrifugal pumps would be of the following order:-

	Demand of Water Pumps(Nos).	
	1980	1985
Submersible Pumps	14,148	20,000
Centrifugal Pumps.	9,432	10,770
Total:	23,580	30,770

The projected demand for centrifugal and submersible pumps in 1980 and 1985 by HP has been estimated as given in Table 5.3 below:

TABLE 5.3

BREAK-UP OF PROJECTED DEMAND OF WATER PUMPS BY HP.

		Projected Demand	
	Percentage Share.	1980	1985
(a) Centrifugal Pumps.			
Less than 5.5 HP	10%	942	1,077
5.5 HP	30%	2830	3,231
7.5 HP	30%	2,830	3,231
10 HP and above.	30%	2,830	3,231
Sub-Total:	100%	9,432	10,770

Contd.

	Percentage Share	Projected Demand 1980	1985
(b) Submersible Pumps.			
Less than 5 HP.	5%	707	1,000
5.5 to 10 HP.	10%	1,415	2,000
above 10 to 15 HP.	60%	8,489	12,000
More than 15 HP.	25%	3,537	5,000
Sub-Total.	100%	14,148	20,000
Total (a+b):-		23,580	30,770

It may be mentioned that the projected demand distribution of pumps by HP will change from the existing pattern as larger centrifugal pumps will be required on account of future horizontal water distribution through pipes and bigger submersibles would be needed on account of falling ground-water table.

5.3 ELECTRIC MOTORS FOR PUMPS.

Based on the projected demand for water pumps the demand of electric motors for pumps in 1980 and 1985 will be as given below:-

Electric Motors.	Projected Demand (Nos.) 1980	1985
Upto 5.5 HP.	1,649	2,077
5.5 to 10 HP.	7,075	8,462
10 to 15 HP and above.	14,856	20,231
TOTAL:-	23,580	30,770

NOTE:- Projected 1980 and 1985 demand for very small motors are nearly all for 5.5 HP.

6. MANUFACTURING FACILITIES FOR AGRICULTURAL IMPLEMENTS, WATER PUMPS AND ELECTRIC MOTORS IN PAKISTAN & LIBYA..

6.1 PRESENT POSITION

The present manufacturing facilities for the production of agriculture implements, water pumps and electric motors in Pakistan and Libya are summarised below:-

6.1.1 Agricultural Implements

(a) Pakistan

There is a very large capacity for the manufacture of animal-drawn and hand-operated implements in Pakistan. It is estimated that the total installed capacity for the production of only Sugar Cane Crushers, Chaff Cutters and small implements such as Shovels etc. , is in the vicinity of over 450,000 per year which includes a large number of chaff cutter blades as well.

The substantial installed capacity in plants for tractor-drawn agriculture implements and data for some of these is given below:-

TABLE 6.1

PAKISTAN-INSTALLED CAPACITY FOR THE PRODUCTION OF TRACTOR-DRAWN IMPLEMENTS

Agricultural Implements.	Installed Capacity Per Year.
Seed drills	1000
Ploughs	3000
Rotavators	300
Levellers	1000
Cultivators	5000
Ditchers	1000
Sub-soilers	500
Trailers	4500

These represent production in organized plants, but there is a substantial production in small workshops, particularly of trailers and actuai capacity is substantially higher.

(b) Libya.

There is a very limited production of tractor-drawn implements in Libya. There is only one unit presently engaged in the production of a few tractor-drawn implements in the country. The installed capacity of the unit for agricultural implements is given below:-

(1)	Disc Harrows (7 discs)	300 per year.
(2)	Trailers (3,3.5 and 5 ton capacity).	1800 per year.
(3)	Water Tanks (1500-3000 Lit).	1080 per year.

6.1.2 Water Pumps.

(a) Pakistan.

There are about 40 units presently manufacturing water pumps on commercial and cottage scales in Pakistan. The pumps being manufactured in the 12 large units correspond to international standards and include the centrifugal, reciprocating, deepwell turbine and non-clogging types of pumps. The present installed capacity for centrifugal and deepwell turbine pumps is estimated at about 15,000 per year, out of which about 3,000 is for deepwell pumps and the balance for centrifugal type. The capacity range of centrifugal pumps is from 100 to 1625 Imperial gallons per minute (27 to 448 m^3/hour), with water-head ranging from 22 to 294 feet.(6.7 to 90 meters). The capacity range for deepwell turbine pumps is 75-2600 GPM with (20 to 709 m^3/hour) with well size from 6"-16".(15 cm to 41 cm).

(b) Libya.

Presently there are no manufacturing facilities for the production of water pumps in Libya as the entire demand is met through imports.

6.1.3 Electric Motors.

(a) Pakistan.

A.C.Electric motors of open and totally-enclosed types in general, and some explosion/flame proof as special-purpose, are produced in the country. Large units are also producing electric motors upto 150 H.P. There are presently over 20 units in Pakistan manufacturing electric motors with a total installed capacity of about 0.6 million H.P. Nearly half of the manufacturing units have technical know-how collaboration including the use of well-known trade-names from reputed British and German manufacturers.

(b) Libya.

In Libya there is no local manufacture of electric motors as the entire demand is met through imports.

6.2 BASIC STEEL AND ALLIED INDUSTRIES.

6.2.1 Pakistan.

(i) Steel Mill.

An integrated steel mill near Karachi with the assistance of USSR is underway with an installed capacity of 1.1 million ton per year. The product-mix of the mill will be:

Product.	Tons/Year.
Billets	260,000
Plates	100,000
H.R. Sheets	335,000
C.R. Sheets	90,000
G.I. Sheets	100,000
Formed Sections	120,000

The steel mill will be fully in operation by 1983-84.

(ii) Electric Furnaces.

The total number of electric arc furnaces is 124 with a melting capacity of 735,000 tons which will, however, increase to 810,000 tons by 1980.

(iii) Stainless Steel.

A stainless and alloy steel plant has recently gone into production with annual capacity of 20,000 tons/year which includes 2,500 tons of steel castings and forgings.

(iv) Foundry and Forge.

A heavy foundry and forge complex at Taxila has been set up with the assistance of China which has gone into operation in Feb.,1977. The capacity of the plant is 60,000 tons/year with the following product-mix:

Steel Castings.	6,500 tons
Steel Ingots.	45,000 tons
Press Forgings.	4,500 tons
Forged Billets.	12,000 tons
Steel Balls.	2,000 tons

In addition to above, an increase in the capacity of steel melting furnaces is envisaged. Pakistan Railways are planning to balance and modernize their existing steel castings, stamping and forging facilities.

6.2.2 Libya.

An integrated steel mill with a capacity of 5 million tons is to be established at Misurata by 1985.

A combined foundry-forge plant at Sirte will be set up by 1985 which will have the following capacity and product-mix:-

i. CASTINGS.

	Tons/Year.	Type
- Ferrous Castings.	17,300	Grey Iron, non-pressure C.I. Pipes & malleable fittings.
- Steel Castings.	1,620	Carbon & alloy Steels.
	18,920	

ii. FORGINGS.

- Grinding media.	2,000
- Tractor-drawn implements	710
- Agricultural implements	700
- Hand tools	800
- Trucks, tractors and trailer parts.	765
- Others.	475
	5,450 tons/year.

The above estimates include the demand of castings and forgings for tractor-drawn and agricultural implements as follows:-

i.	Tractor-drawn implements	Castings (t/yr.)	Forgings (T/yr.)
	- Mould-board ploughs	365	546
	- Disc-Harrows and Cultivators	111	164
ii.	Agricultural Implements.		
	- Crow bars	-	140
	- Double faced sledge hammers	-	105
	- Spades and shovels	-	315
	- Pick-axes	-	119
	- Others.	-	21
	TOTAL:-	476	1410

(Source: IRC Report).

The estimates of IRC give no separate break-up for castings and forgings for pumps.

6.3 Suggested Medium for Transfer of Technology.

It will be seen above that substantial Transfer of Technology is possible from Pakistan to Libya in the field of Agricultural Implements, Water Pumps and Electric Motors.

The suggested organisation in Pakistan for providing the know-how, and subsequent operation of the plant, is the Pakistan Engineering Company (PECO) with manufacturing facilities at Lahore, Pakistan.

The company is a public-sector organisation and part of the Board of Industrial Management (BIM). It produces a large amount of Water Pumps and Electric Motors, and through its own production as well as its sister companies in the B.I.M. has access to know-how and production facilities for Agricultural Implements.

The Engineering of the project, however, would be undertaken by N.D.I.S.C., which is the Engineering Organisation of the B.I.M.

7. CAPACITY OF PLANT AND THE PRODUCT-MIX.

7.1 GENERAL.

The capacity of a Pilot Demonstration Plant has to be essentially based on small-scale manufacture with the production line tailored to a reasonable range of products. As a matter of fact the whole emphasis has to be on the development of local skill in the Pilot Plant. Moreover, the product-mix should be in line with the local demand pattern as far as possible. The selection of products should be based on relatively simpler equipment which can be easily manufactured.

Normally a so-called "pilot demonstration plant" would consist of small demonstration facilities, possibly located in a technical institute. However the level of technology which is to be developed in the next 5 years in Libya requires a much more sophisticated facility.

Following discussions in Libya, it is clear that an actual manufacturing facility must be installed with initially a limited production capacity, rising relatively soon to a full-fledged production facility. This report covers the first phase of such a facility which continues to be referred to as the "Demonstration Plant".

The facility will not only be capable of expansion but would form a nucleus of trained personnel for production facilities to be located elsewhere in Libya.

7.2 PLANT CAPACITY AND PRODUCT MIX.

In order to include relevant types of products which have, and will continue to have a demand in the country in future for the tractor-drawn implements, pumps and electric motors, a small percentage of the projected demand in 1985 for each equipment has been taken into account, as the demonstration phase of the facility.

7.2.1 Agricultural Implements.

As estimated in Chapter 5 the projected demand of tractor-drawn implements in 1985 will be 73,700 which will consist of the most commonly-used implements, and about 8% of this figure is taken as installed-capacity size of the Implements Shop.

It is proposed to assume 2% of the projected demand as production target of the Pilot Plant for the production of tractor-drawn implements. This has worked out to be 1474 implements per year which is rounded off to 1450 per year. Based on the expected usage of each type of implement, the product distribution of its capacity is given in Table 7.1.

TABLE 7.1

CAPACITY OF PLANT MANUFACTURING TRACTOR-DRAWN IMPLEMENTS BY PRODUCT RANGE.

Tractor-drawn Implement.	Proposed Capacity per Year (Nos).
Disc Harrows (Disc Ploughs)	200
Cultivators.	150
Seed Drills.	200
Levellers.	150
Bar Harrows/Rake	150
Ridgers.	150
Rotavators.	150
Trailers.(3.5 tons)	150
Water Tanks(2000 Lit).	150

It may be mentioned that the products listed above will form the first phase of the production schedule of the Pilot Plant. The products included in the list are relatively simple which will be comparatively easier for production. In the second phase of production schedule, however, implements such as balers, wheat threshers, mould-board ploughs & others will be included.

7.2.2 Water Pumps.

The capacity of the water pump manufacturing unit included in the Pilot Demonstration Plant is based on the projected demand for water pumps in 1985. The future demand of water pumps as estimated in Chapter 5 will be over 30,000 pumps per year and the size of the pilot production is proposed at 1% of this figure. This works out to be 300 pumps per year which is considered to be realistic for a pilot-scale plant. The capacity of this unit will consist of 250 centrifugal pumps and 50 submersible (turbine) pumps. It may be mentioned that although the requirement of submersible (turbine) pumps is steadily outstripping the demand for

centrifugal pumps, yet the number of submersible pumps included in the product-mix is much smaller. This is due to the sole consideration that the production of turbine type pumps involves much more complexity & precision, also requiring a lot more production time. In view of this reason, the number of submersible pumps has been kept very low in the Pilot Demonstration Plant, but can be increased in subsequent years as the level of expertise and workmanship of production personnel improves.

The breakup of water pumps by H.P in the proposed unit will be of the following order:-

	Types of Pump.	Production capacity/year.
i-	Centrifugal Pumps.	
	5 H.P.	100
	7.5 H.P.	100
	10 H.P.	50
ii-	Submersible Pumps.	
	10 H.P.	25
	15 H.P.	25
	TOTAL:-	300

7.2.3 Electric Motors.

The proposed capacity of electric motors will be identical to the size of water pumps manufacturing unit. It is, therefore, proposed to include production facilities for 300 electric motors per year. The break-up of various electric motors by H.P. is proposed below:-

Electric Motors.	Production Capacity/year.
5 H.P., 4-pole,horizontal.	100
7.5 H.P., " "	100
10 H.P., " "	50
10 H.P., ",vertical hollow-shaft.	25
15 H.P., ", " " "	25
TOTAL:-	300

8. LOCATION OF PLANT

8.1 GENERAL

Since ultimately a major production facility is to be installed the site selection should be based on all relevant factors for a production facility.

The major factors which influence the selection of a suitable location for an engineering plant of the type proposed are as follows.

i. Availability of land.
ii. Availability of water, fuel & electricity.
iii. Variations in Capital Cost.
iv. Variations in Production Cost.
v. Transport of Equipment, Raw Materials and Finished products.
vi. Drainage & waste-water disposal.
vii. Social Infra-structure.

It may, however, be mentioned that since the proposed plant is a small pilot demonstration unit, most of the above mentioned pre-requisites for plant site selection are not important. However, while examining the various possible plant sites, all these factors will be briefly discussed for the purpose of comparison.

8.2 POSSIBLE PLANT SITES.

The following places are considered to be the possible locations for the proposed Pilot Demonstration Plant for the manufacture of Agricultural Implements, Water Pumps and Electric Motors:

- Tripoli
- Benghazi
- Misurata
- Homs
- Sirte

Incidentally, all the above mentioned possible sites are located on the coast as shown in Fig. 8.1. The approximate distance of each possible site from Tripoli is given below:-

Benghazi	1100 Km
Misurata	230 Km
Homs	110 Km
Sirte	500 Km

8.3 FACTORS INFLUENCING SITE SELECTION.

8.3.1 Availability of Land

Since the proposed plant does not require a large area, therefore the availability of land does not pose any problem at any of the five possible sites. Moreover, the land can easily be acquired as the proposed plant will be owned by the Government. Similarly the cost of land will not be appreciably different in any of the 5 possible sites.

8.3.2 Availability of Water, Fuel & Electricity.

(a) W a t e r.

The availability of water is a problem in the country as a whole but the requirement of water for the proposed pilot plant will be quite small. Therefore the availability of water will not pose any major problem while selecting the plant site. However, it will be relevant to indicate the quality of ground water in the proposed areas for the purpose of comparison.

Location	Quality of Ground Water	Chemical Composition(PPM)			
		Chlorides	Sulphate	TDS	Specific Conductance Micro - Ohms
Tripoli	Good	Less than 250	Less than 250	Less than 1000	Less than 1600
Benghazi	Generally Fair with patches of poor.	250-800	250-600	1000-1500	1600-2500
Misurata	Generally Brackish with patches of good water.	1500-3500	1200-2500	3500-6000	6000-10000
Sirte	Brackish	1500-3500	1200-2500	3500-6000	6000-10000
Homs	Fair	250-800	250-600	1000-1500	1600-2500

From the viewpoint of water quality it is evident that Tripoli is the best possible site as ground-water from other locations is relatively poor in quality. In order to improve water resources in the areas such as Benghazi or Sirte the Libyan Government is setting-up water desalination plants and sewage-water treatment plants in major cities of the country.

The water desalanation plants at Benghazi and Sirte are under construction for which the future planned capacities are as follows:

Sirte.	9000 M^3/day.	Under construction (operation in early 1977).
Benghazi.	40,000 M^3/day.	Under construction (operation in early 1977).
Other places.	40,000 M^3/day.	To be in operation by 1980.

(b) F u e l.

The availavility of fuel will not pose any problem at any of the proposed sites.

(c) Electricity.

The requirement of electric power for the proposed plant is not large and therefore no difficulty will be encountered in this connection at any of the proposed sites. Moreover, there are many development schemes for power generation and distribution net-work linking towns and villages. This means that each possible location is equally placed viz-a-viz the power availability.

8.3.3 Capital Costs.

Some of the elements of capital costs would be slightly different from one site to the other which are discussed below:-

(i) Civil Engineering.

The civil engineering cost at Tripoli Benghazi and Homs will be marginally lower compared to sites in Misurata, or Sirte on account of transportation of building materials (such as cement) from Benghazi, Tripoli and HOms which have cement plants nearby.

(ii) Erection.

The erection cost of plant would be slightly higher if located at places other than Tripoli and Benghazi on account of the following reasons:-

- Transportation cost of erection equipment.
- Relatively higher wages and benefits for skilled workers in view of comparatively remote plant locations.

(iii) Transportation of Equipment.

The additional freight involved in the transportation of plant

and equipment from either Tripoli or Benghazi to Homs, Sirte and Misurata could be marginally higher if the plant is located in places other than Tripoli or Benghazi.

(iv) Social Infra-Structure.

From the view-point of social infra-structure Tripoli and Benghazi are the most suitable sites for the pilot plant. However, the establishment at Misurata of a 5 million tons integrated steel plant, a Forge and Foundry plant at Sirte and a tractor/trailer production plant at Homs, would result in much industrial activity at these places. These locations would also become a base for future industrialization.

(v) Drainage & Waste-Water Disposal.

This factor is common to all the proposed sites and will not pose any problem at any site.

8.3.4 Operating Cost.

It appears that the operating cost of the pilot plant may be lowest at Tripoli and Benghazi as all the imported materials will not involve any appreciable inland transport cost as compared to other sites. However, the element of transport cost for finished products could offset this advantage as either site would be 1100 Km apart from each other. The principal market for implements is located in the highly cultivated areas around Tripoli and Benghazi. The location at Sirte is between Tripoli and Benghazi which has the advantage of supplying the products to the market areas of Tripoli and Benghazi at a relatively lower transportation cost. Moreover the proposed establishment of a Forge & Foundary plant at Sirte is another factor which could possibly improve the suitability of Sirte for the plant location. Similarly the Misurata site could be advantagous at a later stage when a 5 million tons capacity integrated steel plant based on local ore would be established.

8.3.5 Conclusions.

All in all the most suitable site for the Pilot Demonstration Plant is considered to be Misurata on account of the following reasons:-

1. The proposed Pilot Demonstration Plant will be expanded to a commercial industrial unit in future and therefore the related industrial development such as the Steel Mill could have an important bearing on

the plant site suitability at Misurata.

2. Certain Steel raw-materials required for the proposed pilot plant would easily be met in future from the proposed steel complex. The entire requirement of steel sections, pig iron, and other materials for the production of agricultural implements and castings for pumps and motors will be easily and conveniently available from the Steel Mill.

3. The cost of production at the Misurata site will be lowest as the delivered costs of various raw materials, especially steel section, plate and pig iron, will be lower as compared to other sites in view of the close proximity of the integrated steel complex at Misurata.

4. With the establishment of a steel base at Misurata, the development of the engineering industry will be a logical consequence.

5. The establishment of a plant in an area other than Tripoli and Benghazi will be in line with the regional development policy of the Libyan Government for developing areas which are relatively backward.

6. As an alternate site Sirte could also be considered as this location will have a Forge & Foundary unit in future which could meet the necessary requirement of forgings and castings of the plant after it is expanded to a commercially viable enterprise. However, an advantage at this stage is not foreseeable as the Pilot Demonstration Plant will have the provision of forgings and castings for facilitating transfer of technology in all possible skills.

