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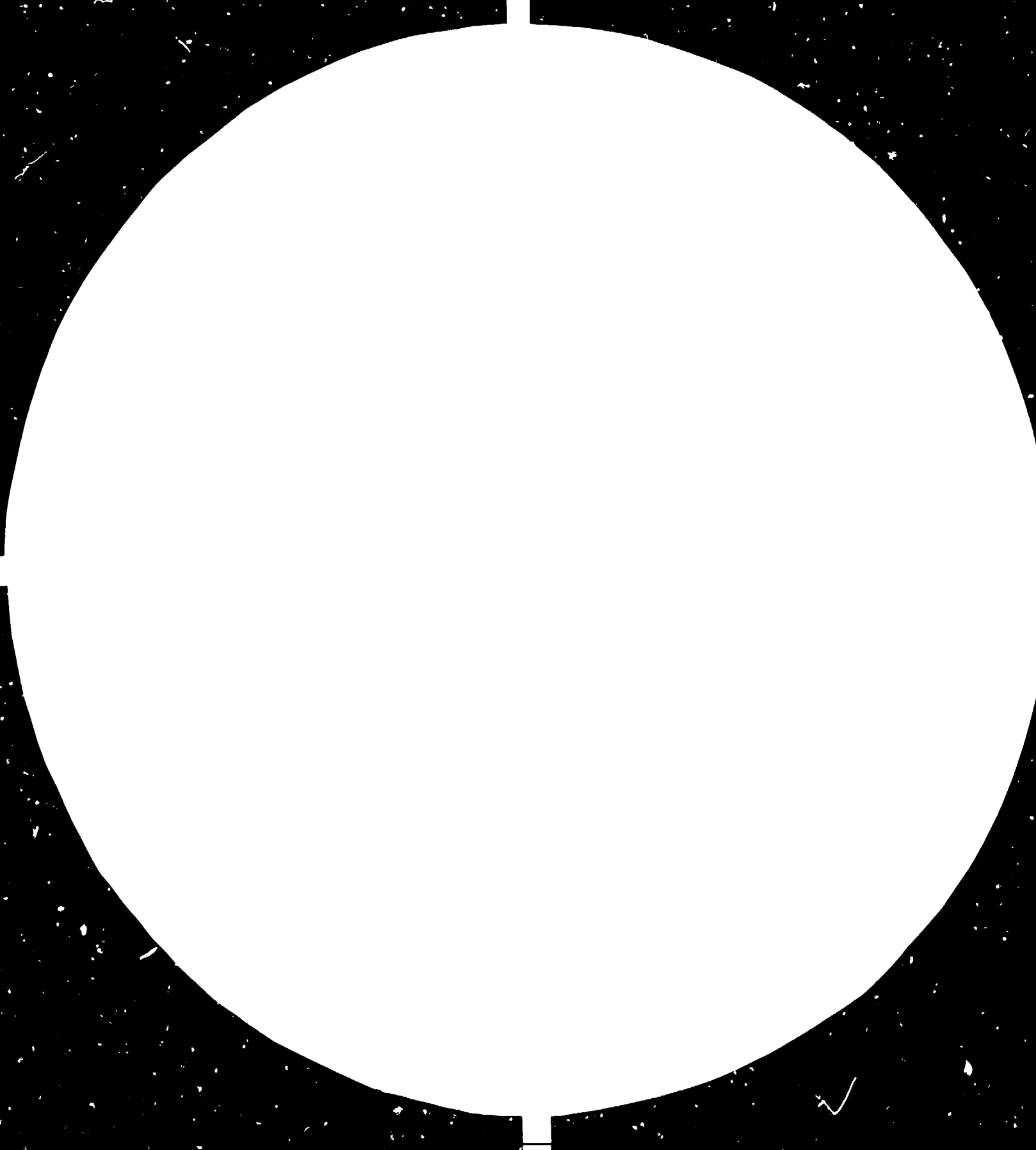
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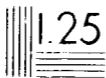
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UNIDO PROJECT DP/PAK/76/003

Pakistan
PROGRAMMING OF THE DEVELOPMENT
OF THE CAPITAL GOODS INDUSTRY
IN PAKISTAN

FINAL CONSOLIDATED REPORT

Summary of Phase-I Reports, Findings and Recommendations, and plan for Phase II for the Government of Pakistan by the United Nations Industrial Development Organization executing agency for the United Nations Development Programme.

Chief Technical Advisor, Frank A. Greenwood

United Nations Industrial Development Organization, Vienna

This report has not been cleared with the United Nations Industrial Development Organization which does not, therefore necessarily share the view presented

ABSTRACT

DP/PAK/76/003 Programming of the Development
of the Capital Goods Industry in Pakistan.

Following initial recommendations, five sectors of the Capital Goods Industry have been examined and reports submitted.

These sectors are Machine Tools, Textile Machinery, Transport Equipment, Construction Equipment and Agricultural Machinery. However, owing to the illness of the Expert dealing with Agricultural Machinery the mission on this topic completed only two months instead of the three months allocated. The present mission has visited centres manufacturing or developing agricultural machinery in order to cover the operations in this sector more completely. (See Appendix 1).

The present mission, which is of 12 months duration, has two major objectives.

- 1) The integration and summarising of the findings in the five sectors and drawing general conclusions regarding the engineering industry concerned with the manufacture of Capital Goods.
- 2) The completion of phase-I of the Project and making recommendations regarding phase-II, which, if approved, would cover a period of three years.

The five sector reports have been discussed with people and organisations concerned and views and criticisms have been sought. The main conclusions and recommendations which follow in the abstract deal with the CG engineering industry, along with major recommendations related to the sectors. Those which are specific to each sector are given in each sector report.

The report presents a detailed work plan for phase-II of the project.
(see page 37 onward).

FINDINGS

Each sector report gives findings and recommendations appropriate to the sector. The following applies to the CG engineering industry as discovered through study of all five sectors.

- .1 The institutions necessary for the development of CG industry exist in the country. But each organisation requires improving or expanding to meet the forthcoming requirements.
- .2 The major short-comings in the industry are:
 - i) Lack of design ability
 - ii) Inability of manufacture reproduceable articles in reasonable numbers (i.e., not one-off).
 - iii) Difficulty in obtaining suitable raw material.
- .3 Most deletion programmes^{*} have slowed down at the 30% - 40% level. This is largely due to lack of certain identifiable know-hows, and related plant and skills, in either their own units or in their sub-contractors units.
- .4 Without considerable development in their own or their sub-contractors plants or in the infrastructure it will prove impossible to take the deletion programmes beyond say about 50% in many cases.
- .5 In order to progress the deletion programmes it is necessary to present them in a revised form so that the causes of delays can be identified, and appropriate action taken.
- .6 There are approximately 50 major engineering units and approximately 400 approved sub-contractors concerned with the CG industry.
- .7 The major units are mainly public sector. Their plants are over-manned and under-utilised. Their requirements are often very specific and connected with improving particular manufacturing procedures. Assistance will also be required in sub-contracting procedures.

* See list of abbreviations and definitions

- .8 The sub-contractors require assistance in batch production of reproducible quality items.
- .9 A methodology exists which can be used to deal with the above weaknesses by identifying the know-hows and skills required to affect improvements.

RECOMMENDATIONS

Action by

- .1 Investigate the present capabilities of each of the institutions:- PSI, PITAC, MAS, PCSIR, CTL, PARC, AMRI and take appropriate action and supply the necessary aid to strengthen these. UNIDO & GOVT
- .2 Agree with PSI on the International Standard System to be used in the country for the engineering industry and publish these standards with equivalents. UNIDO & GOVT
- .3 Capital Goods Development Unit (CGDU) to be set up as a permanent organisation as part of the Ministry of Industries. The staff appointment to be regularised and a budget agreed. GOVT
- .4 CGDU to set-up a data base classifying the engineering units, their products and their capabilities. Recording these in degrees of complexity and noting the composition of the staff. UNIDO & GOVT
- .5 CGDU to recommend to Government the necessary training measures required in order to upgrade the staff and work-force in the engineering units engaged in the production of Capital Goods. These would be in the areas of design, measurement and control of quality, and processing methods such as Casting, forging, heat treatment. UNIDO * GOVT
- .6 Government should consider the possibility of reducing or eliminating tax on the raw materials required in engineering. Taxes may be applied to the finished machine. GOVT

Action by

- | | | |
|-----|--|-----------------|
| .7 | An existing professional body e.g. Pakistan Engineering Council (PEC), should examine the education courses and programmes for engineers and suggest improvements particularly directed towards combining practical experience with theoretical work. | GOVT |
| .8 | There is a need for an agreed collective voice or lobby for the Mechanical Engineering Manufacturers. This appears to be neglected compared with Electrical and Chemical Engineers. | GOVT |
| .9 | Sub-contracting operations need to be expanded and encouraged. Government establishment should lead the way in educating their own subcontractors. | UNIDO &
GOVT |
| .10 | The deletion programmes should be rewritten in a form which, keeping in mind the potential of sub contractors, permits the identification of:

i) The size of the demand of classes of components or parts e.g., revcounters for two wheelers or disc/blades for ploughs, and therefore:
ii) The possibility of meeting these demand on a country wide basis. | GOVT & UNIDO |
| .11 | In order to avoid tying up funds and to avoid delays in recovering the tax on exporting, use a system of bond posting. | GOVT |
| .12 | Government should consider changing the labour laws so as to permit dismissal for good cause. | GOVT |

Recommendations dealing with individual sectors are given in chapter 7.

NEW PROJECT

Project No. DP/PAK/83 Duration 30 months

Both the Project Document and the PC-I for phase I foresaw the requirement of a second phase of the present project.