PEOPLE'S SOCIALIST LIBYAN ARAB REPUBLIC
PROPOSED IDUSTRIAL DEVELOPMENT DURING THE 5-YEAR PLAN 1976 TO 1980

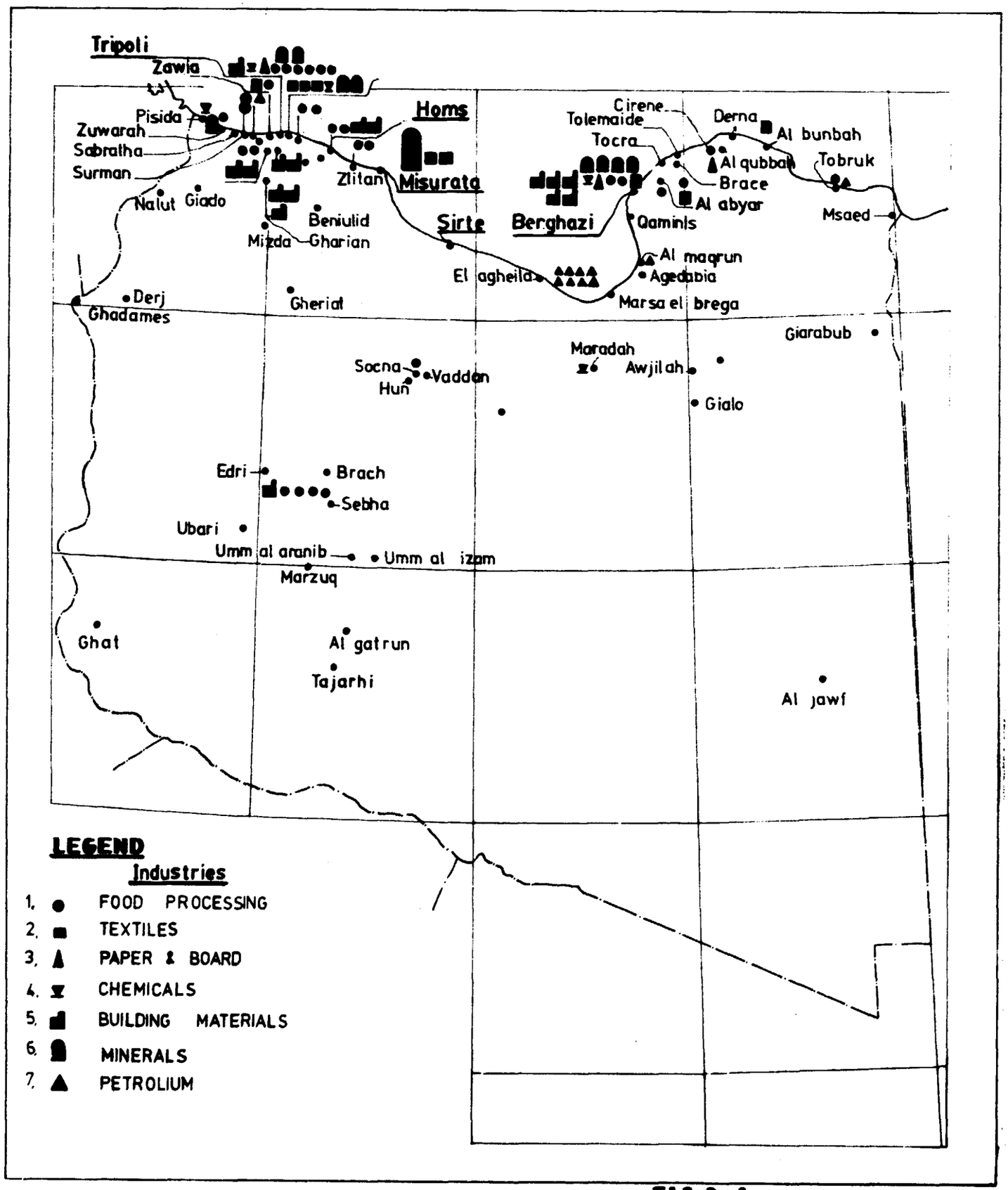

FIG. 8_1

SOURCE; State organisation for Industrialization

0 100 200 300 400 500 Km

N.D.I.S.C.

9. PERSONNEL AND MANAGEMENT

9.1 GENERAL.

This chapter deals with the requirement of personnel for management, production and other necessary services in the Demonstration Plant.

The personnel requirement can be classified broadly into 3 catagories, namely:-

1. General Management,
2. Technical Management, and
3. Workforce.

Fig. 9.1 shows the organization chart for complete plant establishment.

It is to be emphasised that the structure is as suggested in the chart and this report is production oriented, in order to instill factory disciplines from the very inception of the plant.

As pointed out before, the projected "pilot demonstration unit" is not a training demonstration unit, but is in fact a complete plant, and this is the basis for all subsequent chapters of the report.

9.2 GENERAL MANAGEMENT.

This would consist of a Managing Director as the head of the organization with the following departments working under him. The Managing Director would normally have at least 10 years experience as the Chief Executive of an engineering enterprise, but suggestions for training Libyan personnel are given below:

i. Management & Administration .
ii. Labour & Welfare.
iii. Accounts.
iv. Corporate & Legal Affairs.
v. Commercial.

The function of each section is described below:-

PEOPLE'S SOCIALIST LIBYAN ARAB REPUBLIC

ORGANISATION CHART

PILOT DEMONSTRATION PLANT

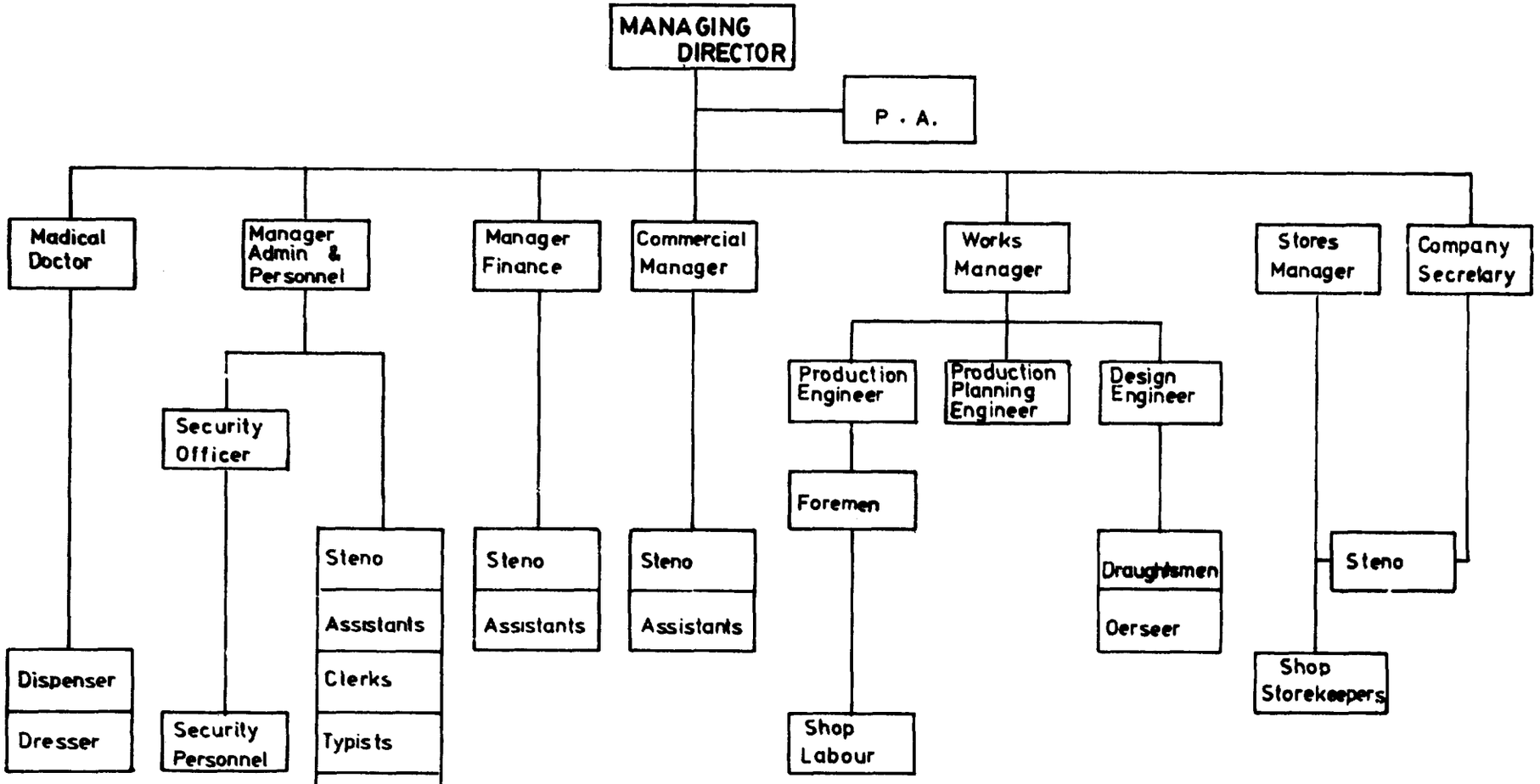

FIG. 9.1

N.D.I.S.C.

marshad choudhry

9.2.1 Management & Administration.

This section will be headed by Administration/Personnel Manager who will be dealing with the following work:

- Recruitments.
- Labour Welfare.
- Service terms & conditions.
- Appointments/Promotions/Termination of services.
- General Administration
- Office establishment.

The Administrative Manager should normally have 10 years experience of administration in an industrial establishment.

9.2.2 Accounts.

This section will be headed by a Chief Accountant who will be responsible for the following functions:

- Cost of production at various cost centres.
- Receipts & disbursement of materials & stores.
- Wages & salaries.
- Costing budget & accounts.

The Chief Accountant should have 10 years experience in handling accounts.

9.2.3 Corporate & Legal.

The Company's Secretary will be in charge of the section who will also be responsible for the corporate & legal affairs.

9.2.4 Commercial.

This section will essentially look after the purchase of raw materials/spare parts etc. and will be headed by Purchase Manager. He will be responsible for local & foreign purchase,indenting, L/Cs., insurance etc.

9 .2.5 OFFICE STAFF.

Office staff comprising of stenographers, typists, clerks, office assistants & peons etc. will be required for routine office work.

9.3 TECHNICAL PERSONNEL.

The factory personnel will be under a Works Manager who in turn will be directly responsible and answerable to the Managing Director. The qualifications and experience of the key technical personnel are briefly given below:-

9.3.1 Works Manager.

He will be responsible for the plant management & efficient operating of the plant. The Works Manager should be a qualified mechanical engineer and should normally have 10 years experience in a steel engineering industry, preferably in the manufacture of pumps, electric motors & agricultural equipment. Moreover, the Works Manager should have at least 5 years experience in a managerial capacity.

9.3.2 Production Engineer.

The Production Engineer will be responsible for the steady and efficient operation of the plant. He should be a graduate in Mechanical Engineering and should normally have 7-10 years experience in the operation of a plant of a similar type.

9.3.3 Foremen.

The Foremen should have diploma in an engineering subject with adequate practical (normally about 10 years) experience in an engineering plant. The shop foreman should have experience in the production line of the respective shop.

9.3.4. Skilled Workers.

The skilled workers such as turners, grinders, moulders, machinists, fitters, electricians, welders, etc. should have sufficient practical experience in their respective trades.

9.3.5 Semi-Skilled Workers.

This includes personnel comprising of assistant furnace-man, assistant electrician, assitant moulder, hammerman etc.

The category of these workers should have some experience (2-3 years) in the relevant trades.

9.4 REQUIREMENT OF PERSONNEL.

Keeping in view the proposed establishment chart in Fig.9.1 the composition of staff can be summarized as given below:-

1. General Management.	Number.
- Managing Director	1
- Administration/Personnel Manager	1
- Secretary to the Company.	1
- Manager Finance.	1
- Commercial Manager.	1
- Manager Stores.	1
- Security/Transport Officer.	1
- Medical Doctor.	1
- Steno/P.A.	4
- Assistants (Stores,Accounts, Office, Time Office).	6
- Clerks/Typists .	6
- Dispenser/Dressers.	2
- Overseer.	1
- Drivers.	7
- Peons.	8
- Security Personnel.	12
- Gardner, sweeper etc.	3

2. Technical.

2.1. Factory Management.

- Works Manager.	1
- Production Engineer.	1
- Product Planning Engineer.	1
- Design Engineers.	2
- Foreman.	4
- Store Keepers.	5
- Draughtsmen.	4
- Clerks/Typists.	5
- Ferro printer.	1
- Store Helpers.	10

-	Peons.	4
	Sub Total:	38

2.2 Shop Production

(i) Pump Shop

-	Turners.	5
-	Grinders.	2
-	Milling-man	1
-	Chipper man.	1
-	Fitters.	4
-	Asstt. Fitters	3
-	Painter.	1
-	Asstt. Painter.	1
-	Crane Driver	1
-	Machinist.	5
-	Testing-man	1
-	Helpers.	9
-	Balancing machine operator.	1
-	Other machine operators.	3
		38

(ii) Electric Motor Shop.

-	Press-man	2
-	Fitters.	2
-	Furnace-man	1
-	Die Caster.	1
-	Asstt. Die Caster.	1
-	Vertical Mill Operators.	1
-	Turners	3
-	Grinders	1
-	Machinists.	2
-	Astt. Fitters	2

-	Balancing Machine Operator.	1
-	Winders	2
-	Assemblers.	2
-	Spray Painter	1
-	Crane Driver	1
-	Field Testers.	1
-	Asstt. Field Tester	1
-	Electrician	1
-	Asstt. Electrician	1
-	Die Fitter.	1
-	Helpers.	6
		34

(iii) Agricultural Implements Shop

-	Turners.	2
-	Machinists/Operators	4
-	Milling man.	1
-	Universal Steel Worker Operator.	1
-	Welders (Gas & Electric).	3
-	Asstt. Welders.	2
-	Forging Hammer-man.	1
-	Asstt. Forging Hammer-man	1
-	Grinders.	2
-	Plate Rolling Machine Operator	1
-	Asstt. Rolling Machine Operator	1
-	Radial Drill Operator.	1
-	Pressman	1
-	Fitters	10
-	Helpers.	11
		42

(iv) Foundry

-	Moulders.	3
-	Asstt. Moulders.	3
-	Asstt. Grinders.	2
-	Chipperman	2
-	Asstt. Chipperman.	2
-	Hammerman	1
-	Crane-drivers.	1

-	Furnace-man.	3
-	Fitter	1
-	Asstt. Fitters.	2
-	Carpenters	2
-	Electrician	1
-	Turner	1
-	Machinist	1
-	Laboratory man	1
-	Helpers	10
		37

(v) Maintenance & Services.

-	Foreman (Mech).	1
-	Foreman (Elect).	1
-	Fitters (Mechanical & Electrical)	4
-	Winder (motor rewinding).	1
-	Auto Mechanic	1
-	Asstt. Mechanic	1
-	Electrician.	3
-	Instrument Mechanic	1
-	Asstt. Electrician	2
-	Turners	1
-	Machinist	2
-	Tool & Cutter Grinder	1
-	Pressman	1
-	Milling man	1
-	Auto Fitter.	1
-	Mobile Crane Driver	1
-	Fork Lift Drivers	4
-	Helpers	4
	Sub Total:	31
	Grand Total:-	280

9.5 PROPOSED METHOD OF TRAINING AND COLLABORATION OF PAKISTANI PERSONNEL.

It is recognised that the experienced personnel normally required for the jobs mentioned above, and the period of experience

mentioned above may not be practicable under conditions in Libya.

It is therefore suggested that about 20 persons be sent from Libya for training in Pakistan (see Section 10.8 later) and these should form the hard core establishment of the proposed plant.

In the meantime for a period of about 3 years some expatriate personnel could be obtained from Pakistan, during the period that the Libyan personnel are being fully trained to take over all functions.

It is proposed that only experienced professional and skilled personnel for some of the important jobs should be recruited from Pakistan and for a limited period of time. This will ensure smooth and efficient operation of the plant in the early years and will also help in training the local personnel. The following personnel are, therefore, suggested to be taken from Pakistan preferably from Pakistan Engineering Company for 3 years.

Personnel.	Number.
- Works Manager.	1
- Manager Finance.	1
- Production Engineer	1
- Product Planning Engineer	1
- Medical Doctor	1
- Design Engineer	1
- Foremen	4
- Draughtsmen	3
- Storekeepers.	3
- Skilled Workers.	52
Total:	68

9.6 SALARIES & ANNUAL PAY BILL.

The following average monthly salaries for the personnel are proposed. It may be mentioned that the salaries for expatriates will comparatively be more than the local personnel for the same job in line with the normal practice. However this difference in salaries is offset by the percentage of fringe benefits as detailed later.

Personnel.	Average Monthly Salary in U.S. Dollars.
- Managing Director	1200
- Works Manager	1200
- Manager Finance.	900
- Production Engineer/Planning Engineer/ Design Engineer/Medical Doctor	900
- Commercial Manager/Administration/Personnel/ Manager Stores/Company's Secretary/ Security Officer.	800
- Foremen.	750
- Storekeepers. -(Expatriates)	650
-(Local)	550
- Draughtsmen. -(Expatriates)	600
-(Local)	450
- Office Assistants/Stores/Accounts/P.A./ Steno/Overseer.	400
- Typist/Clerks/Dressers/Dispenser	350
- Skilled Workers. - (Expatriates)	500
- (Local)	400
- Semi-skilled/Drivers.	350
- Unskilled/Peons/Helpers	300

9.7 FRINGE BENEFITS

In line with the normal practice in industry in Libya, the following fringe benefits are visualized for the staff of the proposed plant.

- Provident Fund.
- Housing Allowance.
- Transport Allowance.
- Medical
- Leave.
- Subsidised supplies.

The quantum of fringe benefits varies greatly from one grade to the other in Libya. The lower salaried staff are given 60-80% of the basic salary as fringe benefits whereas the higher salaried staff are provided with about 40-50 %. This is assumed for the personnel to be recruited locally. However, for the expatriate staff fringe

benefits at a maximum of 40-50% of the basic salary has been taken into account.

9.8. TOTAL PAYBILL

The total paybill inclusive of fringe benefits is, therefore, estimated at $2,235,660 per year or about $186,300 per month.

It can be seen that the paybill is rather high for a pilot scale plant production. But this is essentially due to the fact that the plant is really a production plant having 4 distinct shops with all the necessary machinery and equipment, and obviously the required personnel, have to be provided. The only way to get the most benefit out of the staff and labour is to run the plant on semi-commercial or commercial basis. These aspects are discussed and analysed in detail in Chapter 11.

10. CAPITAL COSTS.

10.1. GENERAL.

It has been pointed out that, in order to make the project a practical one, and to have all the commercial activities desirable in the so-called pilot plant, it is proposed that the plant should be a semi-commercial plant.

The capital costs estimated in this chapter of the PLANT IS BASED ON THE LAYOUT GIVEN IN Fig. 10.1 as well as on the pilot-scale production to make 1450 agricultural implements, 300 water pumps and 300 electric motors per year, on a single shift basis.

It may be mentioned that the project investment includes virtually all the machines necessary for the commercial production of the desired equipment. The production envisaged in the current Plant is only semi-commercial as the objectives of the proposed plant are different to a fully commercial plant. The plant is based on a single shift production on a relatively small scale but the production from the same plant could be expanded to commercial level at a later stage. This is fully discussed in Chapter 11. The plant and machinery included in the project estimates can easily cater for semi-commercial production, and for more than one shift production.

The machinery and equipment cost is based on the machinery to be imported from Pakistan and various European countries.

In estimating the capital cost of a project of this type substantial difference arise from the price inflationery trends in existence in Libya, Pakistan and abroad. This has been taken into account to the extent possible, and will be discussed later in the chapter.

10.2. LAND AND LAND DEVELOPMENT.

A plot measuring 4 hectares will be required for the plant and for some quarters for the small security personnel.

The price for the land to be acquired by the Libyan Government is generally very low for Government-owned projects. It is difficult to fix the price of land exactly at this stage as the proposed plant has to be located close to the steel mill at Misurata. The final area for the steel mill has not yet been selected and, therefore, an approximate

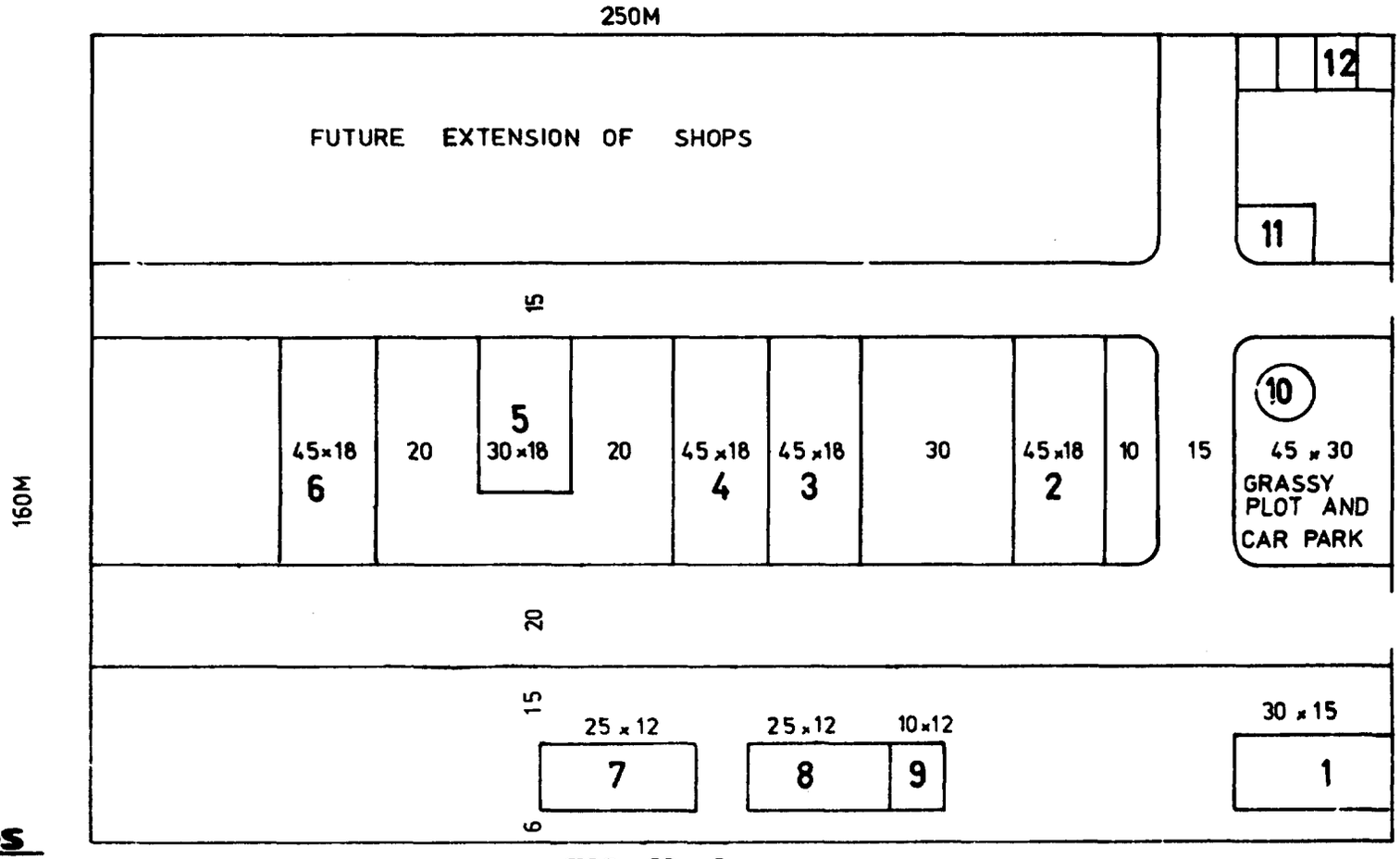

FIG. 10 – 1

LEGENDS

1 MAIN OFFICE
2 AGRICULURE IMPLEMENTS SHOP
3 ELECTRIC MOTORS SHOP
4 PUMP SHOP
5 MAINT. SHOPS
6 FOUNDRIES
7 MAIN STORES
8 CANTEEN
9 DISPENSARY
10 WATER TANK
11 ELECTRIC SUB-STATION
12 SECURITY STAFF QUARTERS

ALL DIMENSIONS IN METRES

NATIONAL DESIGN AND INDUSTRIAL SERVICES CORPORATION LIMITED LAHORE PAKISTAN

LAYOUT OF PILOT DEMONSTRATION PLANT FOR MANUFACTURE OF PUMPS, ELEC. MOTORS, AGRICULTURE IMPLEMENTS

m. arshad choudhry

price of $\$5/m^2$ for land required for the Pilot Plant has been assumed. The cost of private land, however, would be extremely high.