The wording of the Project Document is as follows:

It is foreseen that a second phase of the project will be necessary to :

- a) Progress the studies of Phase I through feasibility and preinvestment to the implementation level including the establishment of identified supporting activities.
- b) Carry out studies for other product groups.
- c) Assist in updating the macro plan in accordance with changes in the economic climate.
- d) Recommend, if necessary, the establishment of instruments of the Capital Goods Sector development such as the institution of a development fund, the creation of engineering and specialized man-power support a development incentives scheme, the development of technology, etc.

Proposals for this continuing work are given on page 38.

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ACKNOWLEDGEMENTS

During the period of this mission there have been a number of significant changes. The position of Director General IPB has changed hands. Mr. Askari Taqvi during his period of office gave considerable support and guidance to the project and we trust that this interest will continue. We wish to thank Mr. O.M. Qarni who held the position of D.G in a temporary capacity for a short period for the encouragement he gave. The position has been newly taken by Mr. Zainul-Abedin who has already expressed interest and offered his support for which the author expresses his appreciation.

Thanks are also due to the two directors of IPB Mr. M.N. Ahmed, Director of Engineering, for his interest and to Mr. Ashfaq Husain for his valued help in overcoming day to day problems.

Mr. Iqbal Ahmad Deputy Director IPB, who is deputed from IPB, and worked on the project from its inception is due to return to IPB in the near future. His help and guidance during this period has proved of great value to all the experts and his work has contributed to the success of the project to date. Whilst it is regretted that his direct help will not be available for the implementation phase of the Project the author wishes him success in the future and again looks with confidence in his continued interest and concern.

The counterparts Mr. Syed Hamid Husain and Mr. Mohammad Shamimuddin have continued to give of their best and have greatly helped to build a sound foundation for the CGDU.

In conclusion the author thanks the office staff for their cheerful and ready assistance.

1. INTRODUCTION

1.1 GENERAL

In 1975 the Government of Pakistan asked UNIDO to assist in an exploratory way in investigating the scope for further rationalisation and programmed development of the Capital Goods Industry. In May 1976 a mission carried out this initial investigation and suggested that the development efforts be centralised in a special unit of the Ministry of Industry. Accordingly the Government decided to set up a Capital Goods Development Unit (CGDU) to initiate and monitor the programming of the development of this sector.

The CGDU, whilst operational, has not yet been formally established by the Government but the Project is continuing through the work of the Experts and their Counterparts.

This report is the final report of Phase I. Proposals and recommendations are made for Phase II and a Work Plan is presented. A methodology is described which will enable the planning of development to be structured. The method makes it possible to accurately quantify the stage of development of individual companies or industrial sectors from which assessments of the inputs necessary to cause improvements can be made.

In Phase-I the following sector reports have been prepared and submitted:

i)	General Enquiry	Romeo R. Bonini	1st June 1980
ii)	Machine Tool Industry	Karl J. Feil	5th Jan 1982
iii)	Textile Machinery	Frank A. Greenwood	5th Jan 1982
iv)	Transport Equipment	William Hock	10th April 82
v)	Agricultural Machinery	W.J.Dziecelewski	27th May 1982
vi)	Construction Equipment	Karl Heinz Oberhuber	30th July 1982

The Project Document was signed on 27th March 1979 and planned to become operational in April 1979. The Project actually become operational on 27th January 1980 with a proposed duration of 2 years, but it has been necessary to extend Phase-I upto 30 June 1983. The co-operating agency is Investment Promotion Bureau (IPB).

The revised UNDP contribution is 387,853 US dollars (see the Project Revision dated 31st October 1981). There has been an increase from the original 266,000 US dollars reflecting the delays and the fact that Textile Machinery has been added to the programme . The Government contribution remains at 000,000 rupees but is under review.

1.2 OBJECTIVES OF MISSION

Briefly these are as follows:-

- 1.2.1 Phase-I of the Project has been concluded by summarising the findings and conclusions of the 5 sectors reports. By correspondence and interviews the views of interested parties have been sought and these have been taken into account in the proposals for Phase-II.
- 1.2.2 Assisting in finalising the Project Document for Phase-II and preparing a detailed plan for implementation.

Note:- The Project requires a formal Progress Report to be written in June 83. This is the final date of Phase I and such a report will be prepared. However the timing of this present Report takes into account firstly, that the PC-I for Phase-II has been submitted and will serve as an explanation and background to both this document and the related Project Document. Secondly it is necessary to produce this report in good time for the beginning of the financial year (July-83)*.

1.3 SUBCONTRACTING

There has been no Sub-contracting in Phase-I

* This report was first issued in April '83.

1.4 FELLOWSHIP

It has not been possible for the Government to take up the fellowship component of the Project (Value 52,800 US \$).

1.5 STAFF

The counterpart of the CIA at present seconded to the Project is expected to be recalled to IPB in the near future. One counterpart left to go abroad on July 1982. There are now two counterparts on the staff, one being an engineer and the other a statistician. Whilst this staff is very small in number and therefore vulnerable, it is sufficient to complete the work of Phase-I but the staff should be increased and appointments made permanent in Phase-II. (see recommendations.)

2. THE CAPITAL GOODS INDUSTRY

The studies which have been carried out in the 5 sectors have shown how complex is the subject of Capital Goods Development. The requirements of each sector differ in many ways from each other. On first sight there is little in common between say the manufacture of agricultural implements and of machine tools. However, the whole CG industry does have many common requirements. These have been summarised in the diagram shown in Appendix 2.

The following notes deal with each subject illustrated

2.1 PLANNING

2.1.1 Deletion Programmes

These programmes will be the main engine for change and will stimulate the whole of the CG industry.

The programmes have a degree of imposition from the Government with the purpose of encouraging development. In most cases the relatively easy elements have been substituted but many obstacles are now being encountered which will seriously slow down the work unless changes are made.

The items to be deleted are usually identified in absolute detail and costed to the third decimal place, but since the objective is to achieve maximum deletion then the AUs^{*} should have a large degree of freedom in organising its own programmes so as to respond to the numerous technical difficulties encountered.

It should be recognised that the assembling unit (AU), which may also be manufacturing, has direct control over the manufacture of only certain parts. These parts should be identified and the AU penalised if this section of the programme is not completed on time. In cases of excessive delays licences could be withdrawn or sanction levels could be reduced, Where too many licences have been granted this form of sanction can be used to reduce the number of manufacturers.

* AUs = Assembling Units

The AU will be dependent on the supply of suitable raw material or part-finished items over which it has little control. It could be that the achievement of the AU in this area has to be conditional. Such items should be identified. Such identification will help the planners in the removal of deficiencies e.g. the serious lack of die making or heat treatment etc. Sometimes it is possible to modify designs to take into account deficiencies such as non availability of a certain sections or alloys. For simple machines this is readily carried out but for sophisticated machinery this calls for high quality design ability which may be entirely lacking.

There are bought-out items or components included in the deletion programmes e.g. batteries and speedometers. The former can be supplied but there is at present no supplier of speedometers in the country. Again bought-out items or components should be identified with a statement of the requirements in order to meet the deletion demand e.g. the setting up of instrument manufacture. The collective demand of the deletion programmes would encourage the setting up of certain manufactures.

There seems to be little or no advantage in assembling certain items, say a gearbox, unless elements of this are manufactured in the country. In fact such activities will often increase costs. Banning engines in CP condition may delay operations due to hold up in the supply of some from the licensor. This type of ban should be delayed until such that a reasonable number of components can be manufactured in the country and the supply assured.

The deletion programmes are generally about 30% completed. This represents an early stage in development. Typically, components which require welding, sheet metal work and simple turning are being produced. Some plastic and rubber components are also being produced.

The requirements are just beginning to enter the next level of complexity and this is going to cause a serious hold-up in the programmes probably at a deletion level of less than 50%. Many statements heard of plans to reach 85% deletion in a few years time are totally unfounded on fact or even on realistic plans.

2.1.2 RAW MATERIALS

Availability

There are many difficulties here. Often compromises in composition or dimensions have to be made, the latter compromise giving rise to wastage.

The production from the Steel Mill should help to ease the problem of supply of certain items but not of special or alloy steels. It will be important that the price of the steel is competitive against the imported material. The setting up of a data base dealing with the availability of raw material will help to locate bottlenecks and show gaps in supply/demand.

Quality

The subject is dealt in more detail later but with regard to raw material there is a need for the acceptance and use of one International Standard and the recognition of one authority with the measurement of standards in the country. There are too many instances of conflicting results from various laboratories.

2.1.3 DEMAND/SUPPLY

The sector reports deal with the demand - supply gaps in the five sectors. There is a need to examine the overall requirements so as to show the growth potential from which the training programmes required and the demand level for specialised raw materials, machine tools etc. can be estimated. (see chapter 3).

2.1.4 MARKET SIZE

The export market for engineering goods is very small (2% of total exports). It is realistic, therefore, with few exceptions (e.g. surgical instruments and cutlery) to assume that the market available is the home market for some years to come and exports will continue to be very small for the next five years.

This should not suggest that efforts in the export field are not worthwhile but that essential actions directed towards improved quality products are required for both the domestic and export markets. The product for the domestic market must be to international levels of quality.

In spite of the fact that the available market is small, rapid growth of the CG industry may be expected. Continued movement into the urban areas and continued growth of GDP will require increased output from the engineering industry. This will be satisfied by imports or increased and improved home production. If increased home production is not achieved this will create a high demand for imports to the detriment of domestic industrial development.

2.1.5 INFRASTRUCTURE

Many of the requirements are met in the more developed areas, for instance, there are good rail and road connections, post and telegraph services are satisfactory but there is a serious shortage of electrical power and gas.