The cost of land development has been taken at 60% of land cost which will include cutting, filling, clearing, drainage and land acquisition fees. In addition to this, provision has also been made for land surveying. The total cost of land and land development has been estimated at $346,000.

10.3 CIVIL ENGINEERING.

All shop buildings will be constructed as steel sheds with G.I. roofs. Walls will be constructed in brick work. The main shop buildings will consist of foundry, pump shop, agriculture implements shop, electric motor shop and maintenance shop which will be constructed as steel sheds. Other buildings will be in RCC frame-structure & cement block walls. The shop buildings will be 45x18M each with a height of 8 meters at Crane gantry level.

The civil engineering cost estimates take into account the following works:-

- Boundary wall and gates,
- Roads & pavements,
- Factory buildings,
- Office building,
- Electric sub-station,
- Stores,
- Water tank,
- Dispensary,
- Canteen,
- Quarters for security staff,
- Lavatories and washrooms, etc.

The total cost of civil engineering works has been estimated at $2,330,000 which is based on the prevalent construction rates in Libya.

10.4 COMMUNICATION.

Apart from other communication facilities, a telephone PABX Exchange (2x25) is included in the estimates.

10.5 PLANT AND MACHINERY.

The details of principal machinery and equipment alongwith brief specifications are given in Table 10.2.

The machinery and equipment to be supplied from Pakistan and to be imported from Europe is listed in Table 10.2. It has been estimated that the cost of imported machinery C&F Tripoli will be $2789,000 from Pakistan and other European countries. The cost of locally-available equipment has been estimated at $20,000.

10.6 SPARES.

An amount of $418,000 has been earmarked on this account which constitutes 15% of the C&F cost of plant and machinery. Normally a figure of 10% is taken for plant of this type which is considered adequate to cater for spares, but in this case a higher percentage has been assumed. This is due to the fact that adequate maintenance facilities and necessary technical skills are not yet fully available in Libya.

10.7 ERECTION & INSTALLATION.

Erection cost would be composed of the expenditure to be incurred for expatriates and the local costs consisting of wages and materials. The various elements under the expenditure of erection are as follows:-

- Cost of expatriates for erection and start-up of plant
- Travel
- Wages and salaries for local labour and supervisory staff.
- Consumable materials.
- Rental charges for hired cranes
- Erection insurance

The erection charges on an industrial project in Libya generally vary from 8-10% on total project cost which would be 15-20% on the C&F cost of plant and machinery. Since most of the plant and machinery is in the form of independent units of machine tools, involving little assembly work, therefore a figure of 15% on the C&F cost of plant and machinery has been assumed as the cost of overall erection. Out of this, 10% will be in foreign exchange and 5% in local currency and thus, the total erection cost of the plant will be $419,000.

10.8 TRAINING.

It is proposed that 20 persons should be sent from Libya to Pakistan Engineering Company (PECO) for training for a period of 3 months. The persons will include 18 semi-skilled workers belonging to different trades who would have already received the necessary training from the training institutes and centres in Libya. It is proposed that two fresh qualified engineers or diploma holders from Libya should also be sent to PECO for training. The training of the local workers in Pakistan prior to the erection of the Pilot Plant will be very useful, as this will act as a base for the local technical personnel who will eventually operate the plant after a couple of years.

The capital costs have a provision for the expenditure on training of the personnel. It has been estimated that the cost of training of 20 persons will include the following expenditures.

- Wages & Salaries.
- Travel.
- Living Allowance.

It has also been estimated that the expenditure on the training of personnel from Libya would cost $200,000.

10.9 FURNITURE & VEHICLES.

This consists of the cost for furniture/fixture for the offices & provision for cars and a bus for the use of factory personnel. The estimated expenditure on this account would be $80,000.

10.10 CONSULTANCY SERVICES FEES.

This covers the expenses for engaging the consultants who will assist the promoters in the various phases of project implementation. A lumpsum figure of $100,000 has been provided for this expenditure.

10.11 PRELIMINARY EXPENSES.

An amount of $50,000 has been estimated for preliminary expenses which will include the following:-

- Salaries/benefits for personnel upto the Commencement of erection.	20,000
- Office expenses, conveyance, postage, telephone. @$2,000 per month for 4 months.	8,000
- Travel.	5,000
- Company's incorporation & floation charges, printing, registeration and stamp duties etc.	2,000
- Under-writing & Legal Expenses.	5,000
Total:	$ 50,000

10.12 START-UP EXPENSES.

This covers the expenditure during the early stage of start-up prior to actual production. The major part of this expenditure will be for the operating expenses and it has been assumed that about one month's production will be lost at 60% of operative capacity. The expenses on account of wastage during start-up has been estimated at $100,000.

10.13 PROJECT COST WITHOUT ESCALATION & CONTINGENCIES.

The total cost of the project if implemented on present day purchase prices on cash basis would be as follows:-

- Local Currency.	$ 2,992,000
- Foreign Exchange.	$ 3,839,000
Total:	$ 6,831,000

These estimates, however, exclude escalations and contingencies which are discussed below.

10.14 ESCALATION RESERVES AND NORMAL CONTINGENCIES.

The question of price escalation necessitates due attention and provision for the same has to be made in the project estimates. For the purpose of estimation a price escalation of 1% per month has been taken into account which takes care of future rise in wages and material costs. This means that the cost of the project would increase by $ 820,000 in one year, and this increase in cost has been taken into account in the estimates.

In addition to the escalation preserves for various components of capital costs, provision for possible prolonged erection and start-up period has been made in the form of physical contingencies at the rate of 5% of the project cost estimates. This means that the project cost will increase by $ 383,000 on account of contingencies provided in the estimates.

10.15 TOTAL PROJECT COST.

The total project cost including price escalation and contingencies but without working capital, therefore, works out as under:-

- Local Costs.	$ 3,519,000
- Foreign Exchange Costs.	$ 4,515,000
Total:	$ 8,034,000

10.16 WORKING CAPITAL.

For the purpose of calculating capital all supplies of input materials have been considered for three months whereas the utilities, wages, salaries and other expenses should be accounted for one month, but insurance cost has to be taken right in the begining of the year. No hypothecation of stock for loan with interest has been taken into account. The actual requirements of working Capital would depend on whether the plant is operated as a pilot plant or as a semi-commercial unit, and is discussed in Chapter 16 (see Table 16.2).

10.17 TOTAL PROJECT COST EXCLUSIVE OF WORKING CAPITAL.

The total project cost exclusive of working capital is detailed in Table 10.1.

TABLE 10.1

CAPITAL COST

('000'$)

		Local	Foreign	Total
1.	Land, Land development and communication.	346	-	346
2.	Civil Engineering.	2330	-	2330
3.	Plant and Machinery.	20	2769	2739
4.	Spares.	3	415	418
5.	Erection and Installation	3	415	418
6.	Training.	80	120	200
7.	Furniture & Vehicles.	80	-	80
8.	Consultancy services.	30	70	100
9.	Preliminary expenses.	50	-	50
10.	Start-up Expenses.	50	50	100
	Total cost without Escalation and Contingencies.	2992	3839	6831
11.	Escalation Reserves and Contingencies:			
	i) Escalation (12%).	359	461	820
	ii) Contingencies (5%).	168	215	383
	GRAND TOTAL:-	3519	4515	8034

T A B L E 10.2

LIST OF MACHINERY AND EQUIPMENT

PUMP SHOP

S/No.	Machinery & Equipment.	Qty.	Imported from Pakistan.	Other Countries.
			$	$
1.	Lathe, CL 160, size II(PECO make).	1	5400	-
2.	Lathe, CL 200,size II(PECO make).	2	12800	-
3.	Lathe, CL 250,size II(PECO make).	1	8400	-
4.	Lathe,CL 305,size III(PECO make).	1	10400	-
5.	Shaper, SH 460 (PECO make).	2	6300	-
6.	Power Hacksaw HS160 (PECO make).	1	1300	-
7.	Pedestal Drill,UD 50(PECO make).	2	6000	-
8.	Pedestal Drill,PD 20(PECO make).	2	1700	-
9.	Multi-spindle Drill.	1	-	20000
10.	Radial Drill,1200mm arm,50 mm capacity.	1	-	32000
11.	Vertical Turning Mill,1000 mm table	1	-	85000
12.	Keyway Milling Machine, 270 x 910 table.	1	-	18000
13.	Universal Milling Machine, 1300x330 table & 1050x225 table, K6U & K4U types. (PMTF make).	2	70000	-
14.	Turret Lathe, 42mm bar dia,T3C (PMTF make).	1	20000	-
15.	Internal Grinder, 190 mm Cen.ht.	1	-	45000
16.	Surface Grinder,180x1200 table	1	-	38000
17.	Cylinderical Grinder, 180 mm cen.ht.	1	-	40000
18.	Pedestal Grinders, double wheel, 225 dia.	3	-	4500
19.	Centering Machine, 35 mm Spindle.	1	-	10000
20.	Dynamic Balancing Machine,400 mm dia.	1	-	35000
21.	Shaft Straightening Machine,50 mm.	1	-	40000

22.	Pipe Expander, 5" to 8" pipe.	1	-	40000
23.	Pressure Testing Unit Complete with hydraulic pumps, valves gauges etc.	1	-	1000
24.	Water Test Pit complete with overhead tank, pipelines, venturimeter, pumps etc.	1	10000	-
25.	Overhead Travelling Crane, 5 tons complete with control & fittings.	1	25000	-
26.	Spray Painting Booth complete with spraying & other accessories.	1	2500	-
27.	Jigs, Fixtures & Gauges.	Lot	-	50000
28.	Workshop Tools & Equipment.	Lot	-	40000
29.	Store Racks, Platforms, Bins etc.	Lot	-	7000
			179800	475500

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ELECTRIC MOTOR SHOP

S.No.	Machinery & Equipment.	Quantity.	Imported from Pakistan.	Other countries.
1.	Guillotine Shear, 4 mm x 2 M.	1	-	20000
2.	Eccentric Press, 100 tons.	1	-	50000
3.	Eccentric Press, 40 tons.	1	-	25000
4.	Notching Presses.	2	-	20000
5.	Hand Screw Press.	1	-	1500
6.	Hydraulic Press, 15 tons.	1	-	11000
7.	Pressure Die-Casting Machine complete with accessories & a small oil fired furnace, Crucibles, blower (150 CFM) etc.	1	-	52000
8.	Heating Furnace, electrical, upto 600°C complete with controls.	1	-	13000
9.	Lathe, CL160 size II (PECOmake).	1	5400	-
10.	Lathe, CL 200 size II (PECO make).	1	6400	-
11.	Lathe, CL 200 size II (PECO make) with copying attachment.	1	7500	-
12.	Lathe, CL 305 size II (PECO make).	1	9500	-
13.	Shaper, SH460 (PECO make).	1	3200	-
14.	Drilling Machines, UD50 (PECO make).	2	6000	-
15.	Multi-spindle Drill.	1	-	20000
16.	Power Hacksaw, HS 160 (PECO make).	1	1300	-
17.	Pedestal Grinders, double wheel, 225 dia.	2	-	3000
18.	Keyway Milling Machine, 270x910 table.	1	-	18000
19.	Cylindrical Grinder,180 mm cen.ht.	1	-	40000
20.	Vertical Fine Boring & Turning Mill, 600 mm table.	1	-	60000
21.	Coil Winding Machine, table-type.	3	-	10500
22.	Insulation Cutting Machine.	1	-	2500
23.	Dynamic Balancing Machine,300 mm dia.	1	-	25000
24.	Varnishing & Baking Plant, complete.	1	-	20000
25.	Testing equipment-test panels, Dynamometer 30 KW,Instruments, Routine testing stations, etc.	Lot	-	50000
26.	Dies and Press Tools, Jigs, Fixtures etc.	Lot	20000	80000
27.	Workshop Tools & Equipment.	Lot	-	40000
28.	Spray Painting Booth complete with all accessories.	1	2500	-

29.	Overhead Travelling Crane 5 tons, complete with controls etc.	1	25000	-
30.	Store Racks, Bins, Platforms etc.	Lot	-	8000
			86800	569500

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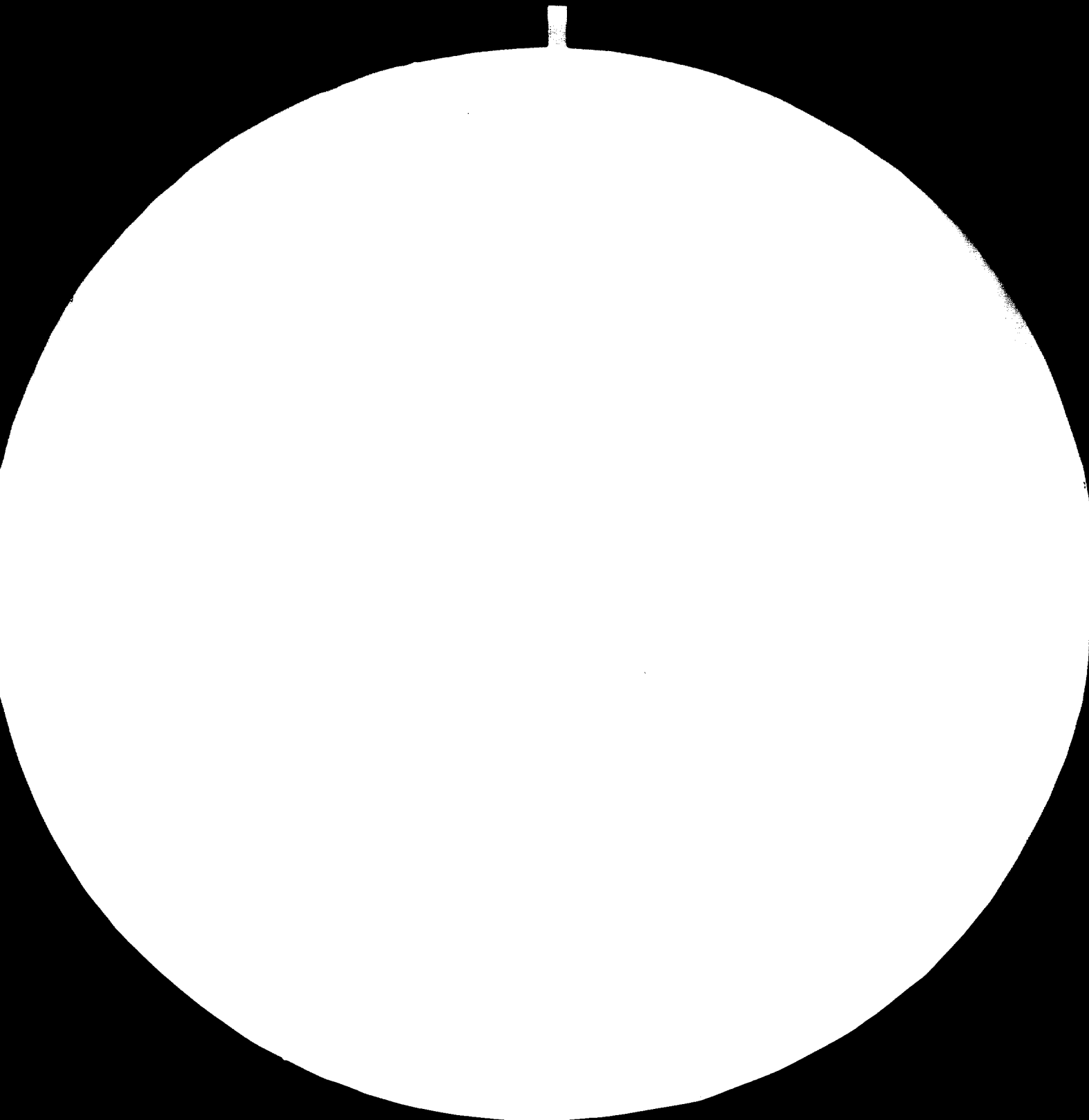
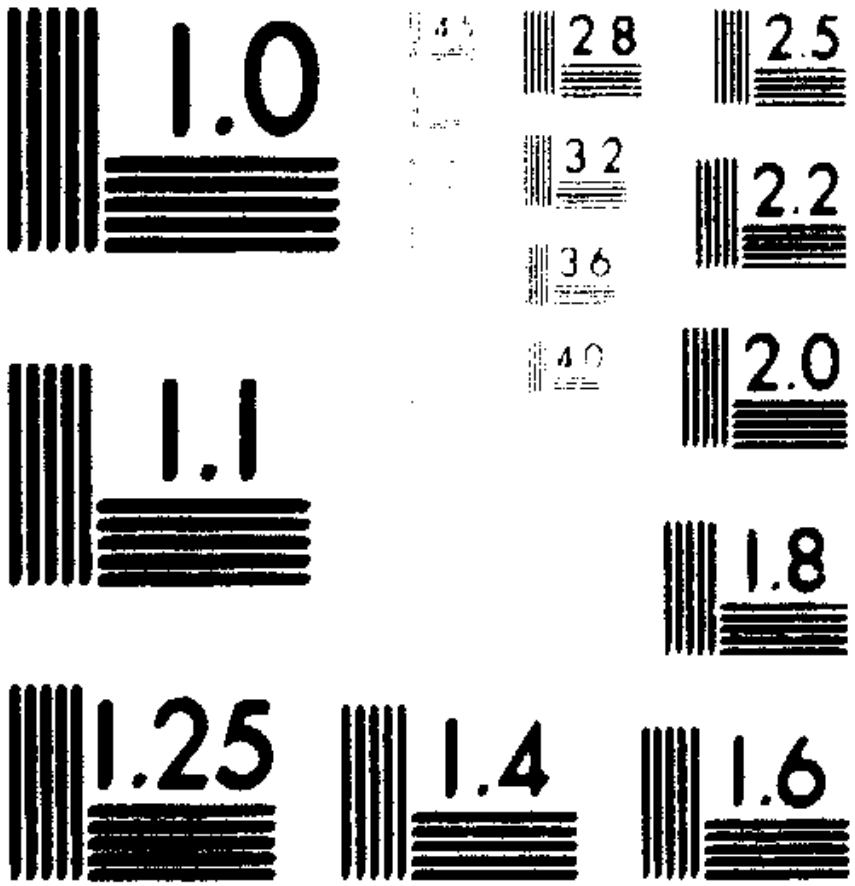
AGRICULTURAL IMPLEMENTS SHOP

S.No.	Machinery & Equipment.	Quantity.	Imported from Pakistan $	Other Countries $
1.	Lathe,CL 160 size III (PECO make).	1	5400	-
2.	Lathe,CL 200 size II (PECO make).	1	6400	-
3.	Lathe,CL 250 size III (PECO make).	1	9400	-
4.	Turret Lathe, 42 mm bore, T3C (PMTF make).	1	10000	-
5.	Shaper SH460 (PECO make).	1	3200	-
6.	Pedestal Drills, UD 50 (PECO make).	2	6000	-
7.	Pedestal Drills,PD 20 (PECO make).	2	1700	-
8.	Radial Drill,1200 mm arm 50 mm drilling.	1	-	32000
9.	Guillotive shearing Machine,4mm x 3M.	1	-	26000
10.	Universal Milling Machine,1300x330mm table, K6U (PMTF make).	1	35000	-
11.	Pedestal Grinders, double-wheel,225 mm.	2	-	3000
12.	Universal Steel Worker.	1	-	40000
13.	Cylindrical Grinder,180 mm cent.ht.	1	-	40000
14.	Surface Grinder, 180 x 1200 table.	1	-	35000
15.	Forging Hammer, hydraulic.	1	-	35000
16.	3-Roll Plate Rolling Machine 200 mm dia. rolls x 3 M.	1	-	25000
17.	Deep-drawing Press, 40 tons.	1	-	32000
18.	Power Hacksaw, HS160 (PECO make).	1	1300	-
19.	Hydraulic Pipe Bender	1	-	1000
20.	Electric Welding sets, 400 Amps.	5	-	12000
21.	Gas Welding sets, complete with accessories.	2	-	3000
22.	Workshop Tools & Equipment.	Lot	-	35000
23.	Jigs, Fixtures, Dies & Gauges.	Lot	-	35000
24.	Overhead Travelling Crane 5 tons complete with control etc.	1	25000	-
25.	Store Racks, Bins & Platforms etc.	Lot	-	7000
			103400	361000