The public institutions which serve the engineering industry must improve their services to industry. All need to become more effective and thus used with more confidence. There may be a number of reasons for the relative ineffectiveness - shortage of funds, too high charges for their services, lack of knowledge on the part of potential customers, distance from customers, lack of skilled or trained staff lack of correct equipment etc. The relevant institutions are PSI, CIL, PCSIR, PITTAC, MAS, PARC. Each of these institutions should be examined to see how their effectiveness can be improved. In a number of cases there is a need to extend their activities, at least, to each of the major industrial centres in the country.

The engineering section of PSI needs considerable strengthening. One agreed International Standard should be used and a detailed programme for development is required which needs to be implemented urgently.

Coupled with this there should be a ^{National} Standards Laboratory which should be the single arbiter of standards in the country. It should be responsible for the calibration and checking of instruments used in Approved Laboratories and act as a reference for other publicly or privately owned standards instruments.

2.1.6 TECHNOLOGY TRANSFER

In spite of statements made in International forums dealing with the transfer of technology it remains a very expensive operation.

The licensor will look for advantages such as the continued sale of parts or spares, the purchase of minimum levels of stock items, limitations to export etc. However, the alternative of developing ones own technology can be far more expensive.

However, full advantage of the technology transferred is very rarely taken. There are many instances of insufficient effort by the licensee to take full advantage of available information and often the technology is "frozen" instead of using the know-how gained so as to build upon or improve. It has however to be remembered that this requires some development and design capability which is almost entirely missing except for very few units. The result is that individual machines are reproduced for many years or institutions which are set-up remain unchanged. Careful planning should take place prior to the transfer particularly taking into account the number and quality of the staff involved, ensuring back-up. The transfer should be regarded as a step on the ladder so that the organisation can climb and improve.

2.1.7 CAPACITY, UTILISATION OF CAPACITY, PRODUCT MIX

There are many statistics available showing that ^{*}BMR action without expansion would be sufficient to meet the demand over the next few years. Many plants are seriously under utilised.

* BMR; Balancing modernizing and replacement

There are many reasons for this under utilisation but some government department actions have given rise to difficulties. Having in mind the total demand and the stage of development in the country often too many licences have been sanctioned e.g. in the case of tractors and two wheelers. This gives rise to too many models with many attendant difficulties. Appendix 3 shows the effect of this on capacity utilisation in the case of two wheelers.

Perhaps the most serious difficulty of the combination of a small market and many models is that it will never be economic to manufacture the more sophisticated elements of the machinery and it totally frustrates the building up of an effective subcontracting industry.

In the interest of the development of the engineering industry severe penalties for non-achievement of realistic targets in the deletion programmes should be considered. This action should be designed to reduce the number of models.

It can be seen that actual production expressed as a percentage of installed capacity is as low as 36%. The government attempts to solve the problem by sanctioning production at reduced levels i.e. applying quotas, but a better way if this were possible would be to drastically reduce the number of licences and turn some factories over to other products. This could be carried out by suitable adjustment of quotas.

If the companies attempt to solve the problem of under-utilisation by diversifying their products, this results in the serious disadvantage of spreading the available skills too thinly, particularly of management and design.

The country can tolerate a reduced number of models of vehicles in the interest of increasing production batches. For the customer to be able to choose between two wheeler engine sizes which are assembled in the country of 50⁽¹⁾, 70⁽¹⁾, 80⁽²⁾, 150⁽¹⁾, cc's: (the number of makes being given in brackets) is too expensive a luxury. It adds to cost and makes certain deletion programmes impractical.

In the very large Public units underutilisation has also been attached by diversification but if each major product is examined there is still a low utilisation - in other words it has not proved possible to find a product where the demand is high enough to solve the problem. Too high a degree of diversification discourages development in any one particular field and contributes to the freezing of technology.

It must be strongly emphasised that it is better to concentrate expertise in the manufacture of high grade articles, so as to improve the machinery into which such components are assembled. This will expand the market for the home-produced article which in turn helps to solve under utilisation.

2.1.8 QUOTAS

In the case of two wheelers a quota system in the form of sanctioned production levels tends to work against the interest of the development of CG (see para 2.1.7). However, there are instances where quotas may be of help, the purpose being to increase batch sizes and thus reduce costs.

It may be argued that this is over-protective and it is acknowledged that this danger does exist, but it is a fact that for every single machine produced or about to be produced in Pakistan there is an abundance of equivalents made elsewhere. A careful adjustment of duty levels can give the necessary competition and soon as the overall demand has reached a sufficient level, free competition may be permitted.

2.1.9 MERGER POSSIBILITIES

In the organised sector wherever there are too many manufacturers of a particular product a merger of companies may be beneficial e.g. two wheelers or tractors. In the non-organised sector where very small units are operating, the labour laws and tax laws should be directed towards encouraging the growth of the more advanced units or the merger of such units so that there are possibilities of them being able to handle more complex products employing trained engineers and designers.

As a company develops in its use of know-hows e.g. design, manufacture of prototype, testing, quality control, marketing, cost control etc. so it is essential for it to reach certain minimum sizes.

2.1.10 USE OF LABOUR

There is a serious over-manning of many public engineering units and the labour laws contribute to this.

An active and efficient factory will produce a better product than an over-manned factory apart from the obvious effect on the cost of the product. Workers are more content in such an environment

Clearly those are important social questions raised but a dynamic efficient CG operation will have a great effect on standard of living and should not be discouraged by having to carry too high a social cost.

2.1.11 INSTITUTIONS

There are many existing institutions in the country capable of assisting the engineering industry.

Insufficient use is being made of these and there is no doubt that some weaknesses exist in the institutions which require assistance and improvement.

The institutions of immediate interest are PSI, PIT.C, MAS, PCSIR, CTL, PARC, AMRI.

2.2 GOVERNMENT

A number of comments regarding government action have been made in the preceding paragraphs. The following may also be noted.

2.2.1 Bans

It will be essential for many years to come to protect nascent industry by bans or high duties. Unfortunately a ban is a blunt instrument for control, so much so, that Government will often permit the import of banned items to developing areas or under special circumstances. In such cases since the banned item can be made in the country equivalent financial support could be given if the items are purchased from a home producer.

Duties, which can give a finer control than bans are preferred.

The imposition of bans should be carefully timed. It is essential that the home supplier should be in a reasonably good position to supply the demand before the ban is imposed.

2.2.2 Tax

Taxes on raw materials should be drastically reduced or, better, eliminated entirely. A careful control of duty level on the final product can be a good way to encourage the CG industry without giving it overprotection.

2.2.3 Barter

Barter agreements obviously have the effect of satisfying some of the demand and reducing the level of demand available to the home industry. Care should be taken in such agreements to give the maximum possible protection to the CG industry.

2.2.4 Labour laws

The labour laws which are designed to support cottage industry may act so as to fragment the engineering industry. Many of the very small units will have to increase in size, through mergers or their own growth, so that they can carry out quality control, measure the product, use and maintain automatic machines on production lines and later design and develop their products.

There is a need for greater flexibility in the laws governing "hiring and firing" labour so as to avoid overmanning.

2.3 COMPETITION

2.3.1 Small Industry

The main competition for the few companies at present producing quality engineering products is from the small family run industry. These small units, employing say less than 50 people, rely on hand fitting. The quality of material used and product quality are doubtful but the main reason for their success is the low price which matches the low purchasing power of the market. However, the market is changing and the rate of change is increasing, so that during the next decade the market size for quality products will increase considerably.

It is essential that a number of small industrial units which at present are proud of producing complete machines in small, sometimes even single, quantities, see the advantage of becoming subcontractors and become specialists in certain types of production activities or product types e.g. quality spring manufacture or quality fasteners.

This does not mean that they have to grow to be successful. The expertise required by the vendor is that of manufacturing methods, the vendee supplying designs and dealing with such matters as development, marketing etc. A relatively small number of engineers trained in specialist production methods can have a big effect in the vendor operations.

To encourage effective subcontracting the first requirement of the vendor companies is the use of modern production methods and equipment. Whereas the requirements of the vendee are many, design, development, marketing etc. Both vendor and vendee must be quality conscious.

Many small companies will continue to produce the cheaper lower quality items for the manufacture of the less critical products.

2.3.2 Overseas Companies

Partly owing to an absence of marketing activities, customers of the CG industry tend to import machinery from overseas even when exact home equivalents are available. Overseas companies using their fully developed marketing and technical support represent serious competition even though import tax levels are very high. This problem can be overcome by improving quality, marketing and servicing.

Overseas companies cooperate in CKD activities but it is wrong to think that CKD represents any real advantage to Pakistan unless this is followed by a really effective and well planned deletion programme which is carried out with determination. The supplier of the CKD parts works on the principal that "half a loaf is better than no bread" but he will attempt to retain his half share as long as possible. The recipient of the CKD parts, similarly, will find it very costly in money and effort to push the deletion beyond the 30% level and will be tempted to remain as a trader.

2.3.3 Cheaper Imports

Whilst the machinery from some overseas companies is more expensive than locally made items, there are many instances of imported machinery being much cheaper even after tax.

Unfortunately the development from one level of manufacturing competence to another is expensive and therefore increases the cost of the product. A reasonable proportion of this inevitable increased cost should be borne by the state in the general taxes. This is particularly important when considering the funding of supporting activities such as standards, quality measurement, some aspects of training etc.

2.4 PRODUCTS

2.4.1 Cost Structure

Raw Materials:- As stated elsewhere there are problems of availability and high cost. However, the difficulties in obtaining suitable raw material is often used as an excuse for poor workmanship. A solution to the problem, as seen in a unit manufacturing agricultural implements, is to carefully design within the limitations of available raw material, and importing only the essential items possibly in fully machined state.

Labour:- The over-employment of indirect labour seriously adds to cost - this is generally more exaggerated in Public units.

Overheads:- The serious under-utilisation of buildings, plant and machinery contributes to cost. This situation will only improve with a substantial increase in demand.

Development:- There is a cost component associated with developing own skills and training and also, in many cases, of the skills and training of subcontractors. It must be acknowledged that this is a necessary cost and support given.

Profit:- In Public units this is often negative and the operation has to be supported from State funds. The reasons for loss should be clearly stated so that the necessary support is not "feather-bedding" but is directed towards improving the situation e.g. it could be that the cause is outside the control of the company and the infrastructure has to be improved in order to rectify the situation. It would be helpful if social costs were segregated from manufacturing costs.

2.4.2 Selling price

In Pakistan the selling price of aCG is very rarely influenced by the consideration of its effect on sales volume.

The competitors selling price may be unrealistically low or extremely high when tax is added. Selling prices are therefore very largely determined by government policies. This is necessary whilst the CG industry is being developed but it puts a great responsibility on the government to apply bans, adjust tax levels, arrange barter etc. in a way so as to continually encourage the development of industry.

A correct assessment of the stage of development and of its realistic rate of change is therefore essential (see chapter 3, 4, 5) so as to assist government to apply the controls in such a way as to bring maximum benefit.

2.4.3 Quality and Quality Control

Both the measurement of quality of the product and the control of quality during manufacture is largely missing or if present is in an elementary form.

In some cases there is an overchecking of items because of one-off production methods and quality control by sampling is not understood.

These shortcomings result in inferior quality and customer confidence is adversely affected.

2.4.4 Marketing

This is almost entirely missing. Often even the large organisations expect customers to approach them. Sales literature hardly exists and there is very little sales forecasting. Hence there is no effective production control on capacity planning.

2.5 CUSTOMERS

2.5.1 Quality/Price

Customers in general have a low spending power and will sacrifice quality for price.

2.5.2 Home/Export

Can be assumed to be entirely home market for the great majority of capital goods.

2.5.3 Correct use of Product

There are instances of large wastage due to customer misuse of products (see Construction sector report). There is a need for Manuals describing the proper use and some times training facilities should be given to customers by the supplier in the case of more sophisticated machinery. It was interesting to see real attempts to educate the purchaser in the correct use of tractors and farm implements.

2.6 STAFF

2.6.1 Training

The production methods and practices need to be improved but the supporting activities such as marketing, sales, design, development of product need to be introduced and then developed since they are almost entirely missing.

The training necessary will be through secondary education, university or technical colleges, specialised training institutions, in house training, sandwich courses day release schemes etc.

2.6.2 Loss of skilled labour

There is a need to educate more skilled people than those strictly necessary to meet the countries immediate requirements owing to the loss to neighbouring countries. However, this can be well worthwhile even if calculated in money terms, since the overseas Pakistani repatriates very large sums and often works in overseas countries with the intention of returning later when he will bring developed skills with him. Since this benefits the country rather than the employer support for training should come from the government.

3. METHODOLOGY

3.1 REQUIREMENTS

There exists an embryonic CG industry in Pakistan. The requirement, stated in its simplest form, is that of developing this industry so that all the required inputs such as standards, development, training etc., remain in phase i.e. are available at the required state of improvement at the right time.

Another simple way of looking at the problems is the requirement that parts such as that shown in Appendix 4 (which is imaginary) can be manufactured in reasonable production runs of the correct material to the tolerance and finished required. When a number of subcontractors are able to compete for such business on the basis of price and delivery the CG industry will be in a reasonable condition.

3.2 Sub-Contracting

In order to meet the above requirements a large number of activities have to be coordinated. At one extreme a number of companies, mostly under public ownership, have achieved a reasonable degree of development but the vast bulk of engineering units are at a very early stage. Appendix - 5 illustrates the general position of all engineering units and the functions of CGDU in improving the level of competence of each of the groups of units.

3.3 Principal Units (P)

These are units, public or private, which are capable of producing and/or assembling quality products. They are often engaged in CKD activities and are carrying out deletion performances and typically they have, or did have in the past, links with a foreign company. We have identified 40 such units in the 5 sectors considered and there are probably no more than 60 in all the small to medium size electromechanical industry (EMI).

3.4 Approved Subcontractors (A)

These are units which have been identified by the Principal Units as capable of producing parts of quality sufficient for their purpose. They should also be able to produce in reasonable quantities i.e. not one - off.

Subcontracting is not necessarily their major activity. Such units are relatively few in number, say 300-400, and can be readily identified.

3.5 Engineering Units (EU)

These are all other engineering units which are not in the A or P groups. Directories already exist showing their names and addresses and range of products, however, it is known that much of this information is incorrect and sometimes misleading e.g., a firm may be listed as producing textile machinery but this may be a simple machine which has not been manufactured for years and the quality of the product will be of a low grade and produced on a one - off basis. These units are best described as general engineering units since their expertise lies in production methods based on direct copying rather than on a design based on the understanding of the technology of the machine. There are about 8000 such units. Some of these units will wish to become sub-contractors. These will be designated (F) for future and a very rough estimate of their number is 500.

3.6 CGDU

A major function of CGDU will be to correctly identify each of these P, A and F units so as to give whatever assistance is necessary through existing institutional channels in addition to possible UN agencies. It should be noted that there will be great advantages in co-operating through the Vendor Project PAK/81/007 and the Data Base of the Project concerned with Planning Development and Statistical Cell of the Ministry of Industry, PAK/79/002/A/01/37.

A more complete description of the functions of the CGDU is given in Appendix 6.

3.7 DEGREES OF COMPLEXITY

A number of UNIDO publications ^{* 1-4} greatly assist in reducing the complex problem of defining the inputs required to give rise to improvements in CG industry. The approach consists of defining the Central Production Unit, the Technical Infrastructure and the components and according to degrees of complexity.

The Index of Complexity (Ic) of a capital, intermediate, or consumer electromechanical product is the quantity of complexity involved in a given product, as shown by 80 suitably selected typical factors, whose contributions or influence may be summed in order to obtain a single final result. The complexity is based on the technical difficulties encountered in the following sequence: PRODUCT CONCEPT - LABORATORY - DESIGN - MANUFACTURE - ASSEMBLY. (see Appendix 7).

Each factor has a series of six gradings or positions which define the different technological levels at which it is utilised in practice.

A fairly fundamental series of considerations shows that the whole Ic field the total complexity index can be divided in practice into six sections or technological levels N, of progressive complexity, from N1 to N6, each one including products with similar and/or comparable problems. Thus the Ic field is made up of the following technological levels N:

<u>Limits</u>	Technological levels N					
	N ₁	N ₂	N ₃	N ₄	N ₅	N ₆
Minimum scores, or lower limit	17.0	30.1	55.1	100.1	180.1	320.1
Maximum scores, or upper limit	30.0	55.0	100.0	180.0	320.0	580.0

* 1-4

- | | |
|--|--------------------------------------|
| 1. TECHNOLOGY IN THE SERVICES OF DEVELOPMENT | ID/WG-324/4 |
| 2. TECHNOLOGY IN THE SERVICES OF DEVELOPMENT | ID/WG-324/4
SUMMARY |
| 3. TECHNICAL ANNEX | ID/WG-324/4
ADD.2 |
| 4. HUMAN RESOURCES AND THE TECHNOLOGICAL COMPLEXITY OF CAPITAL GOODS | FRANCO VIDUESICH
UNIDO CONSULTANT |

Scores will be given describing the degree of complexity and also an assessment of the use of know how. It is intended that this information will be part of a computer programme so that the information will be available expressed in many forms and classified in different ways so as to assist the planners in developing the engineering industry

1.3 USE OF KNOW HOW

Depending on the stage of development of a particular unit the amount and quality of the specialist knowledge it employs will vary. This is best shown in the form of know-hows (KHs) used.

Appendix 3 gives a list of 45 KHs. divided into 4 groups viz.

- I Product and Related
- II Product Preparation and Support
- III Production
- IV Various Techniques

By noting the presence and quality of the KHs employed it is possible to give a score.

This combined with the score for level of complexity will give a simple but accurate assessment of the stage of development of the unit.

A preliminary survey has been made of three P units, with the following results.

Unit	Operation	Ic	Level of Complexity	KH	Use of KH
1	Machine Tool Manufacture	122	N ₃	49	I
2	2 Wheeler assembly	32	N ₁ -N ₂	22	E
3	Tractor Manufacture	58	N ₂	31	E-I

Note:- There are five levels of use of individual KHs.

- N - None
- E - Elementary
- I - Intermediate
- A - Advanced
- C - Complete

4. MAGNITUDE OF TASK

The magnitude of the problem is therefore approximately stated as shown in the following table.

<u>Class of Unit</u>	<u>Change Required</u>	<u>Estimated number of units</u>	<u>Approx number employed</u>
P	N 3 → N 4	10	25,000
P	N 2 → N 3	40	20,000
A	N 2 → N 3	200	10,000
F	N 1 → N 2	500	10,000
EU	N1 → N2	8000	80,000

(Not Capital Goods)

The above must be taken as a very rough estimate giving orders of magnitude since detailed examination of the industrial units have still to be made. As the complexity of the product rises so the range of skills and how-hows (KH) required increases. This, in turn, requires more personnel. So there is a necessary increase in the size of the unit (T) as complexity (N) increases.

An examination of the P units and their products as they presently exist in Pakistan show that they fall in the N2, N3 levels of complexity and the T3, T4 levels of size. The A units have complexity levels of N1, N2 with normally T1 size and occasionally T2.