F O U N D R Y

S.No.	Machine & Equipment.	Qty.	Imported from Pakistan	Other Countries.
1.	Mains Frequency Crucible-type Induction Furnace for cast iron, 1.25 tons capacity, complete with control panel etc.	1	-	40000
2.	Oil-fired Cupola, 1 ton capacity, complete with all accessories.	1	7000	-
3.	Medium Frequency Induction Furnace for steel castings, 200 Kg. capacity, complete with control panel etc.	1	-	47000
4.	Sand preparation plant complete.	1	-	22000
5.	Moulding Machine, Tilting-type.	2	-	20000
6.	Moulding Boxes.	20	6000	-
7.	Core-Box Baking Oven (Co_2 Process) complete.	1	-	5000
8.	Shot Blasting Unit, complete.	1	-	6000
9.	Magnetic Crack-Detection unit, complete.	1	-	22000
10.	Rockwell Hardness Tester.	1	-	20000
11.	Annealing Furnace, electrical, complete.	1	-	20000
12.	Forging equipment, complete (hand forging)	Lot	-	2500
13.	Testing Laboratory Equipment.	Lot	-	12000
14.	Store Racks, Platforms etc.	Lot	-	4000
15.	Overhead Travelling Crane 5 tons, complete with control etc.	1	25000	-
	Pattern Shop (Wood & Aluminium).			
16.	Band Saw (PAK make).	1	3500	-
17.	Pedestal Drill UD50 (PECO make).	1	3000	-
18.	Lathe, CL 160 size II (PECO make).	1	5400	-
19.	Shaper SH 460 (PECO make).	1	3200	-
20.	Planing Machine (Wood).	1	-	12000
21.	Tools & Workshop Equipment.	Lot	-	10000
			53100	242500





MAINTENANCE SHOP

S/No.	Machine & Equipment.	Quantity.	Imported from Pakistan.	Other Countries.
1.	Lathe,CL 250 size II (PECO make).	1	8400	-
2.	Lathe,CL 305 size III (PECO make).	1	10400	-
3.	Shaper, SH 460 (PECO make).	1	3200	-
4.	Pedestal Drill UD 50 (PECO make).	1	3000	-
5.	Bench Drill, 20 mm Capacity.	2	-	3000
6.	Pedestal Grinder, double-wheel, 225 mm.	1	-	1500
7.	Tool & Cutter Grinder.	1	-	20000
8.	Milling Machine, 1300x330mm table type K6U (PMTF make).	1	35000	-
9.	Hydraulic Press, 30 tons.	1	-	20000
10.	Electric Welding Set, 400 Amps.	1	-	2400
11.	Gas Welding set complete with accessories.	1	-	1500
12.	Auto Tools, complete set.	Lot	-	13000
13.	Electrical & Workshop Tools & Equipment, Testing instruments etc.	Lot	-	30000
14.	Overhead Travelling Crane, 5 tons, complete with controls etc.	1	25000	-
15.	Store Racks, Bins & Platforms etc.	Lot	-	4000
			85000	95400

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U T I L I T I E S

S/No.	Machinery & Equipment.	Quantity.	Imported from Pakistan	Other Countries.
(A)	Compressed Air.			
	1. Air Compressor, 600 CFT, 150 psi, complete with receiver.	1+1	-	60,000
	2. Piping, accessories and instruments.	Lot	-	15000
				75000
m (B)	Water.			
	1. Deepwell Turbine Pumps, 2 cusec capacity, complete.	1+1	-	20000
	2. Complete Pipelines, Valves fittings etc.	Lot	-	45000
				65000
(C)	Electric Power			
	1. 11/0.4 Kw Transformers for main sub-station, 1000 KVA each.	2)	100000	-
	2. HT & LT Panels for sub-station and shop distribution.	Lot)		
	3. HT & LT cables, wires and complete electrification.	Lot	-	160000
			100000	160000

TOTAL: $400000

MISCELLANEOUS SERVICES

	Machinery & Equipment.	Qty.	Imported from Pakistan.	Other countries.
(A)	Handling Equipment.(for all shops & stores)			
	1. Fork Lifters, 1¼ ton.	4	-	24000
	2. Pallet Trucks, Hydraulic	10	-	4500
	3. Utility Trucks, Platform Trucks, Hand Trolleys, etc., various types.	12	-	3500
	4. Mobile Road Crane, 5 tons capacity, 6M Boom complete.	1	-	56000
	5. Ladder Hoist, Platform, Lifting tables etc. for building & electrical repair/maintenance.	Lot	-	10000
				98000
(B)	Central Stores.			
	1. Storage Racks, Bins, Platforms etc.	Lot	-	15000
	2. Circular Saw, 700mm dia.	1	-	15000
				30000
(C)	Fire Fighting Equipment.	Lot	-	9000
		TOTAL:	$137000	

SUMMARY

	Shops.	Imported from Pakistan. $	Other Countries. $	Total $
1.	Pumps	179800	475500	655300
2.	Electric Motors.	86800	569500	656300
3.	Agricultural Implements.	103400	361000	464400
4.	Foundry.	53100	242500	295600
5.	Maintenance.	85000	95400	180400
6.	Utilities.	100000	300000	400000
7.	Misc. Services	-	137000	137000
		608100	2180900	2789000

11. RAW MATERIALS AND PRODUCTION COSTS.

11.1. Pilot Scale Production.

In the first instance, cost estimates are based upon Pilot Scale Production of all items. This amounts to about 1 pump and 1 motor per day and about 5 implements per day. The annual production is actually 300 pumps 300 electric motors and 1450 Agricultural implements plus materials required for maintenance and prototype fabrications.

11.2. Material Inputs and Stock Investory.

11.2.1. Material Requirements.

With the exception of a few items like Steel Scrap/C.I Scrap (50% from imports, 50% from local sources) and Limestone (100% local) all other raw materials and stores have to be imported for the prupose of this plant. However, more and more locally available materials will be used in production in subsequent years.

The attached consolidated material list(Table 11.1) shows the yearly requirements of various material inputs for a production schedule given above. A 10% wastage factor is included in most cases but in certain others (Pig iron, Scrap, Aluminum, Coke etc.) a figure of 15% has been considered.

11.2.2 Stock Inventory.

Since it is comparatively easier for Libya to import materials from nearby European sources a high inventory is not considered advisable. Hence a 3-month inventory would be sufficient except in cases where the yearly requirement is 4 tons or less, in which case total yearly figures are taken for the inventory.

11.3. Prices.

Material prices are based on present price levels of International sources and a 5% contingency figure is added to the total to cater for market fluctuations.

TABLE 11.1

CONSOLIDATED LIST OF MATERIALS

Materials.	Yearly requirements M. Tons	Landed Cost $	Quarterly Inventory M.Tons	Landed Cost $
(A) FERROUS.				
Pig Iron	60	9600	15	2400
C.I. Scrap	60	6000	15	1500
Steel Scrap	16	1600	4	400
Steel Billets (0.15% C).	20	4400	5	1100
Steel Sections (0.15% C)	260	59800	65	14950
M.S. Rounds/Bars (C45)	88	30800	22	7700
M.S. Plates/Sheets(commercial quality).	120	27600	30	6900
Steel Flats & Strips.	4	920	4	920
High Carbon Steel Flats.	60	21300	15	5330
Stainless Steel Bars	4	6200	4	6200
Electrical Steel Sheets (for Motors).	14	6930	3.5	1740
Other Alloy Steel Bars & Flats.	2	720	2	720
(B) NON-FERROUS.				
Copper (ingots)	6	9090	1.5	2280
Tin)for making brasses/bronzes.	0.2	2080	0.2	2080
Lead)	0.4	260	0.4	260
Zinc)	2.0	1500	2.0	1500
Aluminium (for Motors)	2	2200	2	2200
Copper Strips (for Motors)	1	2460	1	2460
Brass/Bronze (Bars, Sheets)	3	5400	3	5400
Copper Winding Wires(for Motors).	1.4	4200	1.4	4200
(C) FOR CASTINGS.				
Hard Coke/Coke Dust	52	9360	13	2340
Lime Stone	6	120	6	120
Ferromangenese, Ferrosilicon, Magnesite, Flourspar, Electrodes, Refrectories etc.)	Small	200	-	200

(D) OTHERS.				
Steel Pipes	112	84000	28	21000
G.I. Pipes/Copper Tubing	2	1500	2	1500
Standard parts & Components (Bearings, Gaskets, Packings, Sleeves Tyres & Tubes, Hardware etc.	52	72800	1400	18200
Insulating Materials (for Motors).	-	1060	L.S. (Small)	1060
Oils & Lubricants.	-	10000	L.S.	2500
Other Stores including Lab. Chemicals.	-	17800	L.S.	4900
TOTALS:		399900		122010
	say	400,000	say	122,000

11.4. PRODUCTION COST FACTORS.

Various cost factors included in the calculations of Annual Production Costs discussed below:-

11.4.1. Material Inputs.

Material inputs are in three basic categories:

- Raw Materials
- Parts & Components including Hardware,
- Other stores including indirect materials

These have been itemised in Table 11.1 above and have an annual value of $399,900 whibh may be rounded off to $ 400,000.

11.4.2 Labour Costs.

Since the Pilot Demonstration Plant has the prime responsibility of imparting technical know-how and necessary production training to local technicians, all aspects of production engineering have been taken into account while selecting the most essential personnel for various shops, so much so that even one-operator-to-each-machine rule is also disregarded unless the operation is such that it can only be performed by a person of that particular category and expertise only. This is the reason for the incorporation of the "Machinist" category (Chapter 9) who would be able to work on many types of machine tools - very much similar to Tool Makers in Tool Rooms. For this reason a fully-commercial production will not be possible unless more labour is engaged. Any commercial operation, therefore, has to be on semi-commercial basis.

11.4.3 Utilities.

Power: It is estimated that about 3,900,000 units would be

required if the all machines & equipment are running for full 8 hours, and at the rate of 7.5 Dirham per unit electricity charges in Libya the total yearly expenditure amounts to about $96,525. But this applies to semi-commercial production only and hence for pilot-scale production 40% of this figure is taken for calculations of annual production costs.

Water: Yearly charges on this account amount to about $1200 at the prevalent rate of 2 Piasters per M^3 in Libya. 75% of this figure is taken as annual expenses for water supply for pilot production.

Telephone, Telex: A lumpsum figure is taken on this account after ascertaining the communication requirements of a similar organization under Libyan conditions.

11.4.4 Postage, Telegrams & Cables.

In this case also a lumpsum figure is taken after a similar pattern is prevalent industrial set-ups.

11.4.5 Printing and Stationery.

For pilot-scale production this amount will not be very high as the production paper work will be nominal as compared to semi-commercial or commercial production. However, expenses in the administrative wings would be the same in all cases.

11.4.6 Travelling.

Travelling expenses on inland & foreign travels in connection with official work by managerial and/or technical staff is incorporated on a lumpsum basis.

11.4.7 Machinery and Equipment.

Each production shop has been planned with all the necessary machines and equipment with the exception of certain machine tools (lathes, drills, shapers etc.) which have been cut-down to 65-70% of their normal requirement in comparison with other essential equipment installed in a shop, especially the Pump & Motor Shops. Hence the production capacity of the installed machinery has somewhat reduced, and full commercial production will not be possible.

Inspite of this reduction in machine tools it is not possible to completely eliminate any equipment which is essential for production. This

and the fact that all necessary Tooling (Jigs, Fixtures, Dies, Press Tools, Gauges etc.) has to be provided whether the end use is a pilot-scale or normal production, the capital cost is considerably increased. This is most evident in the case of the Electric Motors Shop.

11.4.8 Depreciation

This is taken on a straight-line basis as given below:

- Building & Civil Works 5%
- Plant & Machinery. 10%
- Furniture, Fixtures & Vehicles. 20%

1 1.4.9. Amortisation

For all other capital cost heads like spares, Erection, Training, Start-up Expenses etc. the amortisation factor is taken as 1 0% in a ten-year period.

1 1.4.10. Overheads.

Only the most essential administrative and technical personnel have been kept in this category. As a matter of fact the Marketing and Extension Staff have been left out for the present and may be added later o n when required. The consequent high paybill on this account, therefore, cannot be avoided.

1 1.4.11. Maintenance.

Building & Civil Works:

Each product group has been planned as having its own shop (shed) complete with an overhead travelling crane, all necessary fittings for utilities like electricity, water and compressed air, and a small store f itted with racks, platforms and storage bins. Yearly Maintenance costs f or factory buildings, offices and other installations are generally taken at 1½ % of capital costs.

Machinery Maintenance: Usually the machinery and plant maintenance costs are taken at 3% of the C&F value but inthis case it has been enhanced to 4% due to inadequate maintenance facilties at present available in Libya.

Service shops like Foundry & Maintenance have to cater to all three product groups and hence expenses are distributed to each group on the basis of total yearly production tonnage.

11.4.12 Insurance and Taxes.

A figure of 1% of the project cost is taken to cover expenses on plant, building & equipment insurance, and to pay out any local or f ederal taxes.

11.4.13 Other Unforeseen Expenses.

Certain unforeseen expenses are in a plant of this size and hence a lumpsum figure is included in the fixed costs.

11.5. Pilot Plant Cost of Production.

The annual costs of production from pilot scale production are indicated in Table 11.2, and the unit cost for each item on a per kilogram basis are given in Table 11.3. The actual costs for each item produced will be discussed in detail in the next chapter.

TABLE 11.2

ANNUAL COST OF PILOT-SCALE PRODUCTION

11.5.1 Variable Costs.

		Costs $	Total $
i)	Materials:		
	Raw Materials	290,000	
	Parts & Components	83,000	
	Other Stores.	27,000	400,000
ii)	Labour Costs (Wages & Fringe benefits)		1,404,900
iii)	Utilities:		
	Power (40% of Max.)	38,600	
	Water (75% of Max.)	900	
	Telephone, Telex	4,000	43,500
iv)	Postage, telegrams, cables		1,400
v)	Stationery, printing etc.		3,200
vi)	Travelling-inland and abroad.		15,000
11.5.2	Fixed Costs.		
i)	Depreciation		483,810
ii)	Amortisation @ 10%		151,230
iii)	Overheads: Technical	372,540	
	Administrative.	458,220	830,760
iv)	Building Maintenance @1½% of costs		41,100
v)	Machinery Maint.@4% of C&F value.		131,200
vi)	Insurance, taxes etc.@1% of project cost.		80,340
vii)	Other unforeseen expenses.		15,560
	Total:		$3,602,000

TABLE 11.3

PRODUCT-WISE COST OF PRODUCTION

(PILOT-SCALE BASIS)

Cost Head	Pumps $	Motors $	Implements $
1. Materials.	117,180	35,630	247,190
2. Labour	534,510	455,390	415,000
3. Utilities	7,400	2,040	34,060
4. Postage,telegrams etc.	240	70	1,090
5. Printing & Stationery.	540	150	2,510
6. Travelling expenses	2,550	700	11,750
7. Depreciation	136,670	100,980	246,160
8. Overheads: Tech.	63,330	17,510	291,700
Admn.	77,900	21,540	358,780
9. Amortisation.	25,710	7,110	118,410
10.Maint.- Buildings.	6,990	1,930	32,180
Machinery.	50,510	5.,510	30,180
11.Insurance etc.	13,660	3,780	62,900
12.Other expenses.	2,650	730	12,180
Total:	1,039,840	698,070	1,864,090
Unit Cost($/Kg)	8.41	20.29	3.24
Yearly Production. Centrifugal 250		300	1,450
Deepwell 50 (on single -shift basis)			

However, the ex-factory costs of one item from each production group as calculated on the basis of the unit costs contained irable 11.3 are given below alongwith comparative approximate selling prices prevalent in Libyan Market:

Product	Ex-factory Cost	Market Price in Libya
(a) Centrifugal Pump 10 HP	$ 1,262	$ 225
(b) Deepwell Pump 10 HP	$11,774	$ 4320(C&F)
(c) AC Electric Motor 10 HP	$ 2,638	$ 217
(d) Disc Harrow(7-disc)	$ 1,960	$ 830(Local)
(e)		$ 890(Imported)

As can be seen from the above calculations the various unit costs are very high. It is, therefore, imperative that certain alternatives must be selected to to bring down these unit costs to a reasonable level as

otherwise the ex-factory costs of the products would become excessively high resulting in losses.

11.6 Reduction in Capital Costs.

In view of the very high costs of production in the pilot demonstration plant mentioned above, which in actual practice has a substantially higher capacity than that mentioned in 11.1 above (about 3 times as much in pumps and motors and 5 times as much in implements), the first attempt was to reduce the number of machines.

Unfortunately reduction is possible only in the general machine tools, as the other machines are one of each type and hence are required for the demonstration plant.

The new list of machinery for this alternative is contained in Table 11.4. A comparison with Table 10.2 will show the reduction in machines for this second alternative (alternative II).

The basic change under this alternative is that the machinery and equipment have been grouped in two district groups, namely specific machinery required for the specific product, and general machine-tools common to all products which have been reduced further and installed in one of the shops to cater for machining operations of all the products. This has, consequently, resulted in a 13% decrease in the capital cost of plant and machinery of pumps, motor and implements shops. In case of Foundry the reduction is not very considerable as only 3 machine-tools and workshop tools have been taken out. Some reduction is also possible in electrification costs. Table 11.5 gives details of plant, machinery and other services under this system.

The revised capital costs for this alternative II is given in Table 11.5.

TABLE 11.4

LIST OF MACHINERY & EQUIPMENT

(ALTERNATIVE II)

	Machinery & Equipment	Qty	Imported from Pakistan	Other countires
			$	$
1.	Lathe, CL 160 sizes II & III (PECO make)	2	10800	-
2.	Lathe, CL 200 sizes II & III (PECO make)	3	19200	-
3.	Lathe, CL 200 sizes II with copying attachment (PECO make)	1	7500	-
4.	Lathe, CL 250 sizes II & III (PECO make)	2	17800	-
5.	Lathe. CL 305 size III (PECO make)	1	10400	-
6.	Shaper SH 460 (PECO make)	3	9600	-
7.	Power Hacksaw HS 160 (PECO make)	2	2600	-
8.	Pedestal Drill UD50 (PECO make)	3	9000	-
9.	Pedestal Drill PD20 (PECO make)	2	1700	-
10.	Bench Drills 13 mm	3	-	4500
11.	Vertical Turning Mill, 1000 mm table	1	-	85000
12.	Vertical Fine Boring Mill, 600 mm table.	1	-	60000
13.	Keyway Milling Machine, 270x910 table.	1	-	18000
14.	Centering Machine, 35mm spindle	1	-	10000
15.	Shaft Straightening Machine 50mm	1	-	40000
16.	Dynamic Balancing Machine. 400 mm.	1	-	35000
17.	Guillotine Shear. 6 mm x 3 M	1	-	26000
18.	Pipe Expander. 5" to 8" pipes	1	-	1000
19.	Universal Milling Machine. 1300x330 table type k6U & 1050x225 table type K4U (PMTF make)	2	70000	-
20.	Vertical Milling Machine, 1050x225 table (PMTF make)	1	35000	-
21.	Multi-spindle Drilling Machines	2	-	40000
22.	Radial Drilling Machines, 1200 mm arm, 50 mm drilling.	2	-	64000
23.	Universal Steel Worker.	1	-	40000
24.	Cylindrical Grinders, 180 mm cent. ht.x750 table	2	-	80000
25.	Surface Grinders 180x1200 table	2	-	76000
26.	Internal Grinder, 190mm cent ht.	1	-	45000

27.	Tool & Cutter Grinder	1	-	20000
28.	Pedestal Grinders, double wheel, 225 dia.	4	-	6000
29.	Hydraulic Forging Hammer	1	-	35000
30.	3-Roll Plate Rolling Machine, 200 mm dia. Rolls x 3M	1	-	25000
31.	Hydraulic Pipe Bender	1	-	1000
32.	Turret Lathe, 42mm bore, T3c(PMTF make)	1	1000	-
33.	Eccentric Press, 100 tons	1	-	50000
34.	Eccentric Press, 40 tons	1	-	25000
35.	Deep Drawing Press, 40 tons.	1	-	32000
36.	Hydraulic Press, 30 tons	1	-	20000
37.	Notching Presses.	2	-	20000
38.	Hydraulic Press, 15 tons	1	-	11000
39.	Hand Screw Press	1	-	1500
40.	Pressure Die Casting Machine complete with accessories and a small oil-fired furnace, crucibles, blower (150 CFM) etc.	1	-	52000
41.	Heating Furnace, electrical, upto 600°C, complete with controls.	1	-	13000
	Welding Section			
42.	Electric Welding sets, 400 Amps.	4	-	9600
43.	Gas welding sets complete with all accessories.	3	-	4500
	Pumps only:			
44.	Pressure Testing Unit complete with pumps, Valves, gauges etc.	1	-	10000
45.	Water Test Pit complete with all pipelines, overhead tank, pumps, venturimeter etc.	1	10000	-
	Motors only:			
46.	Coil winding machines, table type	2	-	7000
47.	Insulation Cutting machine	1	-	2500
48.	Varnishing & Baking Plant, complete.	1	-	20000
49.	Testing equipment - test panels, Dynamometer 30 KW, Instruments, Routine testing stations, etc.	Lot	-	50000

Dies, Press Tools, Jigs, Fixtures etc.