The EU and F units are all in the group N1, T1.

5. REGISTER OF ENGINEERING UNITS

The purpose of the register will be to record all information relating to the various engineering units which will fully describe their products, plants, processes and make up of their staff.

The register will be comprehensive in the sense that the information contained will give qualitative assessments in addition to the normal 'hard' facts.

This qualitative assessment will follow the methodology outlined.

This will give the planners a simple objective valuation of the abilities of the engineering units so that their progress can be assisted and monitored.

The register will operate in close contact with the Industrial Planning and Statistics Project No. DP/PAK/79/002.

6. FINDINGS

6.1 GENERAL

Each sector report gives findings and recommendations appropriate to the sector. The major findings for each sector are given later in the report. The following applies to the engineering industry as discovered through study of all five sectors.

- 6.1.1 The institutions necessary for the development of CG industry exist in the country. But each organisation requires improving or expanding to meet the forthcoming requirements.
- 6.1.2 The major shortcomings in the industry are:
 - 1) Lack of design ability
 - 2) Inability to manufacture reproducible articles in reasonable members (i.e. not one-off).
 - 3) Difficulty in obtaining suitable raw material.
- 6.1.3 Virtually all the deletion programmes have slowed down at the 30% - 40% level. This is largely due to lack of certain identifiable know-hows, and related plant and skills, in either their own units or in their sub-contractors units.
- 6.1.4 Without considerable development in their own or their sub-contractors plants and in the infrastructure it will prove impossible to take the deletion programmes beyond about 50%.
- 6.1.5 In order to progress the deletion programmes it is necessary to present them in a revised form so that the causes of delays can be identified, and appropriate action taken.
- 6.1.6 There are approximately 50 major engineering units (named Principals) and approximately 400 approved sub-contractors concerned with the CG industry.

- 6.1.7 The Principal units are mainly public sector. Their plants are over manned and under utilised. Their requirements are often very specific and connected with improving particular manufacturing procedures. Assistance will also be required in Sub-contracting procedures.
- 6.1.8 The sub-contractors require assistance in batch production of reproducible quality items.
- 6.1.9 A methodology exists which can be used to deal with the above weaknesses by identifying the know hows and skills required to affect improvements.

6.2 MACHINE TOOLS

- 6.2.1 The machine tools industry consists of two large public companies and approximately 70 small units.
- 6.2.2 The industry is working at about 30% utilisation. Therefore there is a basic potential for many years to come.
- 6.2.3 There is a lack of standardisation of designs and parts.
- 6.2.4 If the deletion programmes are properly followed, there will be a good opportunity for sale of Pakistani machine tools.
- 6.2.5 Many engineering units have manufactured their own general purpose or special purpose machine tools.

6.3 TEXTILE MACHINERY

- 6.3.1 Both the Public and Private sectors of the industry lack business.
- 6.3.2 Since the start of ring frame manufacture, import of ring frames has been banned for new textile industry only allowed under EMR. There exists approximately 2 years supply of imported parts. This period must be used to develop own manufacture.

- 6.3.3 The ring frames already installed are 8" or 9" lift. It may therefore be expected that open-end spinners will be imported for coarse count spinning leaving the ring frames for finer counts.
- 6.3.4 Many machines are over 20 years old., and should be scrapped. Even when machines are purchased under BMR for replacement the old machines are not scrapped.
- 6.3.5 The organised loom sector continues to diminish

6.4 TRANSPORT SECTOR

- 6.4.1 This sector is well established and has good plans for the future. The main requirements are in the area of specific manufacturing methods and improved training of engineers and workforce.
- 6.4.2 With the possible exception of Bedford trucks and Massey - Ferguson tractors there has been little progress in the deletion programmes which are generally stagnant.
- 6.4.3 The deletion programmes in this sector could have a great effect on the Capital Goods Industry.
- 6.4.4 There is need for well set up subcontracting activities particularly for the more complex components.
- 6.4.5 There are too many tractor manufactures and too many models for economic production. The same is also true of two-wheelers.
- 6.4.6 There are insufficient maintenance facilities for tractors.

6.5 AGRICULTURAL MACHINERY

- 6.5.1 Tractors on average, have 1.5 implements compared with an accepted optimum of 4., although there are some 20 + implements in common use. It is seen therefore that there is a great need for the manufacture of implements.

- 6.5.2 Cultivators are commonly used but there is very little use of any other implement except for the larger farms.
- 6.5.3 Probably the most readily available method for increasing yield is through machanisations.
- 6.5.4 The fact that land holding are so small makes machanisation difficult and keeps the farmers poor.
- 6.5.5 Many farmer are not aware of the advantages of mechanised farming although they are attracted to tractors, but considerable efforts are being make to rectify this.
- 6.5.6 All manufacturers with possibly only two exceptions make a few standard implements in particular, cultivators, threshers and trailer one of the firms making a range of implements employs production methods which guarentee reproducibility.
- 6.5.7 There appears to the almost a complete lack of trained engineers in the implement manufacturing business.
- 6.5.8 There is considerable doubt as to the value of small HP tractors and hand operated implements, except for special circumstances such as terrace farming and market gardening.
- 6.5.9 Tractors are being used for the wrong purposes e.g. road haulage, waste collection and water distribution in towns etc.

6.6 CONSTRUCTION EQUIPMENT

- 6.6.1 It is estimated that 80-90% of the entire equipment fleet is out of order .
- 6.6.2 A large proportion of the above equipment is owned by MCP and WAPDA. It is possible that a large proportion of the idle equipment could be refurbished.
- 6.6.3 There is large scale misuse of equipment, indicating the need for training of operators and maintenance programmes.

RECOMMENDATIONS

- | 7.1 <u>GENERAL</u> | <u>Action by</u> |
|---|------------------|
| 7.1.1 Investigate the present capabilities of each of the following institutions:-
PSI, PITAC, MAS, PCSIR, CTL, PARC, AMRI and take appropriate action and supply the necessary aid to strengthen these. | UNIDO |
| 7.1.2 Agree with PSI on the International Standard System to be used in the country for the engineering industry and publish these standards with equivalents. | UNIDO &
GOVT |
| 7.1.3 Capital Goods Development Unit (CGDU) to be set up as a permanent organisation as part of the Ministry of Industries. The staff appointment to be regularised and a budget agreed. | GOVT |
| 7.1.4 CGDU to set up a data base classifying the engineering units, their products and their capabilities. Recording these in degrees of complexity and noting the composition of the staff. | UNIDO &
GOVT |
| 7.1.5 CGDU to recommend to Government the necessary training measures required in order to upgrade the staff and workforce in the engineering units engaged in the production of Capital Goods. These would be in the areas of design, measurement and control of quality, and processing methods such as Casting, forging, heat treatment. | UNIDO |
| 7.1.6 Government should consider the possibility of reducing or eliminating tax on the raw materials required in engineering. Taxes may be applied to the finished machine. | GOVT |
| 7.1.7 An existing professional body e.g. Pakistan Engineering Council (PEC), should examine the education courses and programmes for engineers and suggest improvements particularly directed towards combining practical experience with theoretical work. Successful students to be recognised by respected national qualifications. | GOVT |

- 7.1.8 There is a need for an agreed collective voice or lobby for the Mechanical Engineering Manufacturers. This appears to be neglected compared with Electrical, Electronic and Chemical Engineers. GOVT
- 7.1.9 Sub-contracting operations need to be expanded and encouraged. Government establishment should lead the way in educating their own subcontractors. UNIDO & GOVT
- 7.1.10 The deletion programmes should be rewritten in a form which, keeping in mind the potential of sub contractors, permits the identification of:
- i) The size of the demand of classes of components or parts e.g., revcounters for two wheelers or disc/ blades for ploughs, and therefore:
 - ii) The possibility of meeting these demand on a country wide basis.
- 7.1.11 In order to avoid tying up funds and to avoid delays in recovering the tax on exporting use a system of bond posting. GOVT
- 7.1.12 Government should consider changing the labour laws so as to permit dismissal for good cause. GOVT

7.2 MACHINE TOOLS

Action by

- 7.2.1 There is a need for a marketing study to determine the type and specification of the machine tools to be manufactured in Pakistan. GOVT & UNIDO
- 7.2.2 A Machine Tool Research and Development Centre should be organised to improve the design of machine tools. It should initially, concentrate on development work and should make its results available to manufacturers at a low fee or free of charge. It could be located in an existing teaching Institute or University. GOVT & UNIDO

7.2.3 The machine tools which could be manufactured in Pakistan with varying degrees of investment are listed in the sector report.

7.3 TEXTILE MACHINERY

Action by

- | | | |
|-------|--|----------|
| 7.3.1 | There should be a policy of scrapping machines and replacing with new. A start could be made with machines over 30 years old. | GOVT |
| 7.3.2 | Encouragement should be given to set up weaving operations of reasonable size (Say upto 100 modern looms). These may or may not be attached to spinning operations. Units of this size should be able to control quality and be able to properly depreciate and replace machinery. | GOVT |
| 7.3.3 | Examine the possibility of extending the range of textile machinery manufactured by the Spinning Corporation e.g. worsted ring frames and doublers. If the Corporation extends its work in the field this will enable it to set-up a group of textile technologists. | GOVT/TMC |
| 7.3.4 | In order to keep down the selling price of ring frames TMC should be allowed special depreciation terms for the CNC machine installed. | GOVT |
| 7.3.5 | An examination of the production of textile assessories should be made and proposals for improvement of quality given. | UNIDO |
| 7.3.6 | Where tax free import of ring frames are permitted under BMR or into tax free zones TMC should be allowed to supply without duty. | GOVT |

- 7.3.7 Licensors for assistance in the manufacture of cotton cards draw frames and shuttleless looms should be sought. UNIDO & GOVT
- 7.3.8 Care should be taken in extending the range of machine to be manufactured so that full account is taken of the change of technology e.g. open end spinners do not require roving frames or winders. GOVT
- 7.4 TRANSPORT
- Action by
- 7.4.1 Choose the second car to be manufactured and consider the possible advantages of manufacturing all cars and derivatives in one plant. GOVT
- 7.4.2 Continue to return manufacturing in this sector to private enterprise. GOVT
- 7.4.3 Approve a programme for transport industry planners and managers to travel abroad to observe industry in a 15-20 year state of advancement over Pakistan. GOVT
- 7.4.4 Propose to multi-national conveyor equipment designers and fabricators to establish plants to provide for future transport needs and possible export using imported drive and controls. PACO/IPB
- 7.4.5 Take the 20 years sales forecasts and convert them into future year by year demands for all transport components (i.e. forgings, crank/pins, filters, bearings etc.) Make available to all potential manufacturers. PACO/UNIDO
- 7.4.6 Invite an automation and material handling manufacturer to consider establishing a sales engineering staff and design group to provide low cost automation to local industry PACO/IPB

7.5 AGRICULTURAL EQUIPMENT

- | | <u>Action by</u> |
|--|------------------|
| 7.5.1 Reduce the number of tractor manufactures as a penalty against poor performance in deletion programmes. | GOVT |
| 7.5.2 The newly formed Farm Machinery Standardisation Committee or PARC to decide on the range of tractor operated implements according to local conditions as a guide to manufacturers. | GOVT |
| 7.5.3 PARC in collaboration with PSI to be authorised to give seals of approval for specific implement, both animal drawn and tractor operated which reach desired standards. A laboratory having quality control and testing facilities to be set up to assist in this. | GOVT/UNIDO |
| 7.5.4 Continued effort to be made to educate farmers in the selection and use of implements. Extensive use should be made of radio and television. | GOVT/UNIDO |
| 7.5.5 Encouragement to be given in the formation of farming cooperatives and in hiring schemes. | GOVT |

7.6 CONSTRUCTION EQUIPMENT

- | | <u>Action by</u> |
|---|------------------|
| 7.6.1 A technical Equipment Centre - either as a new set up unit or operating through the existing workshops should be charged with the task of refurbishing idle equipment. All government owned equipment should be made available for repair or scrapping. | UNIDO & GOVT |
| 7.6.2 There should be more extensive use of mobile workshops. | GOVT |

7.6.3 There should be clear lines of responsibility for ensuring the correct use of equipment from the most senior level to the machine operator in order to avoid waste. GOVT

7.6.4 Training courses on repair and maintenance of Construction Equipment to be organised. UNIDO/GOVT

8. New Project

Title: Programming of the Development of Engineering Industry Sectors

Project No.: DP/PAK/83

Duration: 30 months

Project Aims:

1. The design of economic policy instruments needed to stimulate and promote the planned expansion of selected sectors of the Engineering Industry, particularly in the field of incentives, fiscal and financial measures, and public sector local purchasing.
2. The design or improvement of institutional mechanisms required for the implementation of the sectoral programme and related in particular to engineering and design development, man-power training, standardization and quality control.
3. The improvement of the technological environment both in the Institutions and in individual manufacturing units so that there can be effective transfer of technology on which the units can build and improve.
4. Further development and implementation of the investment programme through the elaboration of industrial profiles, pre-feasibility and feasibility studies for the products identified through DP/PAK/76/003, The programming of the Development of Capital Goods Industries.
5. Detailed study of additional engineering sectors.

IMMEDIATE OBJECTIVES

The immediate objectives to be implemented in close and direct cooperation with the Capital Goods Development Unit (CGDU) are:-

1. To work with the major manufacturing units in the identification of those engineering products in the five sectors which have been examined which may be most profitably manufactured in the country. and to make such recommendations necessary to improve the quality standard achieved in the manufacture of these goods.
2. The Institutions at present set up which can forward the above aims will be examined and assisted so as to make maximum contribution to the improvement of engineering products.
3. The procedures necessary to encourage subcontracting operations that will supply the engineering industry with reproducible high quality components will be improved and implemented.
4. Recommendations will be made to the Government regarding policies and incentives directed towards developing the Engineering Industry in general and the Capital Goods Industry in particular.
5. There will be further studies of additional sectors. The sectors chosen will be in accord with the 6th 5 year plan.

OUTPUTS

The team of UNIDO experts, in close co-operation with the counterpart personnel of the CGDU, will proceed with the following formal outputs corresponding to the 5 main immediate objectives of the project:

1. With reference to immediate objective No. 1
 - a) To prepare or assist the major manufacturing units in the preparation of investment profiles, feasibility studies or market surveys for the products identified through the first phase.
 - b) In particular immediate assistance will be given to the Textile Machinery Corporation in investment studies and to the Machine Tool Industry in a market survey of machine tool requirements.

2. With reference to immediate objective No. 2
 - a) The following Institutions will be examined in detail in order to propose any changes or additions necessary in their operations directed towards the improvement and development of the Capital Goods Industry.

Pakistan Standard Institution (PSI)
 Pakistan Industrial Technical and Assistance Centre (PITAC)
 Metal Industry Research and Development Centre (MIR & DC)
 Pakistan Council of Scientific and Industrial Research (PCSIR)
 Central Testing Laboratory (CIL)
 Pakistan Agricultural Research Council (PARC)
 Agricultural Mechanization Research Institute (AMRI)
 - b) Assistance will be given to Pakistan Standards Institute (PSI) in the setting up of an International Standard Engineers Code and the drawing up of equivalents.

3. With reference to immediate objective No. 3 & 4.
 - a) A review and recording of the units engaged in the production of major Engineering Products and of their sub-contractors will be made. The capabilities of these units will be assessed by a systematic method. Quantitative and qualitative valuations will be given to the complexity of their product and to the use of know how in their manufacturing centres.
 - b) By using data collected in the above review, assessments will be made of man-power requirements and the training programmes necessary.
 - c) Because of the important effect of the progress of the major delectic programmes on the development of Engineering Products these will be reviewed, where necessary, rewritten and progress monitored so that difficulties and bottlenecks encountered during implementation of the programmes can be overcome.

4. With reference to immediate objective No. 5

- a) Detailed study of additional industry sectors. A number of possible sectors have been proposed. However, the sixth Five Year Plan commencing July 1983 will enable priorities to be chosen. Provision will be made for four such new sectors.

INTERNATIONAL EXPERTS

The experts will fall into 4 groups.

Group I

5 experts covering the 5 sectors already reviewed.

Major tasks: Months 7 - 11

In each sector to:

1. Assist in identifying and preparing investment profiles.
2. Advise on transfer of technology.
3. Assist in maximum utilisation of local raw materials and local subcontracting activities.

Group 2

4 experts dealing with Institutions, training and control of quality.

Months 6 - 14

Major tasks:

1. Improve the capabilities of existing Institutions.
2. Advise on Standards and Quality measurement and control.
3. Analyse the industries requirements for trained personnel, set out training requirement for design, costing and other management techniques. Advise on sandwich courses, and on-the-job training of staff and operatives.
4. Develop descriptions of capabilities of engineering units and utilisation of available capacities.

Group 3

Months 11 - 18

3 experts dealing with processing methods.

Major tasks:

Specific advice to manufacturing units and to training organisation. in the following processes.

1. Tool and Die Manufacturing
2. Foundry and Forging
3. Heat treatment

Group 4

4 experts to examine four new sectors

Months 19 - 23

Major tasks:

1. Determine the demand/supply position.
2. Identify priority products for possible manufacture.

A schedule for UNIDO Experts is attached see Appendix-9

MISSION VISITS AND NOTES ON AGRICULTURE

Visits were paid by the mission with two purposes in mind. Firstly, to invite comments and to discuss the sector reports with interested parties and persons. Secondly, to visit agricultural research units and manufacturing units since due to the early departure of the Agricultural Expert owing to his illness, these visits were not carried out. The visits made are listed below on the next page.

The Agricultural Research units were generally well equipped but suffered the shortcomings generally seen i.e. little designing capability and absence of quality control and testing facilities.

It was seen that most implements were being manufactured by 'craft' methods but there was one exception where there was extensive use of dies, jigs fixtures and templates.

It was felt that, with a pooling of the existing knowledge and experience in the country, decisions could be readily taken regarding the choice of implements which should best be made with details of their design and manufacture.