50.	For Pumps.	lot	-	50000
51.	For Motors	lot	20000	80000
52.	For Implements.	lot	-	35000
	Miscellaneous:			
53.	Workshop Tools & Equipment	lot	-	75000
54.	Spray Painting Booth, complete	1	3000	-
55.	Overhead Cranes, 5 tons (1 per shop)	4	100000	-
56.	Store Racks, Bins, Platfrons etc.	lot	-	26000
			346600	1315600

FOUNDRY

Lathe, Shaper, Drill, Tools & workshop equipment and Store Racks etc. have been deleted from this section and included in combined list of machinery and equipment.

UTILITIES:

Compressed air & Water installations remain the same as in Alternative I as also the main sub-station equipment. Reduction is only affected in wires/ cables & installation for those machines which have been taken off the Alternative I list of machinery & equipment.

MISC. SERVICES.

3 Fork Lift Trucks instead of 4 have been provided.

SUMMARY

	Shops/Services	Imported from Pakistan.	Other countries	Total
(A)	Combined machinery & equipment.	346,600	1,315,600	1,662,200
(B)	Foundry	41,500	228,500	270,000
(C)	Utilities.	100,000	260,800	360,800
(D)	Misc. Services.	-	131,000	131,000
		488,100	1,935,900	2,424,000

TABLE 11.5

CAPITAL COSTS OF ALTERNATIVE II.

		($'000) Local.	($'000) Foreign	($'000) Total
1.	Land, Land development and communication.	346	-	346
2.	Civil Engineering	2330	-	2330
3.	Plant & Machinery	20	2404	2424
4.	Spares	3	360	363
5.	Erection and Installation	3	361	364
6.	Training	80	120	200
7.	Furniture & Vehicles	80	-	80
8.	Consultancy Services	30	70	100
9.	Preliminary Expenses	50	-	50
10.	Start-up Expenses	50	50	100
	Total Cost without Escalation and Contengencies.	2992	3365	6357
11.	Escalation Reserves and Contengencies:			
	i) Escalation (12%)	359	404	763
	ii) Contengencies (5%)	168	188	356
	Grand Total:-	3519	3957	7476

11.7 Semi-Commercial Production.

It will be seen later that even with the reduction in capital costs considered under 11.7 above the costs of manufacture still remain high.

Another possibility therefore is to consider operating the plant within 3-years after short-up at the full single shift capacity of the machines.

This would mean an increase in capacity for both the alternatives.

11.8 Semi-Commercial Production without Motors.

In view of the fact that international prices of motors is low, the cost of production from all the alternatives considered above is likely to remain high. Therefore the alternative of not including motors intially in the pilot plant (but leaving space in the buildings for the electric motor shop) also needs to be considered.

Under these conditions, the capital costs are reduced. The capital costs for alternatives I and Alternative II without motors are contained in Table 11.6 and 11.7. It will be seen that the capital costs are substantially reduced.

TABLE 11.6

ALTERNATIVE I - CAPITAL COSTS WITHOUT ELECTRIC MOTOR EQUIPMENT.

('000)

		Local	Foreign	Total
		$	$	$
1.	Land, Land development and communication.	346	-	346
2.	Civil Engineering	2330	-	2330
3.	Plant & Machinery	20	2113	2133
4.	Spares	3	317	320
5.	Erection and Installation.	3	317	320
6.	Training	50	70	120
7.	Furniture & Vehicles	60	-	60
8.	Consultancy Services	20	80	100
9.	Preliminary Expenses	35	-	35
10.	Start-up Expenses	30	40	70
	Total Cost without Escalation and Contingencies.	2897	2937	5834
11.	Escalation Reserves and Contingencies.			
	i) Escalation (12%)	348	352	700
	ii) Contengencies (5%)	162	165	327
	Total:	3407	3454	6861

TABLE 11.7

ALTERNATIVE II - CAPITAL COSTS WITHOUT ELECTRIC MOTORS.

		($'000) Local	($'000) Foreign	($'000) Total
1.	Land, Land development and communication.	346	-	346
2.	Civil Engineering.	2330	-	2330
3.	Plant & Machinery.	20	2003	2023
4.	Spares.	3	300	303
5.	Erection & Installation.	3	301	304
6.	Training.	50	70	120
7.	Furniture & Vehicles.	70	-	70
8.	Consultancy Services.	20	80	100
9.	Preliminary Expenses.	35	-	35
10.	Start-up Expenses.	30	40	70
	Total Cost without Escalation and Contingencies.	2907	2794	5701
11.	Escalation Reserves and Contengencies:			
	i) Escalation (12%)	349	335	684
	ii) Contengencies (5%)	163	156	319
	Grand Total:-	3419	3285	6704

11.9. SUMMARY OF ALTERNATIVES CONSIDERED.

The various alternatives may be summarised as follows:

Alternative I.

i) Pilot-scale Production: As given in Table 11.3.

ii) Semi-commercial production: Materials and certain other cost factors will increase but there will be no increase in the cost of Labour (Table 11.8).

iii) Semi-commercial production without Motors: Capital cost will be reduced as Motor Shop machinery & equipment as well as Tooling have been deleted. Labour costs will also be reduced and there will be a 5% decrease in Technical & Administrative overheads. Production of Pumps and Implements will remain the same as above as shown in Table 11.9.

Alternative II.

i) Pilot-scale Production: Capital costs will be reduced due to decrease in machinery & equipment, and the Labour costs will also change accordingly. There is no change in the Technical & Administrative overheads. Production basis in the 3 product groups shall remain the same as in Alternative I, as shown in Table 11.10.

ii) Semi-commercial production: Due to reduction in the installed machinery the yearly production will be less than that in Alternative I, Table 11.11 gives the resultant production cost details.

iii) Semi-commercial production without Motors: In this case the specific machines meant for motor production and tooling have been deleted which has resulted in further reduction in capital costs. Slight decrease in Labour cost is also considered. Administrative and Technical overheads shall, however, remain the same. The yearly production figures will be enhanced as the rest of the machinery & equipment will be utilized for Pumps & Implements only. Table 11.12 shows the details of this alternative.

The production from various alternatives will be as follows:-

Alternative	Production	Production in Numbers per Year.		
		Pumps	Motors	Implements
I	- Pilot scale	300	300	1450
	- Semi commercial	1500	4800	5000
	- Without Motors.	1500	-	5000
II	- Pilot scale	300	300	1450
	- Semi commercial	900	2100	2900
	- Without Motors.	1350	-	4350

11.10. Cost of Production of Various Alternatives.

The cost of production of various alternatives considered in 10.9 above is contained in the following tables:-

Alternative I - Pilot Plant - Already contained in Table 11.3
- Semi-Commercial - Table 11.8
- Semi-Commercial Without motors - Table 11.9

Alternative II - Pilot Plant - Table 11.10
- Semi Commercial - Table 11.11
- Semi-Commercial without motors - Table 11.12

11.11. Summary of Capital Cost and Cost of Production for Various Alternatives.

The Capital Costs and cost of production per Kgm according to the various alternatives may be summarised as follows:-

		Capital Cost.	Production Cost $ per Kgm.		
		Million $	Pumps	Motors	Implements
Alternative I	- Pilot Plant.	8.03	8.41	20.29	3.24
	- Semi commercial	8.03	2.52	2.56	1.17
	- Semi commercial without motors.	6.86	2.87	-	1.23
Alternative II	- Pilot Plant.	7.48	5.82	7.35	4.30
	- Semi Commercial	7.48	2.80	2.61	2.20
	- Semi Commercial without motors.	6.70	2.93	-	1.39

The ex-factory costs of some of the items from each production group under various alternatives are now summarized below:

(U.S. $)

S.No.	Product	Alternative I			Alternative II		
		Pilot Plant	Semi-Commercial	Semi-Commercial without motors.	Pilot Plant	Semi-Commercial	Semi-Commercial without motor
1.	Centrifugal Pump 5 HP	698	209	238	483	232	243
2.	Centrifugal Pump 10 HP	1,262	378	431	873	420	440
3.	Deepwell Pump 10 HP	11,774	3,528	4,018	8,148	3,920	4,102
4.	AC Electric Motor 5 HP	1,420	179	-	514	183	-
5.	AC Electric Motor 10 HP	2,638	333	-	956	339	-
6.	AC Electric Motor Vertical Hollow Shaft 10 HP	4,383	553	-	1,588	564	-
7.	Disc Harrow(7 discs)	1,960	709	744	2,602	1,331	841
8.	Trailor 3-5 tons capacity.	2,940	1,060	1,116	3,900	1,995	1,261

The various alternatives are discussed in detail in the next chapter.

TABLE 11.8

ALTERNATIVE I

PRODUCT-WISE COST OF PRODUCTION
(SEMI-COMMERCIAL BASIS)

	COST HEAD	ANNUAL TOTAL	PUMPS	MOTORS	IMPLEMENTS
		$	$	$	$
A-	VARIABLE COSTS:				
1)	Materials.	2,008,360	585,900	570,080	852,380
2)	Labour	1,404,900	534,510	455,390	415,000
3)	Utilities	87,700	17,290	15,390	55,020
4)	Postage, telegrams etc.	1,800	360	310	1,130
5)	Printing & Stationery.	4,800	950	840	3,010
6)	Travelling Expenses.	18,740	3,700	3,290	11,750
B-	FIXED COSTS:				
7)	Depreciation	483,810	143,200	131,850	208,760
8)	Overheads: Tech.	372,540	73,460	47,830	251,250
	Admin:	458,220	90,360	80,420	287,440
9)	Amortisation (@10%)	151,230	29,820	26,540	94,870
10)	Maint. - Building:	41,100	8,100	7,210	25,790
	Machinery:	131,200	48,410	48,470	34,320
11)	Insurance etc.	80,340	15,840	14,100	50,400
12)	Other expenses.	30,260	5,970	5,310	18,980
	Totals:	5,275,000	1,557,870	1,407,030	2,310,100
	Cost per unit ($/kg)		2.52	2.56	1.17
	Yearly production:		1500	4800	5000

(on single-shift basis)

TABLE 11.9

ALTERNATIVE I

PRODUCT-WISE COST OF PRODUCTION

(SEMI-COMMERCIAL BASIS WITHOUT MOTORS)

	COST HEAD	ANNUAL TOTAL $	PUMPS $	IMPLEMENTS $
A-	VARIABLE COSTS:			
1)	Materials.	1,438,280	585,900	852,380
2)	Labour.	1,152,010	695,260	456,750
3)	Utilities.	62,700	15,050	47,650
4)	Postage, telegrams.	1,400	340	1,060
5)	Printing & Stationery.	2,400	580	1,820
6)	Travelling expenses.	15,490	3,720	11,770
B-	FIXED COSTS:			
7)	Depreciation	386,140	166,980	219,160
8)	Amortisation (@10%)	112,310	26,950	85,360
9)	Overheads-Tech.	353,310	84,940	268,970
	Admin:	435,310	104,470	330,840
10)	Maintenance-Buildings:	41,100	9,860	31,240
	Machinery:	100,340	58,530	41,810
11)	Insurance, taxes.	68,610	16,470	52,140
12)	Other expenses.	20,000	4,800	15,200
	Totals:	4,190,000	1,773,850	2,416,150
	Unit cost ($/kg)		2.87	1.23
	Yearly production		1500	5000

(on single-shift basis)

TABLE 11.10

ALTERNATIVE II

PRODUCT-WISE COST OF PRODUCTION
(PILOT-SCALE PRODUCTION)

	COST HEAD	ANNUAL TOTAL $	PUMPS $	MOTORS $	IMPLEMENTS $
A-	VARIABLE COSTS:				
	1) Materials.	400,000	117,180	35,630	247,190
	2) Labour	1,305,480	310,480	136,280	858,720
	3) Utilities.	43,500	7,400	2,040	34,060
	4) Postage, telegrams.	1,400	240	70	1,090
	5) Printing & Stationary.	3,200	540	150	2,510
	6) Travelling expenses.	15,420	2,620	730	12,070
B-	FIXED COSTS:				
	7) Depreciation	440,920	74,960	20,720	345,240
	8) Amortisation @ 10%	138,420	23,530	6,510	108,380
	9) Overheads- Tech:	372,540	63,330	17,510	291,700
	Admn:	458,220	77,900	21,540	358,780
	10) Maintenance - Buildings:	41,100	6,990	1,930	32,180
	Machinery:	114,040	19,390	5,360	89,290
	11) Insurance, Taxes	74,760	12,710	3,510	58,540
	12) Other expenses.	15,000	2,550	700	11,750
	Totals:	3,424,000	719,820	252,680	2,451.500
	Unit Cost ($/Kg)		5,82	7,35	4,30
	Annual Production		300	300	1450

(on single shift basis)

TABLE 11.11

ALTERNATIVE II

PRODUCT-WISE COST OF PRODUCTION
(SEMI-COMMERCIAL BASIS)

	COST HEAD	ANNUAL TOTAL	PUMPS	MOTORS	IMPLEMENTS
		$	$	$	$
A-	VARIABLE COSTS:				
	1) Materials.	1,095,330	351,540	249,410	494,380
	2) Labour	1,305,480	310,480	136,280	858,720
	3) Utilities.	87,700	18,590	12,020	57,090
	4) Postage, telegrams.	1,800	380	250	1,170
	5) Printing & Stationery	4,800	1,020	660	3,120
	6) Travelling expenses.	18,890	4,010	2,590	12,290
B-	FIXED COSTS:				
	7) Depreciation	440,920	93,470	60,410	287,040
	8) Amortisation @ 10%	138,420	29,350	18,960	90,110
	9) Overheads- Tech:	372,540	78,980	51,040	242,520
	Admin:	458,220	97,140	62,780	298,300
	10) Maintenance -Buildings:	41,100	8,710	5,630	26,760
	Machinery:	114,040	24,180	15,620	74,240
	11) Insurance & Taxes.	74.760	15.850	10.240	48.670
	12) Other expenses.	18.000	3,820	2,460	11,720
	Totals:	1,658,000	1,037,520	628,350	2,506,130
	Unit cost ($/Kg)		2.80	2.61	2.20
	Yearly production		900	2100	2900

(on single-shift basis)

TABLE 11.12

ALTERNATIVE II

PRODUCT-WISE COST OF PRODUCTION

(SEMI-COMMERCIAL BASIS - WITHOUT MOTORS)

	COST HEAD	ANNUAL TOTAL	PUMPS	IMPLEMENTS
A-	VARIABLE COSTS:	$	$	$
	1) Materials.	1,268,880	527,310	741,570
	2) Labour.	1,138,320	714,630	423,690
	3) Utilities.	62,700	15,360	47,340
	4) Postage, telegrams.	1,400	340	1,060
	5) Printing & Stationery.	2,400	590	1,810
	6) Travelling expenses.	15,300	3,750	11,550
B-	FIXED COSTS:			
	7) Depreciation.	391,360	95,880	295,480
	8) Amortisation @ 10%.	109,600	26,850	82,750
	9) Overheads - Tech:	353,910	86,710	267,200
	Admn:	435,310	106,650	328,660
	10) Maintenance-Buildings.	41,100	10,070	31,030
	Machinery.	95,160	23,310	71,850
	11) Insurance & Taxes.	67,040	16,420	50,620
	12) Other expenses.	20,520	5,030	15,490
	Totals	4,003,000	1,632,900	2,370,100
	Unit Cost ($/Kg)		2.93	1.39
	Yearly production.		1350	4350

(on single-shift basis)

12. DISCUSSION OF ALTERNATIVES.

12.1. General Comments.

In earliers chapters (upto Chapter 10), a basic pilot demonstration plant had been considered. While this was a demonstration plant, the necessity for providing commercial-sized equipment, even one main machine of each type, resulted in high capital costs.

The natural result of this was that if production was to be kept at the pilot demonstration capacity of only 1 pump per day (300 per year), 1 motor per day (300 per year), 5 implements per day (1450 per year), the costs per unit were inordinately high.

One alternative pointed out in the last chapter is to reach the maximum single-shift capacity of the pilot plant in 3 years (semi-commercial production). Another alternative is to eliminate motors, and to produce pumps and implements only.

Therefore in chapter 11, the various other alternatives have been considered. These are summarised in section 11.9 of the last chapter and the capital costs and costs of production summarised in section 11.11 of the last chapter.

In this chapter these alternatives are considered:-

12.2. Capital Costs of Various Alternatives.

An examination of the Capital Costs given in Section 11.11 indicates that the lowest cost is for Alternative II (grouped machine-tools) without production of motors, and the highest for Alternative I (separate production lines and machine tools for each shop).

However, the variation in difference is not large. It is $6.70 million for the lowest alternative and $8.03 million for the highest.

In neither sense would such capital costs represent anything but semi-commercial production, and hence the alternatives should be considered on a semi-commercial basis.

12.3. Costs of Manufacture.

12.3.1. Pumps.

The costs of manufacture for pumps can be summarised for standard pumps for the different alternatives as follows:-

	$ per Kgm	Centrifugal 5 H.P.	Deep-Well 10 H.P.
Alternative I - Pilot Scale	8.41	$ 698	$ 11774
- Semi-Commercial	2.52	$ 209	$ 3528
- Semi-Commercial without motors	2.87	$ 238	$ 4018
Alternative II- Pilot Scale	5.82	$ 483	$ 8148
- Semi-Commercial	2.80	$ 232	$ 3920
- Semi-Commercial without motors	2.41	$ 243	$ 4102

These costs can be compared with the following prices:-

5 H.P. Centrifugal Pump	- Libyan market price	$ 185 (approx.)
	- Pakistan Export Price F.O.B.	$ 165
	- Pakistan Internal price	$ 179
10 H.P. Deep-well Turnine Pump	- Libyan market price	(not available)
	- Pakistan Export Price C & F.	$ 4,320
	- Pakistan Internal price	$ 5,800 (Approx.)

An examination of the above prices for various items would indicate that the cost of manufacture at the semi-commercial level is likely to be higher than the current imported equipment.

This is natural at the level of production forecost. For instance in Alternative II without motors, an examination of Table 11.12 will show that for pumps the percentage costs of different important elements of cost are:-

Raw materials	32.3%
Labour	43.8%
Depreciation and Amortization	7.5%
Overheads	11.8%

It will be seen that the high costs are the labour costs, and this is due to the fact that the plant is a "demonstration plant" and the concept of virtually one-man-on-one-machine has had to be adopted.

In the case of the various alternatives for pumps, the difference in the cost of manufacture is relatively small between Alternative I and II, and, in the ultimate analysis the marketability of the additional production could be the main criteria for choice of alternative.

12.3.2. Motors.

The costs of manufacture for standard sizes of motors, representing those motors which are used in the pumps, are as follows:-

	$per Kgm.	5 H.P.	10 H.P. VHS
Alternative I - Pilot Plant	20.29	$ 1420	$ 4383
- Semi-Commercial	2.56	$ 179	$ 553
Alternative II- Pilot Plant	7.35	$ 514	$ 1588
- Semi-Commercial	2.61	$ 183	$ 564

These prices may be compared as follows:-

5 H.P. Motors.	- Libyan market price	$ 145
	- Pakistan Export Price (FOB)	$ 127
	- Pakistan Internal Price	$ 163
10 H.P. VHS Motors.	- Libyan Market Price	(Not available)
	- Pakistan Export Price (FOB)	not exported (est. $ 429)
	- Pakistan Internal Price	$ 504

It should be emphasised that the actual production (see section 11.9) at the semi-commercial level of motors is projected at 4500 for Alternative I, and 2100 for Alternative II as against 1500 and 900 pumps respectively. It is quite clear that if the above cost levels are to be maintained, some motors will have to be sold for other purposes. The manufacture of motors, therefore, must be based upon commercial considerations which will be discussed later.

12.3.3. Implements.

On the same basis as above, the cost of one standard implement, and a trailer may be taken for comparison.

	$ per Kgm	Disc-Harrow (7-disc)	Trailer, 3-5 tons
Alternative I- Pilot Plant	3.24	$ 1960	$ 2940
-Semi-Commercial	1.17	$ 708	$ 1060
-Without Motors.	1.23	$ 744	$ 1116
Alternative II- Pilot Plant	4.30	$ 2602	$ 3900
- Semi-Commercial	2.20	$ 1331	$ 1995
- Without Motors.	1.39	$ 841	$ 1261

There compare with Libyan Market Prices, which were easily available. as follows:-

7-disc Disc Harrow	$ 830 to $ 890
3-ton Trailer	$ 2140 (Imported)

It will be seen that a margin exists in the implements, for all except the pilot plant.

12.4. Commercial Considerations.

In chapter 4 present and projected demands for pumps and implements are given. These can be summarised as given below, and compared to the projected production under semi-commercial basis.

(Nos.)	Present Demand.	Projected Demand, 1980	Projected Demand, 1985
Centrifugal pumps	6400	9432	10770
Deep-well Pumps	9600	14148	20000
Total Pumps:	16000	23580	30000
Implements (including Trailers)	18750	49500	73700 +

As against the above figures, the production under the two alternatives, working semi-commercially, with and without motors, would be as follows:-

(Nos.)	Alternative I		Alternative II	
	With motors	without motors	with motors	without motors
Pumps	1500	1500	900	1350
Implements	5000	5000	2900	4350

It will be seen that, when the Demonstration Plant is in full production (1980), the pumps in both alternatives represent only 5 to 6% of the demand, and the implements 9 to 10% of the demand.