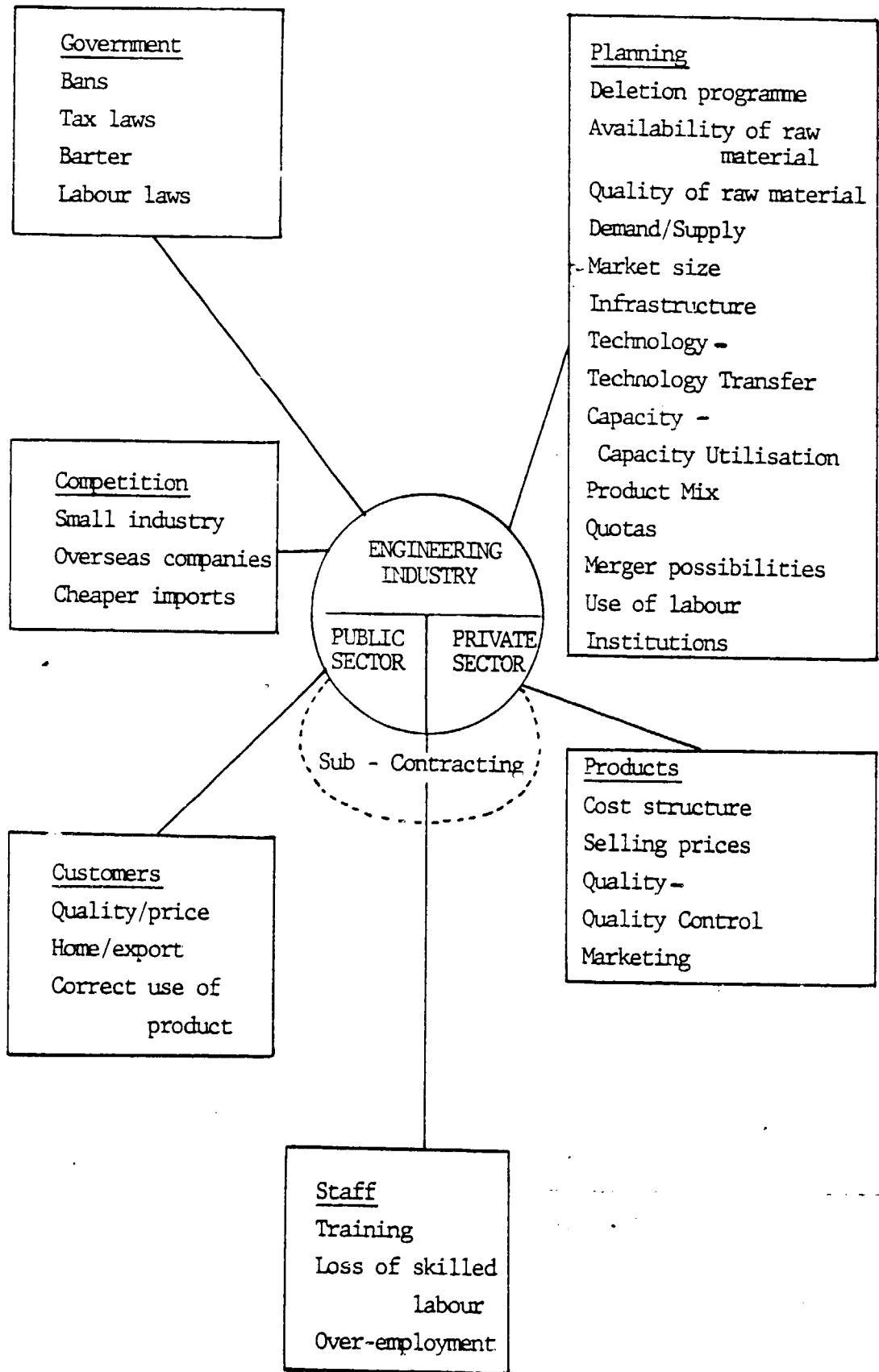
List of units/agencies visited

<u>S. No.</u>	<u>Unit/agency</u>	<u>Person met</u>	<u>Date</u>
1.	Pakistan Machine Tool Factory, Karachi (PMTF)	- Maj General M.Saeed Khan, Managing Director - Mr. Fazal-ur-Rehman General Manager (Engg)	15-1-83 and 6-3-83
2.	Textile Machinery Corporation (TMC), Karachi	- Mr. M.B.Farooqui, Chairman - Mr. Anwar Khan, General Manager (Planning)	16-1-83
3.	Textile Commissioner Organization, Karachi	- Mr. G.N.Khan, Acting Textile Commissioner - Mr. M. Idris Ahmad, Dy Director	30-1-83 and 20-2-83
4.	Textile Industry Research and Development Centre (TIRDC), Karachi	- Dr. Niaz Ahmad, Director with 4 senior officers of diff. depts	2-2-83
5.	State Engg Corporation (SEC), Karachi	- Mr. Mehboobul Hasan General Manager (TECH) - Dr. Saeed Akhtar Dy General Manager (TECH)	7-2-83
6.	All Pakistan Textile Mills Association (APTMA), Karachi	- Mr. Bashir Ali Mohd Vice Chairman - Mr. S.M.Usman, Secretary	8-2-83
7.	Pakistan Automobile Corpo- ration (PACO), Karachi	- Col.Hashmi, General Manager (Projects)	14-2-83
8.	International Computers Ltd (ICL), Karachi	- Col.Iqbal, General Manager for Pakistan - Mr. Mushtaq Ahmad Sales Manager	16-2-83
9.	Atlas Honda, Karachi	- Mr. Danishmand Chief Executive - Birgadier Manazir Plant Manager	1-3-83

<u>S. No.</u>	<u>Unit/agency</u>	<u>Person met</u>	<u>Date</u>
10.	Awami Autos/Sind Engg Karachi	- Col. Munir, General Manager (TECH) - Mr. Hisamuddin Senior Manager, (Planning and Dev)	6-3-83
11.	Ministry of Production, Islamabad	- Mr. Askari Taqvi Addl Secretary	26-3-83
12.	National Highway Board, Islamabad	- Mr. Khalid Mohd Amin Director General	26-3-83
13.	Planning Commission of Pakistan, Islamabad	- Mr. Arshad Ahmad Dy Chief (Industries)	26-3-83
14.	Heavy Mechanical Complex (HMC) Taxila	- Mr. Amir Abdullah Malik, Dy Managing Director. - Mr. Hasnain Akhtar Marketing Manager	27-3-83
15.	Heavy Foundry & Forge (HFF) Taxila	- Dr. M. Akram Sheikh Managing Director - Mr. M.A. Khalid Marketing Manager	27-3-83
16.	Zulsham Engg Co, Burhan, Attock	- Mr. Salim Qureshi Managing Director - Mr. Shamim Qureshi Production Director	27-3-83
17.	Agricultural Machinery Institute, PARC, Islamabad	- Dr. Zia-ur-Rehman Project Director	28-3-83
18.	Ministry of Industries, Islamabad	- Mr. Imtiaz Chaudhry Joint Secretary	28-3-83
19.	World Bank, Islamabad	- Miss Bhatta, Secretary	28-3-83
20.	Bright Engg Co. Lahore	- Mr. Aziz Ahmad Managing Partner	30-3-83

<u>S. No.</u>	<u>Unit/agency</u>	<u>Person met</u>	<u>Date</u>
21.	Prima Industries, Lahore	- Mr. Abdul Rashid Managing Partner	30-3-83
22.	Millat Tractors Ltd, Lahore	- Mr. Ehsanullah Managing Director - Mr. Sohail Bashir Rana, Senior Manager (Dev. and Projects)	30-3-83
23.	Happo Ltd, Lahore	- Mr. Muzaffar Ali Managing Director	31-3-83
24.	PECS Industries, Lahore	- Mr. Javed Iqbal Managing Director	31-3-83
25.	Zahocr Industries, Lahore	- Mr. Humayoon, Executive	31-3-83
26.	Rimtaj Industries, Lahore	- Mr. Mohammad Husain Managing Director	31-3-83
27.	Mechanised Construction of Pakistan (MCP), Lahore	- Mr. G.A.Khan, Executive Director	2-4-83
28.	Agricultural Mechanization Research Institute (AMRI) Multan	- Mr. Rafiqur Rehman Agricultural Engr	3-4-83
29.	Shah Mohd & Sons, Multan	- Mian Iqbal Hassan Managing Director	3-4-83
30.	Agricultural Engg Directorate Agricultural Field (Punjab)	- Malik Mohd Afzal Director General	4-4-83
31.	Ghazi Industries. Mian Churnu	- Mr. M.Anwar Ghazi Director	4-4-83
32.	Kharkhana-e-Aalat-e-Zari (Agri.- Impl.Workshop), Bhawalpur, Government of Punjab	- Mr. Mohd Zakir Project Director	6-4-83
33.	Halima Ghazanfar Farm Machinery Ltd (former GIMC), Rahimyar Khan	- Sardar Mohammad Ghazanfarullah Khan, Chief Exec- utive.	6-4-83