The production for the Demonstration Plant is therefore small and absorbable, subject to the safeguards considered in the next chapter.

The production of motors, however, represents a more difficult problem.

At the level of pumps forecost above, the production of motors is uneconommercial. At the higher production rate of slightly over 200% (alternative II) the price is more reasonable.

However unlike pumps, motors are much more freely available internationally and experience from other countries has shown that bulk purchase of motors, even at a level of 1000, can be made at relatively low prices.

Therefore, in the first instance the production of motors can be deferred to a second phase, and a market survey should be conducted (which was outside the scope of this report) for the entire demand of 5 H.P., 7.5 H.P., 10 H.P. and 15 H.P. motors. If local motors could be acceptable for other uses(in addition to pumps) motor production at much higher levels should be undertaken, and the same motors also available for the pumps as well as for other uses.

12.5. Selection of Alternatives.

From the foregoing it is clear that:-

(a) Manufacture should be based on semi-commercial production.

(b) Manufacture of motors should be deferred to a second phase.

This leaves only the Alternative I ((without motors) or Alternative II (without motors).

The capital costs and per kilogram costs of production for the two alternatives (see section 11.11) are:-

	Alternative I (without motors)	Alternative II (without motors)
Capital Costs MM $	6.86	6.70
Production Costs.		
Pumps, $ per Kgm.	2.87	2.93
Implements, $ per Kgm.	1.23	1.39

It will be seen that while there is only a small difference in Capital Costs, the costs of manufacture of Alternative I are lower.

It is, therefore, considered that Alternative I, initially without motors, may be adopted.

12.6. Cost of Manufacture of All Items under Chosen Alternative.

The cost of manufacture on an average per kilogram basis for the various items under Alternative I (without motors), can be summarised as follows:-

P R O D U C T I O N	Cost of Manufacture	R e m a r k s
A - PUMPS	$	
Centrifugal 5 HP.	238	Monobloc type.
Centrifugal 7.5 HP.	253	"
Centrifugal 10 HP.	430	"
Deepwell Turbine 10 HP.	4018	50 M. Pipe.
Deepwell Turbine 15 HP.	7343	50 M. Pipe.
B - AGRICULTURAL IMPLEMENTS.		
Disc Harrow (7-disc)	745	
Cultivator	650	
Seed Drill	380	
Leveller	406	
Ridger	81	
Rake	162	
Rotavator	380	
Trailer 3.5T.	1116	
Tank 2000 Lit.	740	

It should be pointed out that these prices can be adjusted as they are based only on a per Kgm. basis.

Actually the middle-sized pumps would have to be cheaper and the turbine pumps more expensive.

Comparison with local Libyan prices of standard items are given below:-

	Market price in Libya
Centrifugal Pump, 5 HP.	$ 185
Disc-Harrow	$ 830 - $ 890
Trailers 3T.	$ 2140
Deepwell Pump 10 HP	$ 4320 (C & F)

It will be seen that while pump prices are higher, the prices of Implements are lower.

13. FINANCIAL IMPLICATIONS.

13.1. Basic Concepts.

From the cost data contained in Chapter 11 and 12, it is quite clear that a semi-commercial Demonstration Plant cannot compete against commercial imports, with the negligible duties on imports in Libya.

It follows, therefore, that if the Demonstration Plant is established, it would require either one of the following:-

(a) Protection against Imports.

(b) Subsidies for the local production.

(c) Pooling of Imported Equipment and local equipment prices (with some differential lower costs for the local equipment).

13.2. Protection against Imports.

The mission during its visit to Libya found that current local manufacture of implements at the General Industries Company, Tripoli, was suffering severaly by competition from imports even though their prices were lower. As an example the locally-made 7-disc harrow was some 7% lower, but this was found to be inadequate.

In actual practice, it is believed that local prices for pumps in the initial stages would have to be at least 15% lower, and for implements 25% lower.

A comparison of the costs of manufacture shows that costs themselves are some 25% higher than imported sales prices for pumps. Implement costs of manufacture (disc-harrow baiss) are actually some 15% lower.

Since this is a Demonstration Plant no profits are to be considered at this stage, and hence the suggested protection is:-

Pumps :-	40% protection.
Implements:-	10% protection.

13.3. Subsidies.

If the above protection cannot be given, and this must be decided by Government, the subsidy required on the same basis (40% on pumps, 10% on implements, trailers etc., on the cost of manufacture) would be:-

Pumps.....	$ 710,000 per year.
Implements....	$ 242,000 per year.
Total.....	$ 952,000 per year.

It may be emphasised that in the first 2 years the subsidy may be greater while 100% single shift production was being reached.

13.4. Pooling of Prices.

In view of the fact that the Government of L.A.R. is gradually bringing all imports of Agricultural goods such as Pumps and Implements under Government Agencies by 1979-80 when this Demonstration Plant will be operating, all imports and local production from this plant would be under Government Control.

This would allow the required differential in prices to be kept by pooling the local costs and imported landed costs.

As an example if the landed cost of a 5.5 H.P. pump was $ 175, and the cost of production of a local pump was $ 240, and 10 times as many pumps were imported (by 1980) as local production, the prices in order to keep a 15% differential for the local pumps would be:-

		$
200 local 5.5. H.P. pumps at $ 240.	=	48,000
2000 Imported 5.5 H.P. pumps at $ 175.	=	350,000
		398,000
Average cost of each pump.	= $ 181	
Suggested selling prices of local pumps.	= $ 157	
Suggested selling price of Imported pumps.	= $ 184	

It will be noticed that there is a very small increase in the cost of the imported pump.

In this case also no profit or storage charges have been considered.

13.5. Special Comments.

All the above calenlations are based on the premise that no dumping will begin from developed countries once local production begin. Of course, if the pooling of prices is adopted, this would have no effect.

It has been the experience of other Least Developing Countries (LDCs) that dumping starts even before local production begins, and severe difficulties are encounted due to large internal strok when a local production facility starts up. Therefore some controls will have be exercised by the Government in this connection.

PEOPLE'S SOCIALIST LIBYAN ARAB REPUBLIC
PROJECT FOLLOW-UP AND IMPLEMENTATION TIME SCHEDULE

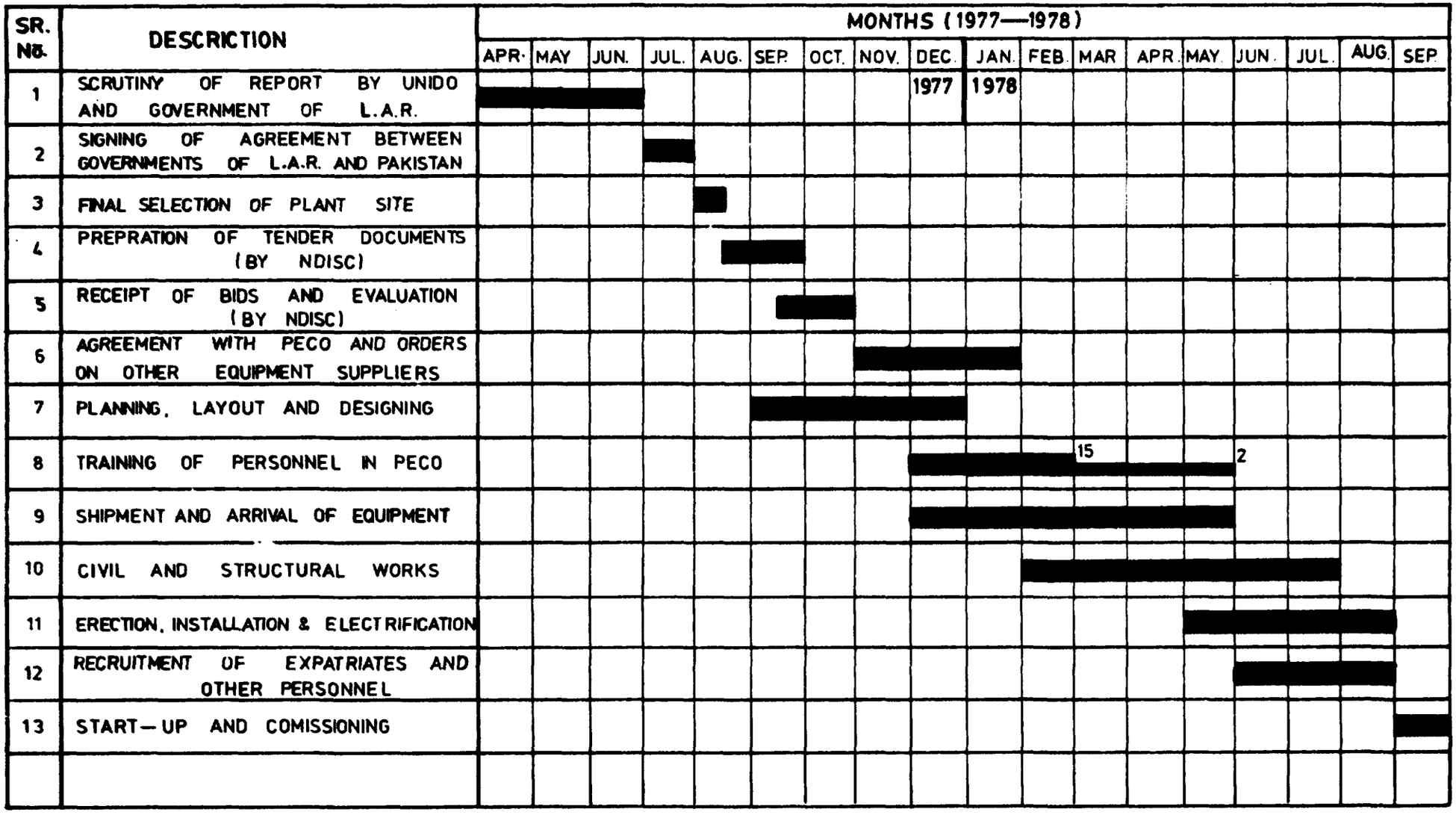

FIG. 15.1

NDISC NATIONAL DESIGN AND INDUSTRIAL SERVICES CORPORATION LIMITED, LAHORE, PAKISTAN

PECO PAKISTAN ENGINEERING COMPANY LIMITED, LAHORE, PAKISTAN

m. arshad choudhry

14. COMMERCIAL MANUFACTURING FACILITY

14.1. General

In the report the aspects of running a manufacturing facility on a Pilot Demonstration scale and semi commercial production are studied in detail in the earlier chapters. It has been observed that if the facility is to be utilized as a training institute and whatever commercial production available is considered as a by-product then the concern cannot be measured with an economic yardstick. In fact the technicians that will be trained in the institute are the true "products" and their usefulness on a national level surpasses the visual benefits.

However, it could be more logical to operate the facility both as an institution as well as to run it on a semi-commercial scale. This has been discussed in detail in the report. It does not change the capital expenditures and because the production is below economic level, therefore economics of such an approach are also not good, although as an institute it could meet some of its expenses.

Therefore, it was felt, following discussion with the Libyan Government, that a larger facility based on Commercial Lines should be considered.

In this chapter a larger manufacturing facility, reaching commercial production, is considered. This relates to a fullfledged economical proposition i.e. to consider an economical viable production facility which could not only impart training to the boys but should also be run on commercial lines. This could only be done by enlarging the facility to have a much higher production and the capability to operate on a 2-shift basis. The details are discussed below.

14.2. Product-Mix.

As stated earlier in order to make the facility economically viable, the production from it will have to be increased. The product-mix now considered is as given below when operating on semi-economical lines. Production of agricultural implements from the facility has been kept the same as before because of market needs.

(Nos)

	Alternate-I Semi-commercial	Suggested in the bigger facility
(i) Centrifugal Pumps	1,250	7,500
(ii) Deepwell turbine Pumps	250	1,500
	1,500	9,000
(iii) Electric Motors for Centrifugal Pumps	4,000	24,000
(iv) Electric Motors Vertical Hollow Shaft for Deepwell Pumps	800	4,800
	4,800	28,800
(v) Agricultural implements	5,000	5,000(no change)

It will be observed the production other than agricultural implements increases is six fold in the main fields.

14.3. Capital Cost.

Although the product-mix will increase six times, but due to the fact tha t in estimating the capital costs earlier, a provision was specially made that if at a later stage this project is to be operated on two shifts no new additions will be required, the act ual capacity increase is only three times. This aspect has been kept in view when estimated the capital expenditures as detailed in Table 14.2.

The new Capital Cost is:

	('000 U.S.$)
Local Costs	8,980
Foreign Costs	10,530
Total:	19,510

In other words the capital expenditure will be 2.4 times against a production increase of 6 folds(facility to increase 3 times per shift operating on double shift basis).

14.4. Cost of Production.

This is tabulated in Table 14.3. The cost of production of agricultural implements has been kept the same as was expected under alternative I(semi-commercial basis).

It will be observed t hat the unit costs of production for both pumps and motors have been considerably reduced.

The cost per Kg in case of pumps has reduced from $2.52 to $1.87 which shows a reduction of about 26%.

Similarly with regards to motors the reduction is about 25%. The reductions are substantial and it will certainly increase the economic viability of the facility.

The cost of production of some of the products from the bigger sized facility is given below, as compared to the semi-commercial alternative, and to C&F prices.

The cost of production of some of the products from the bigger sized facility is given below, as compared to the semi-commercial alternative, and to C&F prices.

Table 14.1

Comparative Manufacturing Cost of Commercial Facility

$ per item

S.No.	Products	Alternate I Semi-commercial	Bigger commercial plant.	C & F imported price
1.	Centrifugal Pump	209	155	185 (Libyan Market)
2.	Centrifugal Pump 7.5 HP	222	165	
3.	Cent rifugal Pump 10 HP	378	281	225
4.	Deepwell pump 10 HP	3,528	2,618	4,320
5.	Deepwell Pump 15 HP	6,451	4,787	-
6.	A.C.Electric Motor	179	135	145
7.	A.C.Electric Motor 7.5 HP			
8.	A.C.Electric Motors 10 HP	333	251	217 (Libyan Market)
9.	A.C.Electric Motor vertical Hollow Shaft 10 HP	553	416	429 (FOB Karachi)
10.	A.C.Electric Motor VHS 15 HP	614	463	-

Comparing with the imported prices(Libyan market or otherwise) it will be observed that the product items cost prices are fa vourable and the bigger sized facility is a viable proposition.

To allow profit margins, some items may still need about 20% protection.

Table 14.2.

Capital Cost. (000 $)

	Local	Foreign	Total
1. Land, Land Development and Communication.	546	-	546
2. Civil Engineering	5,825	-	5,825
3. Plant and Machinery.	42	6,600	6,600
4. Spares	6	990	996
5. Erection and Installation.	332	664	996
6. Training.	240	360	600
7. Furniture and Vehicles	240	140	240
8. Consulting Services.	60	140	200
9. Preliminary Expenses	145	-	145
10. Start up Expenses	200	200	400
Total Cost without Escalation and Contingencies.	7,636	8,954	16,590
11. Escalation Reserves and Contingencies			
i. Escalation at 12%	916	1,074	1,990
ii. Contingencies at 5%	428	502	930
Grand Total:	8,980	10,530	19,510

Table 14.3

PRODUCT-WISE COST OF PRODUCTION

Cost Heads	Annual Total	Pumps	Motors	Implements
	$	$	$	$
A.Variable Cost				
i. Materials	7,788,260	3,515,400	3,420,480	852,380
ii. Labour	4,232,700	2,061,558	1,756,142	415,000
iii. Utilities	251,100	103,740	92,340	55,020
iv. Postage,Telegram etc.	2,470	720	620	1,130
v. Printing & Stationary	6,590	1,900	1,680	3,010
vi. Travelling Expenses	25,730	7,400	6,580	11,750
B. Fixed Cost.				
vii. Depreciation	1,455,000	598,712	552,658	303,630
viii. Overheads:				
- Technical	569,640	194,218	124,172	251,250
- Admn	686,840	211,682	187,718	287,440
ix. Amortization(included in depreciation).				
x. Maintenance				
- Building	87,375	32,640	28,945	25,790
- Machinery	265,680	115,680	115,680	34,320
xi. Insurance	195,100	76,690	68,010	50,400
xii. Other Expenses	41,540	11,940	10,620	18,980
Total	15,608,025	6,932,280	6,365,645	2,310,100
Total weight(Kg)		5,708,000	3,302,400	1,966,200
Cost/Kg $		1.870	1.928	1.175

15. TRAINING FACILITIES.

15.1. Pakistan.

There are various schemes under which technical training institutes in Pakistan have been set up during the past 30 years. Various catagories are given below:-

a) Polytechnic institutes under Provincial Boards of Technical Education.

b) Technical Training Centres under Labour Directorates.

c) Technical Institutes set up under joint collaboration with foreign Governments (German, Swedish etc.).

d) Apprenticeship Training Schemes applicable to all large industrial establishments.

e) Privately-established Institutes run by autonomous governing boards.

15.2. Libya.

The following ministries/state organizations have established, or are in the process of establishing during the 5-Years Plan, manpower training institutions in various parts of the country:

1. Ministry of Industry.
2. State Organization for Industrilization.
3. Ministry of Labour & Civil Services.
4. Ministry of Agriculture & Agrarian Reforms.

15.2.1. Ministry of Industry.

The training centres under this ministry are different to those run by Ministry of Labour. In these centres only "skilled" labour and "technicians" are trained. One such centre is operative while 2 more are being established. Students are taken with 9 years basic education although consideration is being given to 8 or

even 7 years basic education due to shortage of trained manpower. In the Ist year of training 4 days of practical and 2 days of theoritical trainins is imparted in a week. In the 2nd & 3rd years on-the-job training is given in factories & workshops.

Centre No. I.

Located at Benghazi with a capacity of 240 trainees per year. The centre was started in 1972 and has the following trades:-

- Welding.
- General mechanics.
- Machine Tool Operation.
- Sheet Metal Working.
- Electrical (General).
- Motor Winding.
- Foundry (to be started in early 1977).

Centre No. 2.

It is located at Tripoli and will be in operation in October, 1977, and will have a capacity for 250 trainees. The main trades will be the same as in Centre No. 1 plus Electronics & Motor Vehicles Maintenance but no Foundry training shall be included.

Centre No. 3.

Being established at Benghazi in the Cement Plant to impart specific-trade training to 50 trainees in 2 shifts, and will be operative by June, 1978. The Centre is mainly for specific-trade training in Cement & Building industries and will train apprentices in plant operation, machinery maintenance and electrical maintenance in a 3-Year course.

Planned Centres.

3 new training centres are planned under this scheme and will be operative by 1978. Two centres will train skilled workers only and the 3rd centre will be

for advanced training of skilled workers so that Supervisors and Foremen may be selected to work in various factories around the country.

15.2.2. State Organization for Industrialization.

This organization sends trainees to various contractor organizations for specific training in the construction industry connected with the construction (Civil & erection/installation) of big projects.

15.2.3. Ministry of Labour & Civil Services.

At present there are 11 centres functioning under this ministry and trains skilled & semi-skilled workers in 13 different trades although not all the centres have facilities for all 13 trades. The centres have 1-year, 2-year and 3-year courses both in skilled and semi-skilled categories, and also runs a'job-finding' service for its trained manpower. Various trades in which training is imparted are:-

- Carpentry.
- Welding.
- General Mechanics.
- General Electrical.
- Auto Electrician.
- Electric Motor Winding.
- Radio & Television.
- Air-conditioning & Refregeration.
- Plumbing/pipe fitting.
- Auto Repair & Maintenance.
- Advanced Pipe Welding.
- Machinery Maintenance.

Table 15.1 gives details of location, capacity etc.

Table 15.1.

S.No.	Location	Capacity	No. of Trades	Remarks.
	Existing			
1.	Tripoli	400	13	Capacity to be enhanced to 500 by middle of 1977.
2.	Benghazi	400	7	
3.	Misurata	250	6	
4.	Derna	200	6	
5.	Sebha	150	6	
6.	Ajedabia	250	5	
7.	Gharian	150	5	
8.	Zuara	150	4	
9.	Homs	150	5	
10.	Zeitan	150	4	
11.	Sorman	150	5	
12.	Tobruk	150	-	Inauguration by Jan.,1977.
13.	Sirte	150	-	-do-
	Planned			
14.	El. Beida	150	-	Operative by end 1977.
15.	Yafren	150	-	-do-
16.	Houn	150	-	-do-
17.	Brak	150	-	-do-
18.	Tarhuna	250	-	Operative by 1978.
19.	El-Marj	200	-	-do-
20.	El-Abiar	250	-	-do-

15.2.4. Ministry of Agriculture & Agrarian Reforms.

Garabuli Training Centre.

This centre is basically meant to train Drivers for Tractors and Combines. The courses are of 4 months' duration and each course can accommodate 100 trainees at a time. Simple theory is taught to the under-training drivers and practical training is imparted on 20 tractors, 5 combines and 2 caterpillars. Maintenance of farm-machinery (tractors, combines) is a part of the practical training.

15.3. Training of Pilot Plant Personnel in Pakistan.

Since PECO (Pakistan Engineering Company Limited) is going to be entrusted the job of establishing the Pilot Demonstration Plant it would be advisable to train all the 20 plant personnel (2 Engineers & 18 Technicians) in this factory who already have a Training School for apprenticeship training. Moreover, PECO has an added advantage that it has full-fledged workshops for the manufacture of 2 products selected for the pilot plant, namely Pumps & Motors. For the purpose of specilized training in Agricultural Implements manufacture arrangements can be made in another workshop. Appendix 6 gives a brief description of Training facilities in PECO.

Some training in designs should also be given to the Libyan personnel and it is suggested that the two Engineers in the above personal should be trained at the National Design Centre of the N.D.I.S.C., also at Lahore for a further 3 months period.

16. SUGGESTIONS FOR PAKISTAN - LIBYA CO-OPERATION, AND RECOMMENDATIONS FOR IMPLEMENTATION.

16.1. Time Schedule for Implementation.

The attached bar-chart in Fig 15.1 gives the suggested time schedule, and is self-explanatory.

It is suggested that the Agreement between the Government of Libya and Pakistan be completed in July, and the actual site selected by August.

The effective date for commencement of Engineering Work is therefore estimated at 15th August 1977, and provided all formalities are completed in time, the detailed engineering can be co-pleted by December 1977, except Civil Engineering which can be completed a month later.

The equipment should all arrive in Libya by May 1978, and erection would be completed along with Civil Engineering, and the entire equipment erected by August 1978. Start-up would commence thereafter.

In the bar-chart no details are given of the actual dates for which utilities are to be provided by the Libyan authorities. About 200 KW of power, and some water facilities would be required for erection, but the main requirement of utilities must be completed and joined to the battery limits supply by June/July 1978.

The requirements of power for operation is a maximum of 800-1000 KW (two 1000 KVA transformers are provided, of which one is a stand-by) and about 50 m^3 per day of water are required, and these would have to be assured in time by the L.A.R. authorities.

It should be emphasised that the attached bar-chart represents operation without any hitches i.e. no float is provided in the network.

In practice such projects would take 18 months instead of 12-13 months from the effective date (assured 15th August 1977) and this should be the target date for completion after Government formalities are over.

16.2. Suggestions for Co-operation.

The main areas in which co-operation is possible and desirable for the implementation fo the project are discussed below. It is proposed that the arrangements on the Libyan side should be made by the Government of the L.A.R., and from the Pakistan side, by the State Enterprises (under the Board of Industrial Management) consisting of the National Design and Industrial Services Corporation (NDISC) and the Pakistan Engineering Co. (PECO). The former will supply the Engineering Services and the latter operational services.

(a) Project Implementation.

(i) Supply of know-how and basic engineering for the project from Pakistan (PECO and NDISC)

(ii) Supply from Pakistan of that part of the equipment which can be manufactured in Pakistan (organized by NDISC).

(iii) Detailed Engineering for the entire plant, including all service facilities within battery limits, to be undertaken by Pakistani Engineering Consultants specialised in this field (NDISC).

(iv) Procurement Services by Pakistani firms (NDISC) for the purchase of the balance of the equipment required from third countries. Inspection of Pakistani equipment also to be undertake by NDISC.

(v) Actual pruchase of the equipment from all sources to be undertake jointly by a new joint-venture company (see below) on the advice of (iv) above.

(vi) Civil Engineering designs and lay-out to be undertaken in Pakistan, if so desired. All work on soil test to be undertaken in Libya by local companies.

(vii) Pakistan to supply experts to help supervise the erection of the plant, and short-up the plant in Libya. The exact number of experts can be worked out at the appropriate stage, but approximately a team of 6 Engineers and experts from Pakistan would be sufficient. These would come from PECO. The start-up team would include all the expatriate personnel for operation of the plant (see training).

(viii) The actual erection of the plant should be undertaken under an erection Contract, to be decided by the Joint Venture.

(b) Training.

(i) 17 Libyan personnel to be trained in Pakistan (see chapter 14) for 3 months at the PECO Plant, and the 2 Engineers for further 3 months at NDISC. These could be later increased by 3 more where trainiing for electric motor manufacture is desired.

(ii) Two Pakistani experts should help to set up a training programme for Libyan personnel about 3 months before commencement of production.

(c) Financial Participation.

It is proposed that the project should be a joint-venture project between the Governments of Libya and Pakistan, and the suggested participation is given below:-

16.9. Recommendations for Implementation.

In their terms of reference for the project UNIDO had requested the Consultants to suggest the implementation modelity as one of three alternatives:-

(a) The project may be implemented as a pure investment project by the Government of Pakistan with specific contribution from Government of Libya;

(b) implementation through active equal participation both by Government of Libya and Government of Pakistan;

(c) Implementation as a 100% Libyan Government project with selected subcontracting elements with the Government of Pakistan;

It is suggested that the project should be a joint venture project, but should have a majority holding of the L.A.R.

In detailing this suggestion it is proposed that :-

(i) All services and equipment available from Pakistan should be provided by the Government of Pakistan as their contribution to the project.

(ii) All other costs should be borne by the Libyan Government.

Table 16.1 breaks up the entire cost of the project including working capital on the above basis. It will be seen that out of the total capital requirements of $ 7,806,780 an amount of $ 4,924,440 should be available from the L.A.R., and $ 2,882,340 from the Government of Pakistan.

This could be increased to $ 8.0 million to provide some cost reserve, with contributions of $ 5.1 million or 63.75% from the L.A.R. and $ 2.9 million or 36.25% from the Government of Pakistan in the form of services and equipment. This only represents a suggestion on the part of NDISC and would be subject to the Government of Pakistan's approval.

The detailed break-up of the Capital cost requirements from the Government of Libya is given in Table 15.3. The actual over-all requirements of funds are :-

Capital costs (as per Table 15.2)	$ 4,053,440
Working Capital	$ 871,000
Cash Reserve and Rounding Off	$ 175,560
	$ 5,100,000

In the event that the project is a joint-venture project on the lines suggested above, the break-up of contributions from the Government of Pakistan in the capital costs, working capital and general rounding off, is detailed in Table 15.4 and may be broken up as follows :-

Services and Equipment	$ 2,807,340
3-months raw materials (Working Capital)	$ 75,000
Rounding off	$ 17,660
	$ 2,900,000

The other alternatives which UNIDO requested to be considered were:

(i) The project may be implemented as a pure investment project by the Government of Pakistan with specific contribution from the Government of Libya.

It has been pointed out in Chapter-13 that the small size (Demonstration Plant) of the project would require specific action from the Government of Libya such as subsidies or pooling of prices etc. Under these conditions this project cannot be considered to be a purely commercial alternative and hence this option can be ruled out.

(ii) Implementation as a 100% Libyan Government project with related sub-contracting elements with the Government of Pakistan.

This alternative would only provide for services, and part of the machinery to be supplied by Pakistan.

The entire project would require $ 8.0 million as total capital cost in which subcontracting to Pakistan would consist of :-

Services (Training & Consultancy)	$ 176,630
Machinery (part only)	$ 2,630,710

upto the time of start-up of the project.

A fter the start-up of the project, whether it is a joint-venture or otherwise, an agreement would have to be made by the Project with PECO to run the plant for a period of upto 3 years, when Libyan personnel should be capable of taking over almost entirely.

A t this stage, the project calls for an initial requirement of 68 personnel from Pakistan. The personnel would be paid the regular Libyan wages for expatriates, which is included in the estimates. PECO should agree that such personnel should not receive any additional amounts in Pakistan. No priovision has been made in the report for any management fee for PECO, as this would entail disucssions at the appropriate level, after formation of the company to run the project.

TABLE 16.1

CONTRIBUTIONS OF CAPITAL COSTS FROM THE GOVERNMENT OF L.A.R. AND THE GOVERNMENT OF PAKISTAN FOR THE PROPOSED DEMONSTRATION PLANT BASED ON ALTERNATIVE-I

Cost Details	Govt. of L.A.R.	Govt. of Pakistan.
	$	$
(1) Land, Land development and Communications.	346,000	-
(2) Civil Engineering and Shop Structures.	640,000	1,690,000
(3) Plant, Machinery and Equipment.	1,586,000	547,000
(4) Spares.	320,000	-
(5) Erection and Installation.	320,000	-
(6) Training.	49,800	70,200
(7) Furniture,Fixtures & Vehicles.	60,000	-
(8) Consultancy Services.	20,000	80,000
(9) Preliminary Expenses.	35,000	-
(10) Start-up Expenses.	70,000	-
	3,446,800	2,387,200
12% Escalation.	413,620	286,460
5% Contingencies.	193,020	133,680
(i) Total Capital Costs.	4,053,440	2,807,340
(ii) Working Capital (as per Table 16.2)	871.000	75.000
	4,924,440	2,882,340
TOTAL COST OF PROJECT:-		$ 7,806,780

TABLE 16.2

WORKING CAPITAL

(Alternative I - Semi-Commercial Production without Motors)

		$
(1)	Materials, parts & Components (for 3 months)	359,600
(2)	Labour Costs (for 1 month)	96,000
(3)	Utilities (for 1 month)	5,230
(4)	Postage, Stationery, Travelling etc. (for 1 month)	1,600
(5)	Overheads, Technical and Administrative (for 1 month)	65,770
(6)	Insurance & Taxes (total)	68,600
(7)	Finished Products for 1 month (at cost)	349,200
	Total:-	946,000

TABLE 16.3

CONTRIBUTION FROM THE GOVERNMENT OF L.A.R. - CAPITAL COSTS

	Alternative I	
	Local Currency	Foreign Exchange
	$	$
A - Plant and Machinery.		
(1) Plant, Machinery & Equipment.	20,000	1,566,000
(2) Spares.	3,000	317,000
Total without Escalation and Contingencies.	23,000	1,883,000
Escalation @ 12%.	2,760	225,960
Contingencies @ 5%.	1,290	105,450
Sub-Total:-	27,050	2,214,410
B - Other Capital Costs.		
(1) Land, Land development and Communications.	346,000	-
(2) Civil Engineering.	640,000	-
(3) Erection & Installation.	3,000	317,000
(4) Training.	49,800	-
(5) Furniture, Fixture & Vehicles.	60,000	-
(6) Consultancy Services.	20,000	-
(7) Preliminary Expenses.	35,000	-
(8) Start-up Expenses.	30,000	40,000
Total without Escalation and Contingencies.	1,183,800	357,000
Escalation @ 12%.	142,060	42,840
Contingencies @ 5%.	66,290	19,990
Sub-Total:-	1,392,150	419,830
Total Capital Cost:	1,419,200	2,634,240

OVERALL TOTAL:- $ 4,053,440

TABLE 16.4

POSSIBLE CONTRIBUTION FROM THE GOVERNMENT OF PAKISTAN.

EQUIPMENT AND SERVICES	Alternative I (Without Motors)
(1) Machinery & Equipment.	
(a) Machine Tools (by PECO)	132,300
(b) Other equipment (By PECO)	25,500
(c) Machine Tools (By PMTF)	160,000
(d) Equipment from other manufacturers.	4,200
	322,000
(2) Utilities & Services.	
(a) 1000 KVA Transformers, control panels, distribution boards, cables/wires (certain sizes only) - from Pakistani electrical equipment manufacturers.	100,000
(3) Buildings.	
(a) Steel shop structures for 5 shops - fabrication, supply and erection. (by PECO).	1,690,000
(b) Overhead travelling cranes (by PECO)	125,000
	1,815,000
(4) Training of Personnel by PECO.	70,200
(5) Consultancy Services (By NDISC)	80,000
TOTAL CAPITAL COST WITH 12% ESCALATION & 5% CONTINGENCIES:	2,807,340
WORKING CAPITAL	
(6) Materials (for 3 month's semi-commercial production)	
(a) Steel Sections (angles, channels etc.).	29,000
(b) M.S. Bars and Shafting.	16,500
(c) Standard parts and Components.	29,500
	75,000
TOTAL:-	$ 2,882,340
Rounded-off to	$ 2,900,000

RANGE OF MAXIMUM AND MINIMUM TEMPERATURES, NO. OF DAYS OF RAIN, AND TOTAL RAINFALL RECORDED AT SEVEN METEROLOGICAL STATIONS IN THE L.A.R. 1973 - 1974.

APPENDIX-1
(SHEET-1)

Station	Total Rainfall in m/ms.		No. of Days of Pain		Range of min. temp. in °C		Range of max. temp. in °C	
	1974	1973	1974	1973	1974	1973	1974	1973
Tripoli	822.8	438.6	75	62	14.2	16.5	22.4	23.5
Gharian	568.5	354.5	45	37	11.5	15.5	27.5	24.0
Misurata	257.2	283.1	43	49	13.9	17.1	24.4	21.3
Benina	347.8	216.5	61	53	14.2	20.5	23.1	24.0
Derna	229.0	216.4	56	48	14.0	14.5	20.5	17.9
Shahat	475.0	442.2	84	61	12.7	13.8	23.4	24.4
Sebha	4.2	00.0	2.0	0.0	19.6	21.2	24.1	19.0

Source: Department of Meterology.

A - TEMPERATURE

	Region	Mean Winter Min.°C			Mean Summer Max.°C		
		N.W.	N.E.	Fezzan	N.W.	N.E.	Fezzan
1.	Coastal Strip	7.5	9.0	-	31.0	31.0	-
2.	Inland Plain	5.3	-	-	37.6	-	-
3.	East-El-Marj	4.8	4.5	-	32.8	32.5	-
4.	West Garyan						
5.	East-El-Beida	-	4.0	-	-	28.0	-
6.	Desert	2.5	4.5	2.5	40.0	38.0	41.0

B - RAINFALL (Almost 45% rainfall in December & January)

Annual Rainfall mm	N.W. Ha.	Gulf of Sirte Ha.	N.E. Ha.	Total Ha.
More than 300	170,000	-	730,000	900,000
200-300	1,230,000	-	570,000	1,800,000
100-300	3,300,000	1,450,000	2,280,000	7,030,000
Less than 100	-	-	-	159,080,000
				168,810,000

APPENDIX 2

ZONE	WATER USE	PRESENT SITUATION					FUTURE SITUATION					
		WATER CONSUMPTION	SOURCE OF WATER				PLANNED OR EXPECTED WATER REQUIREMENT	SOURCE OF WATER				
			SURFACE	GROUND WATER renewable	GROUND WATER not renewable	OTHERS		SURFACE	GROUND WATER renewable	GROUND WATER not renewable	OTHERS	OBSERVATION
GEFARA	Domestic Water Supply (Drinking & industrial Water)	120	—	310	377	17,9	180	7,5	305,5	433	24,8	at present rate of exploitation Water resources of Gefara will be depleted or deteriorated within 20 Years.
	Agriculture.	585					591					
MISRATAH	Domestic Water Supply (Drinking & industrial Water)	15	—	15	—	—	75	—	20	30	25	
SIRTE	Agriculture.	160	—	85	75	—	315	7	106	200	2	
GHADAMES	Agriculture	2	—	—	2	—	20	—	—	20	—	
FEZZAN	Domestic Water Supply (Drinking & industrial Water)	8	—	—	8	—	37	—	—	37	—	
	Agriculture.											
KUFRA	Domestic Water Supply (Drinking Water + Transport of Water to Agedabia + Oil field injections)	100					120					
SARIR			—	—		—		—	—			
JALO	Agriculture.	200			300		1400			1520		
GEBEL	Domestic Water Suppy (Drinking & industrial Water.)	45	—	45	—	—	70	—	40	—	30	
AKHDAR	Agriculture.	140	—	140	—	—	280	15	255	—	10	
TOTAL	Dom: Water Supply	288	—	595	962	18	482	30	7265	2822	92	
	Agriculture.	1287 } 1575					3188 } 3670					

SOURCE: GENERAL WATER AUTHORITY.

N.D.I.S.C.

M. Shafiq

AREA HARVESTED & TOTAL PRODUCTION OF PRINCIPAL CEREAL CROPS AND OTHER FARM PRODUCTS DURING 1970-74.

APPENDIX-3

Year	Barley		Wheat		Potatoes	Onions	Ground Nuts
	Area Harvested. Ha.	Production. Qtls.	Area Harvested. Ha.	Production. Qtls.	Production Qtls.	Production Qtls.	Production Qtls.
1970	215892	528079	156735	784210	99819	235064	106851
1971	66666	32127	53490	177620	228130	177970	110750
1972	163949	1163950	109737	321850	490460	277350	136920
1973	286287	2045140	148949	673270	783520	390000	110000
1974	334068	1448742	132681	386825	650621	274893	90845

Year	Tomatoes	Citrus fruits	Apples	Olives	Figs	Grapes	Tobacco
	Production Qtls.	Production Qtls.	Production Qtls.	Production Qtls.	Production Qtls.	Production Qtls.	Production Qtls.
1970	1434132	30783	13851	703062	23630	6500	1615
1971	1308160	31640	21190	50000	28750	7450	1249
1972	1700380	35170	16250	955330	30530	8360	1205
1973	1755160	28620	23270	1493130	37900	10962	967
1974	1028797	38600	10200	231630	42270	9626	1074

Source: Ministry of Agriculture and Agrarian Reforms.

1974 PRODUCTION OF PRINCIPAL CEREAL CROPS AND OTHER FARM PRODUCTS - BY MOHAFADA

APPENDIX-4

Mohafada	Barley		Wheat		Potatoes	Onions
	Area Harvested. Ha.	Production. Qtls.	Area Harvested. Ha.	Production. Qtls.	Production Qtls.	Production Qtls.
Derna	48020	179074	6855	9516	-	2600
Gebel Akhder	27700	88687	54095	127185	600	3880
Benghazi	32019	120981	20099	43094	-	2297
El-Khaliq	55320	179933	3359	26669	85	505
Misurata	34125	133490	7757	51614	7650	1236
Homs	51362	140133	7552	19192	4006	1725
Tripoli	22626	200955	3873	19112	225282	32601
Zawia	37068	322005	17337	38111	411870	228395
Gharian	24467	72765	8082	18225	48	-
Sebha	1361	10649	3672	34107	1080	153

Mohafada	Ground Nuts	Tomatoes	Citrus Fruit	Apples	Olives	Figs
	Production Qtls.	Production Qtls.	Production Qtls.	Production Qtls.	Production Qtls.	Production Qtls.
Derna	-	2000	10	30	610	80
Gebel Akhdar	-	9604	-	40	680	1400
Benghazi	-	6734	20	-	1370	2680
El-Khaliq	-	681	10	40	220	1080
Misurata	240	7010	10	1070	22140	1550
Homs	1550	1869	470	1060	41880	1650
Tripoli	16870	109385	21720	3100	67820	9350
Zawia	72032	875530	25720	2250	82160	4430
Gharian	-	9757	120	2350	14710	19430
Sebha	153	6227	520	260	40	620

Source: Ministry of Agriculture and Agrarian Reforms.

TABLE OF PAST IMPORTS OF "LIQUID" PUMPS

1964 TO 1975

APPENDIX-5

Year	Italy	West Germany	U.S.A.	U.K.	France	Other Countries	TOTAL	Value in L.D. ('000')
1964	3212	961	2294	768	59	711	8005	970
1965	1807	1254	1937	854	28	473	6353	1031
1966	3881	554	1601	1271	38	1084	8429	1190
1967	6276	1241	1911	851	129	1993	12401	1796
1968	4626	1199	1524	851	28	1381	9609	1545
1969	4728	1326	2116	1428	22	801	10421	2147
1970	3675	2391	1693	1539	188	556	10042	2969
1971	13556	2251	670	1481	1392	1089	20439	2081
1972	12292	2229	304	1847	186	1878	18736	2229
1973	7999	1639	657	1349	1451	2429	15529	4097
1974	13070	3331	781	1157	1776	4043	24158	4567
1975*	14372	3194	1151	2395	2661	2842	26615	7025

* Computed from 3-month import statistics of 1975.

Source: Department of Census & Statistics (External Trade Statistics)

TRAINING FACILITIES IN PAKISTAN ENGG. CO. LIMITED.

(1) TRADE APPRENTICES

Trades:-		Turner, Machinist, Fitter and Moulder.
Qualification:-		Matric with Science (10 years schooling).
Duration:-		3 years.
Course Details	(i)	Theoretical Course of Shop Mathematics, Shop Theory and Shop Drawing during Ist and 2nd Year.
	(ii)	Practical Training: includes basic Workshop Training during First and 2nd year in Technical School and on-the-job Training in different Shops during 3rd year.
Appointment after Training:		As skilled worker subject to vacancies.

(2) APPRENTICE SUPERVISORS

Trades:	Production, Inspection, Maintenance, Draughtsmanship and Metallurgy.
Qualification:	Diploma of Associate Engineer from Polytechnic Institution (3 years Diploma after Matric)
Duration:	2 Years.
Courses Detail:-	Practical Training: Ist year: Basic Training, Foundry and Pattern Shop. 2nd Year: On-the-Job Training in related Trade.
Appointment after Training:	Supervisor/Charge-hand subject to vacancies.

(3) APPRENTICE ENGINEERS

Trades:	Design, Production, Metallurgy.
Qualification:	B.Sc. Engineering (University Degree).
Duration:	2 years.
Course detail:	Practical Training.
(Production Trade)	Ist year:- Basic Training, Drawing/Design Practice and Study. Foundry and Pattern making.
	2nd year:- Production and Assembly Techniques.

Appointment after Training:- Assistant Engineer subject to vacancies.

(4) SPECIAL TRAINING UNDER COLLABORATION

Trade:	Duration and Course detail as per mutual agreement between the two Organizations.

TITLE OF THE PROJECT:	LIBYAN ARAB REPUBLIC: Technology Transfer from Pakistan to Libya - Establishment of an Engineering Pilot Demonstration Plant for Agricultural Implements, Pumps and Small Engines.
UNIDO PROJECT NUMBER:	VC/LIB/75/003/A.
COUNTRIES:	Pakistan - Libya.
OBJECTIVES OF THE PROJECT:	To conduct techno-economic feasibility study and preparation of a detailed project proposal on establishment of an engineering pilot demonstration plant in Libya for local manufacture of selected and appropriate agricultural implements, pumps and small engines, and to elaborate the Pakistan-Libya co-operative follow-up programme for implementation of the proposed engineering pilot demonstration plant.

ANNEXURE I

SUMMARY OF DISCUSSIONS IN LIBYA BY TECHNICAL TEAM.

DISCUSSIONS:

Various points emanating from meetings and disucssions with government officials, department heads and individuals are considered necessary to be brought into focus. The discussions with various individuals are summarised below:-

A. Ministry of Industry and Related Organisations.

1.(a) Mr. Tahir El Bhishti, Director IRC, showed a keen interest in the project and considered it timely for strengthening the governments' ambitious programmes of farm mechanisation.

(b) He also informed the team that IRC had already undertaken a study for the manufacture of water pumps in the country.

2.(a) Mr. Mohamed Amin El Zaghali, Director General Industrial Development, National State Organisation for Industrialization, gave a brief description about the two joint-venture projects under study - one concerning agricultural Tractors, and the other for agricultural Trailers.

(b) According to Mr. Zaghali the proposed project has no provision in their 5-Year Plan, or for that matter any other plan for the manufacture of agricultural implements. He, however, pointed out that the project holds much interest for the government and the proposed pilot demonstration plant could serve as the forerunner either of the Tractor or the Trailer plant.

3.(a) Since Mr. Yassad, Acting Under-Secretary of State, Ministry of Industry, was out of the country at that time, the most important meeting took place with Mr. Faisal Zaied Ali, Director General IRC, where Mr. Ali Hebeshi (Deputy Director Technical, IRC), Mr. Mahgoub El-Arabi (coordinator from the Planning Wing of the ministry who also represented Mr.Mohamed Zayed, Head of the Planning Wing) and Mr. Abdul Razzak (IRC

counterpart to the team) were also present. The team discussed the project in detail with Mr. Zaied Ali who showed very keen interest in the project but could not provide the official position of the government regarding policy matters which included:-

- priority of the project and its proposed plant,
- contribution to be made by the Government of LAR,
- final location of the plant.

But he promised that an official memorandum will be prepared by IRC and a high level meeting will discuss the project at secretariat level with active participation of the Ministry of Agriculture, Council of Agricultural Development and State Organisation for Industrialization. He hoped that policy decisions will be ready by the time the senior official of the Government of Pakistan arrives in Tripoly for further discussions.

(b) Mr. Zaied Ali pointed out that the governments' plans for total mechanisation in the shortest possible time must be implemented and that intermediate technology cannot be applied at this stage. However, agricultural implements must be made simpler by modification and adaptation to suit local conditions.

(c) Production of electric motors may be included in the proposed plant instead of small engines as the necessity of engines as constantly on the decline due to massive electrification programmes already implemented or are under implementation. This was accepted by the team.

(d) Finally, the project report will be scrutinised and evaluated by IRC before any final decision is taken by the government towards the establishment of the proposed plant.

(B) Ministry of Agriculture and Agrarian Reforms.

Mr. Mohamed Soghmari, Chief of Technical Cooperation Bureau, was not able to discuss the project officially since the letter regarding the arrival of the team had not reached him. The team made three attempts to discuss the project with him officially but could not do so. In any case, he

was kind enough, in the last meeting, to give some general information and informal discussions took place which are based on his personal experience. Some of his unofficial comments were:-

- the present practice of adopting highly sophisticated equipment in farm mechanisation is premature and unrealistic as the farmer does not have the required working knowledge of this equipment and thus cannot make proper and full use of the equipment. Hence the higher expenditure on total mechanisation is not giving the desired results.
- lack of proper maintenance and repair facilities results in waste.
- proper management and marketing facilities are lacking and extension services are practically non-existant.

He was very interested in the project and favoured simpler equipment as is used in Pakistan so that operation becomes easy and maintenance can be carried out by technicians with lower level of knowledge also. He further pointed out that various types of equipment was under field trials in Gebel Akhdar area so that suitable equipment may be selected for future use in farm mechanization.

(C) Ministry of Planning and Scientific Research.

Mr. Bashir Salame, Director General Manpower Planning, favoured complete mechanization and also informed the team that no study had been undertaken by his ministry for the manufacture of agricultural implements.

(D) Faculty of Agriculture, Al Faateh University, Tripoli.

In the two meetings with Dr. Sheruddin Sharif of the Agricultural Engineering Department the following points were gathered regarding the merits and demerits of various types of agricultural implements:

- Mouldboard ploughs are not suitable for Libyan Soils.
- in case of Disc Ploughs (Disc Harrows) a 3-disc plough has not not been found suitable as it goes deeper (25 cm) which results in loss of moisture from the soil and consequent reduction in the yield. Since the soft top soil is only 15 cm a 7-disc plough mixes it better without the danger of moisture loss from the under-soil. In his opinion a 4-disc

plough might do an even better job and it should be developed and tried.

- Rotavators have been found good for fruit farms and horticulture.
- Chisel ploughs have been very successful in dry-land farming but more trials are still needed.
- Spring-toothed Cultivators have not been found suitable for soft soils. Instead peg-toothed Harrows give better results especially for weeds.
- Subsoilers are only suitable in harder soils as in Jebel Akhdar or Cyreneica areas. 9-11 tine subsoilers are too heavy requiring heavier Tractor. Hence a 7-tine subsoiler should be developed and put to field trials.
- In case of Balers the steel wire system is not satisfactory and stringe should be used instead.
- Mowers used presently have very frequent breakdowns probably due to dampening of grass stalks which results in a pulling action instead of cutting, and hence there is a need for developing suitable equipment to solve this problem. 3-wheeler movers of 130 cm width are more suitable than other types.
- Lighter Tractors of 45 HP are more suitable for local conditions in general for small and medium farms.
- Combines of the self=propelled type are being tried at Garabuli Centre for harvesting wheat and barley. It has been found that finger-settings are not according to requirements with the result that fingers get damaged due to stones and uneven land. The settings should be 15-20 cm only.
- The farmers have no knowledge of using implements of various types and different makes and hence extensive field demonstration programmes are necessary.
- Implements of robust construction and simpler design should be introduced to facilitate easy maintenance and repairs.
- Bulk imports of any new and untried equipment should not be done without putting sample equipment to extensive field testing.
- There is a need for developing Fruit Harvestors and special Seed Drills for Alfalfa grass.

(E) General Company for Farm Equipment and Agricultural Necessities.

- A very high inventory of spares has to be carried by public and private organization due to insufficient maintenance facilities and lack of standardization of agricultural implements.

(F) General Industries Company, Tripoli (Private).

- Equipment manufactured by them locally has not found ready market and acceptance by the farmer.

DISCUSSIONS OF GOVERNMENT REPRESENTATIVES.

- The discussions with the LAR Government officials indicate that the Libyan Government has been keen to get into the engineering industry and was receptive to the idea of putting up of a project for pumps and electric motors as an integrated unit. They were of the opinion that it needs a proper research on to the types of the implements needed for their soil before such manufacture is suggested.
- Mr. Saleh Yassad, Under Secretary, Ministry of Industries, stated that the Government is keen to acquire the technology pertaining to the engineering industry. However, since the current plan does not provide for any major engineering industry, this will be decided at the policy level. Mr. Yassad was sure that the decision will be obtained from the Council of Ministers after the report is made available. Extracts from the LAR Plan are given below.
- The Government officials were not impressed by the idea of a pilot project and consider it as a non-feasible preposition. On the other hand, the proposal for a commercial scale project was considered attractive and they showed their interest in it. They asked this be added to the study.

EXTRACTS FROM LAR "THE PLAN OF ECONOMIC AND SOCIAL TRANSFORMATION" MARCH 1976.

The private investors lack spirit of risk. They invest in services and trade therefore the public sector has had to undertake largest proportion of investment programme. Thus State Cos. and public Corporations have together executed 82% of investment projects in the 1973-75 (three year) plan period.

In 5 year plan 1976-80 industrial sector is still referred to "Processing Industry".

Locating various industries in a way to act as nucleus for the attraction of population to the areas most suitable for population growth.

Major targets of the 5 year Plan. In the "Processing Industry" the only item of Engineering is "pipes of spray irregation" (1 million meters) and metal pipes 40,000 tons. Others in the list are Flour Milling, Fodder, Fish Canning, Mineral Water

battling, textile, footwear, Cement, lime, bricks, wet batteries and glass products.

EXTRACTS FROM LAR "PROJECTS INCLUDED IN THE 1976-1980 PLAN.

Agr.Machinery Programme.

1. Seasonal Farming.
2. Construction of Maintenance workshops and sheds for Agri. Machinery.

Metal Industry

1. Electric Wire and cables.
2. Spiral welded pipes.
3. Linear welded pipes.
4. Scrap Iron Melting.
5. Agri.Tractors assembly.
6. Trucks and Tractors assembly.
7. Spray irrigation pipe.
8. Foundary and Rolling Plant.
9. Aluminium Complex.
10. Electronic Complex.
11. Scraptins production line and varnishing and packing unit.

CONCLUSIONS:

1. The emphasis is on total mechanisation and hence there is a basic need for development and improvement of existing farm implements presently in use to bring them in line with the local conditions, cropping patterns and soil conditions by careful selection and adaptation conforming to local technological level.
2. In view of shortage of manpower and abundent resources the entire agricultural farming in Libya is based on total mechanisation, and while the use of hand-operated implements is insignificant the usage of animal drawn implements is entirely unknown. Simple hand-operated and animal-drawn implements based on intermediate technology,therefore, have to be excluded from the manufacturing programme and only tractor drawn implements have been considered.

3. There is virtually no local production of agricultural implements in the country (except for a small production at General Industries) and even hand tools like spades, shovels, axes etc. are imported. Although one private organisation is manufacturing a few types of implements the level of farm-implement manufacture is extremely low, and that of pumps, engines & electric motors non-existant.

4. At present no institution is actively engaged in research, development, adaptation and testing of agricultural implements & machinery, although many institutions have ambitious programmes in this field. There is at present, little cooperation between the Faculty of Mechanical Engineering (who have a very well-equipped testing Laboratory), Faculty of Agricultural Engineering(who do not have any workshop or testing facility just now), and the implement manufacturer or the farmer.

5. Machinery and implement repair/maintenance is the biggest problem at present facing the country with the result that a lot of equipment has to be scrapped from time to time. This is due to the lack of both skilled manpower and good repair workshops, although a few workshops are run by certain ministries, but there are virtually no workshop facilities in rural areas. Due to this maintenance problem the spare parts inventory to be maintained by both public and private equipment importers is very heavy (as much as 30%). This fact, therefore, has also been taken into consideration for the proposed plant in the capital outlay.

6. On account of this dearth of skilled manpower at all levels, adopt in the use of modern agricultural implements & equipment, the government are laying great emphasis on training of skilled manpower. Integrated and broad-based training programmes are being introduced by 3 ministries and more training institutions are expected to be opened during the next 2 years. The pres ent project, therefore, would also have a training bias.

7. There is lack of coordination between different ministries and organisations related to machinery imports, marreting, manufacturing and use. This is not conducive to fruitful implementation of the agricultural mechanisation programme.

8. Machinery and implements are being imported from many countries and of different type with the result that heavy inventories of spares have to be carried by all concerned. This lack of standardisation has resulted in waste of time and money.

9. The proposed semi-commercial plant facility has, therefore, been laid out with the considerations of the development of local skills, production know-how training, design and development, testing and standardization, adaptation and diversification, repair and maintenance, and prototype fabrication, and will also have marketing and extension services after an year's trial production. Thus, in addition to being a manufacturing unit, the plant will serve as a bridge between the government and its related departments on one hand (Ministry of Industry, Agriculture, the Industrial Research Council and Agricultural Research Council, the Faculty of Agricultural Engineering etc.) and the farmer as well as private manufacturers on the other.

10. Following discussion with the Libyan Government a fully commercial facility working on two shifts is considered and a separate chapter has been devoted for this, although this was not included in the Consultants terms of reference. This relates to a full-fledged economical proposition. It is based on an economically viable production which could not only impart training, but could also be run on commercial lines.

11. The commercial facility will only give increased production of pumps and motors and the quantity of agricultural implement sought for manufacture in the semi-commercial facility has been kept at the same level because of the limitation discussed in the report.

PERSONS MET

A.	**U.N.D.P., TRIPOLI**	
1.	Mr. Ahmed N. Sabi'	Deputy Resident Representative (Acting Res.Rep.)
2.	Mr. F. Nnebe'	Administrative Secretary (Programme).
B.	**MINISTRY OF INDUSTRY, TRIPOLI.**	
1.	Mr. Faisal Zaied Ali	Director General, Industrial Research Centre (IRC).
2.	Mr. Tahir El Bhishti	Director, IRC.
3.	Mr. Ali Hebeshi	Deputy Director (Technical) IRC.
4.	Mr. Mohamed Zayad	Acting Head of Planning Department, Ministry of Industry.
5.	Mr. Mahgoub El Arabi	Head of Technical Cooperation, Ministry of Industry.
6.	Mr. Rasheed Sayed Amin	Head Technical Studies Section, IRC.
7.	Mr. Abdul Razzak Ben Yusuf	IRC (Libyan Counterpart attached to the Team).
8.	Mr. T.G.H. Hillesley	UNIDO Project Coordinator, IRC (IPF).
9.	Mr. Mohamed Amin El Zeghali	Director General, Industrial Development, General State Organization for Industrialization
10.	Mr. Rhouma Khitrish	Head of Metallic & Engineering, General State Organization for Industrialization.
11.	Mr. Hasan El Ghazali	Chief of Projects, Foundry & Forge Project, General State Organization for Industrialization
12.	Mr. Faizal Aqab	Foundry & Forge Project.
13.	Mr. Sharif	" " "
14.	Mr. Salem Mohamed Shoaib	Director of Training, State Organization for Industrialization.
15.	Mr. Ahmed Saleh Ashoor	Director Training, Ministry of Industry.
16.	Engr. Fikri Mustopha	Deputy Director (Planning) Industrial Manpower.
	BENGHAZI	
17.	Mr. Mohamed Ali Yamani	General Manager, Ministry of Industry.
18.	Mr. Siddiq Issa	Assistant General Manager.

C. MINISTRY OF AGRICULTURE & AGRARIAN REFORMS.

TRIPOLI

1.	Mr. Mohamed Soghmari	Chief of Technical Cooperation Bureau.
2.	Mr. Mohamed Bibass	Head of Farm Mechanisation Section.
3.	Mr. J.E. Schoof	FAO Expert (Irrigation Research) ARC.

ALZAWIA

4.	Mr. Saeed Ahmed El Kawash	General Manager, AlZawia Agricultural Extension Services Office.
5.	Mr. Ammar El Sabsoubi	Manager, AlZawia Agricultural Extension Services Office.
6.	Mr. Ismail Yunus	Agricultural Engineer(Field), AlZawia Agricultural Extension Services Office.

BENGHAZI

7.	Mr. Osman Abdul Matloub	Director of Agriculture.
8.	Mr. Mohamed Khalifa	Member Peoples Committee, Directorate of Agriculture.

ALMARJ

9.	Mr. Bashir Jooda	Chairman, Authority for Jebel Akhdar Project.
10.	Mr. Khalifa Gharyani	Secretary to the Chairman.
11.	Mr. Mohamed Fahmi	Agricultural Engineer (Field).

D. MINISTRY OF PLANNING AND SCIENTIFIC RESEARCH

1.	Mr. Bashir Salame	Director General, Manpower Planning.
2.	Mr. A.S. Zoghni	Director General, Census & Statistics Deptt.
3.	Mr. El Mehdi Ismail	Chief of Industrial & Agricultural Section.
4.	Mr. Lutfi Carmous	General Director, Computer Centre.
5.	Mr. Abdul Rahman Naeem	Mechanical Engineer.
6.	Dr. Babinsky	Industrial Expert, Ministry of Planning.
7.	Dr. D. Lalevic	Agricultural Planning Adviser.
8.	Engr. Mrs. M. Lalevic	Agronomist.
9.	Mr. Sewi	Chief, Manpower Planning.
10.	Mr. M. Prasad	Manpower Planning Team, Manpower Assessment, (ILO).

E. COUNCIL OF AGRICULTURAL DEVELOPMENT, TRIPOLI

1.	Mr. Mohamed Hadi El Dueck	Secretary General.
2.	Mr. Bashir El Waheishi	Project Manager, Grain Project.

F. GENERAL WATER AUTHORITY, TRIPOLI

1.	Mr. Saad Rabati	Asstt. Director (Technical)
2.	Mr. J.A. van't Leven	Team Leader, Water Development, FAO(FIT).

G. GENERAL COMPANY FOR FARM EQUIPMENT & AGRICULTURAL NECESSITIES.

TRIPOLI - Head Office & Branch Offices.

1.	Mr. Imran Nae'l	Head of Commercial Section.
2.	Mr. Salem Ali Elrahibi	Director, Agricultural & Industrial Branch, (IH, Ford & Caterpillar).
3.	Mr. O.S. Azzaby	Manager, Agricultural & Industrial Branch.
4.	Mr. Yahya	Sales Manager, Agricultural & Industrial Branch.
5.	Mr. Saleh Maulud Abu Bakr	Incharge, MF Section/Workshop.
6.	Mr. Rida A. Fahmy	Import Manager, Fannia (John Deere Equipment)

BENGHAZI - Branch Offices & Field Offices.

7.	Mr. Suleman Atiya	Branch Manager.
8.	Mr. Rajab Ramadan	Incharge, Tractors & Implements.
9.	Mr. Saleh M. Musmari	Caterpillar Branch Manager.

H. AL FAATEH UNIVERSITY,TRIPOLI.

1.	Dr. Sharf Uddin Sharif	Head Agricultural Engineering Department, Faculty of Agriculture.
2.	Dr. Sabri Nashed	Head Mechanical Engineering Department.
3.	Mr. Sadiq Choudry	Agricultural Engineer.

I. MINISTRY OF LABOUR & CIVIL SERVICES, TRIPOLI.

1.	Mr. Salem Eushofa	Deputy Director General, Department of Training.
2.	Mr. Mohamed Yasin	Chief Technical Officer, Industrial Vocational Training Scheme, ILO(FIT).

J. MINISTRY OF HOUSING, TRIPOLI.

1.	Mr. Ajaj A. Arch	Head of Design Section.

K. AGRICULTURAL BANK, TRIPOLI

1.	Mr. S.A. Azzabi	General Manager.
2.	Mr. Ali El Bahari	Chief of Loans Section.
3.	Mr. Mohamed Minnaisi	Legal Adviser.

L. CHAMBER OF COMMERCE AND INDUSTRY, TRIPOLI

1.	Mr. Isa El Housh	Director.
2.	Mr. Munir Waheed Qasim	Editor Magazine.
3.	Mr. Ahmed Kamal	Assistant Director.

M. TRAINING CENTRE, BENGHAZI

1.	Mr. Juma Abdul Kadir El Masri	Director.
2.	Mr. Abdul Kader Huni	Legal Translator.

N. PRIVATE MANUFACTURER - GENERAL INDUSTRIES COMPANY, TRIPOLI.

1.	Mr. Mohamed Scimela	Managing Partner
2.	Mr. Salem Attarhoni	Partner.
3.	Mr. Mohamed Shaladi	Commercial Manager.

O. PRIVATE IMPORTERS,TRIPOLI

1.	Naseruddin El Nahas (Mr. Hussain, & Mr. Ahmed).	Agricultural Implements,Pumps & Engines.
2.	General Company of Agriculture (Chairman: Mr. Abdullah Albaironi)	Agricultural Implements.
3.	SAleem El Bassal	Pumping Set, Spares.
4.	Al Tahir Khalifa El Mashriqi	Pumping Sets, Small Engines.
5.	Ibrahim El Michitgy	Pumps, and Spares.
6.	Ramadan El Masallati	Pumping Sets and Engines.

P. F A R M S.

1. 65 Ha Fruit Farm at Jodain, Al Zawia.
   (Owner: Mr. Abdul Majeed Bin Umayyah).
2. 2 Ha Vegetable Farm at Jodain, Al Zawia.
   (Owner: Mr. Ali Khalifa).
3. 80-200 Ha Government Farms at Al Marj, Jebel Akhdar Project.

PERSONS MET BY GOVERNMENT REPRESENTATIVE

1. Mr. Saleh Yassad,
   Under Secretary
   M/O Industries(Head of the Department).

2. Mr.Tahir Bhisti,
   Director Industrial Research Centre,
   M/O Industries.

3. Mr.Mehmood Zagaille,
   Director Planning,
   M/O Industries.

4. Mr.Mustafa Muafa,
   Director Planning
   M/O Agriculture.

5. Mr. Von K' Lavent,
   F.A.O. Advisor.

6. Mr.Hillesley,
   UNIDO Project Coordinator.

7. Dr. Ibrahim Adly
   Resident Representative UNIDO.

8. Dr. P. Huseley Project Manager
   Agricultural Research Council
   Ministry of Agriculture.