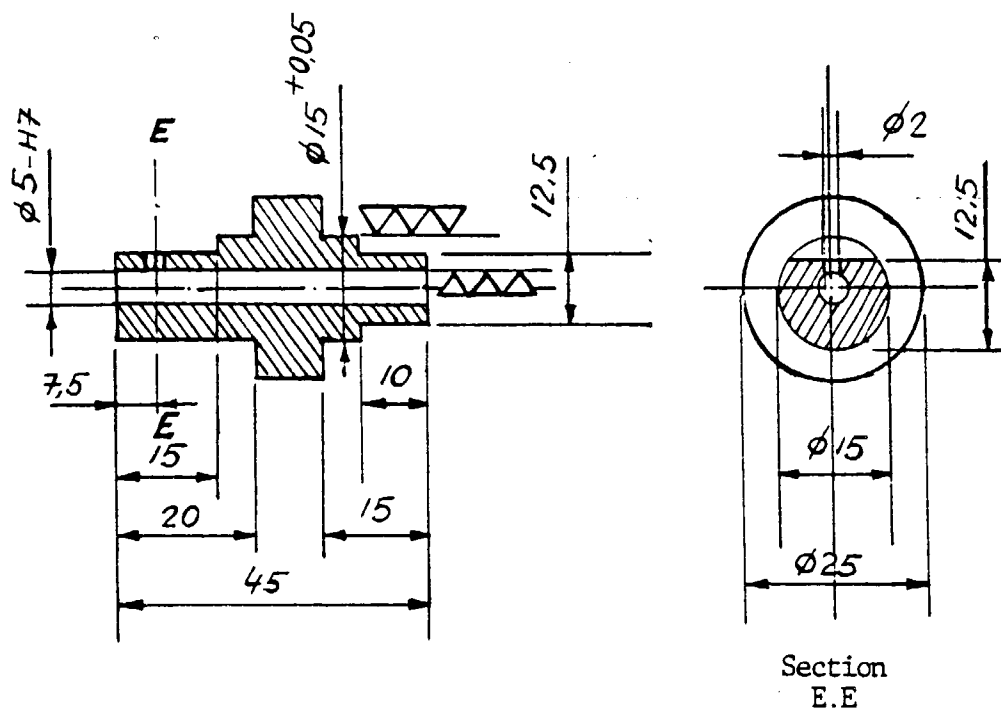
FACTORS AFFECTING THE ENGINEERING INDUSTRY



TWO WHEELER PRODUCTION AND CAPACITY

	Atlas Honda 1981-82	Dawood 'YAHAMA' 81-82	Sind Engg 'SUZUKI' 81-82	Saif Nadeem 'KAWASAKI' 79-80	Khawaja Autos 'VESPA'	Punjdarya Ltd (HONDA)	Novelty Enter- prise 'VESPA'	Rehman Sons 'VESPA'
Installed Capacity	30,000	30,000	15,000	18,000	2000	30,000	12000	12,000
Sanction capacity	18,000	10,000	15,000	10,000	2000	30,000	12000	12,000
Engines Capacity	50 cc	80	80	100	150	N.A.	150 cc	150 cc
	70 cc	100	100	110				
	110 cc							
Production	13240	6964	11362	4500	1745	N.A.	N.A.	N.A.
Deletion Content	30%	22%	36%	11%	30%	-	-	-
Capacity utilization	$\frac{\text{Production}}{\text{Sanction}} = 34.69$							

EXAMPLE OF SUBCONTRACTING REQUIREMENT



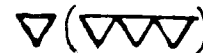
Denomination:
SHOULDERED BUSH

Material:
Cast Iron (B S I452, I948-I2)

Scale: I : 1

Quantity:

- A. 100 per month
- B. 500 per month
- C. 1000 Per month.



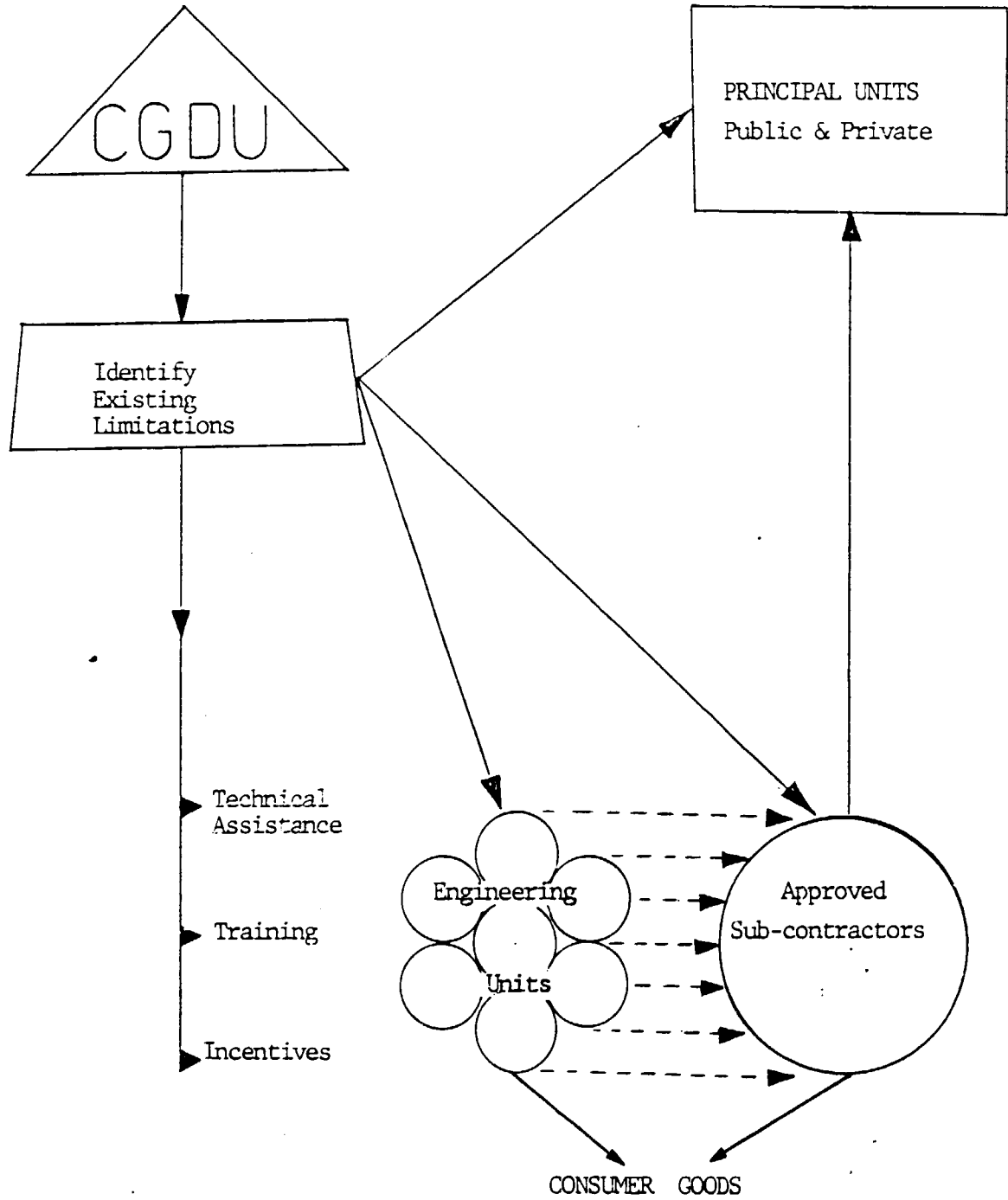
Projection E

All untoleranced dimensions
are ± 0.2

All dimentions in mm

All dimensions in mm

METHOD OF OPERATION OF C G D U



Appendix 6FUNCTIONS OF THE CAPITAL GOODS DEVELOPMENT UNIT

1. The CGDU should be directly responsible to the Ministry of Industry.
2. The staff of the CGDU should include engineers, a statistician, Computer Programmer, Economist and a standards engineer.
3. It should liaise with various government offices and other establishments, in particular with those concerned with import and export, investment, standards, material testing and those concerned with the education and training of engineers and technicians.
4. Its major tasks will be:-
 1. To progress the programme of development for the Capital Goods Industry as agreed between government and UNIDO.
 2. To work with UNIDO experts as and when they arrive to advise on the activities of the sectors.
 3. To advise both public and private industrial units of facilities which are available to them for the improvement and development of their operations.
 4. To encourage the formation of an effective subcontracting industry.
 5. To work with the Standards Institution in agreeing engineering standards.
 6. To be available to give advice on the probable effects on the Capital Goods Industry of any proposed tax or fiscal changes proposed.

7. To carry out market analyses and pre-investment studies.
8. To give advice on the Technological aspects of proposed licence agreements.
9. To keep informed of world developments in engineering by visits to trade fairs, correspondence with trade organisations and collecting trade literature.
10. To assess, classify and record the capabilities of the engineering units concerned with the production of Capital Goods.

Assemblies and Sub-Assemblies of the Techno-economic Factors
in the Structure of the Production of **Capital Goods**

B TECHNICAL INFRASTRUCTURE

B1 Semi-finished products	
1	Casting of iron (conventional)
2	Casting of steel (conventional)
3	Casting of non-ferrous metals (conventional)
4	Casting and forging of strategic material
5	Casting: pressure, centrifugal and the like
6	Casting, others: microfusion, shell and chill moulding, etc.
7	Hammer forging
8	Stamping

B2 Technical services from third parties	
9	Stress relief, annealing, normalizing, etc.
10	Heat treatment
11	Metallic coatings, scouring, etc.
12	Tool manufacture and maintenance
13	Die-making for cold stamping
14	Metal moulds, dies, shell moulds
15	Manufacture of jigs, templates, and the like
16	Light boilermaking services, plating to 1/2" (0.5 inch)
17	Medium boilermaking services, plating to 1" (1 inch)
18	Heavy boilermaking services, plating to 1 1/4" (31.7 mm)
19	Manufacture of gears or gear-cutting alone
20	Special machining, high-precision and standard
21	Special machining, medium and semi-heavy
22	Special machining, heavy
23	Cold stamping

A

CENTRAL UNIT OF PRODUCTION

A1 Product and Production unit	
7	Industrial size
Vt	Variety of types
Ve	Variety of models
S	Series
P	Weight
Hd	Direct hours
Ra	Know-how
L	Laboratories
K Assembly	

A2 Means of production	
1	Cutting of all types
2	Folding, bending, rolling, etc.
3	Cold deformation of wire and strips
4	Riveting, threading, upsetting (cold)
5	Stamping and pressing
6	Other non-cutting machine-tools (cold)
7	Welding of all types
8	Turning: horizontal, all types
9	Turning: with two or more chucks
10	Turning: vertical and plateau
11	Turning: spherical, globoid, dressing, etc.
12	Planing: horizontal, vertical, bench-type, cutting
13	Broaching
14	Milling
15	Drills and screw-cutting machines (chip-removal)
16	Broaching machines (all types)
17	Gear-cutting machines
18	Grinders (all types)
19	Superfinishing machines and other operating by abrasion
20	Electric-erosion machines, laser apparatus and other high-technology equipment
21	User-built machinery
22	Assembly machinery
23	Machine-tools, combined: cutting/non-cutting
24	Machine-tools: other chip-removal
25	Machines for use in manufacturing electric motors
26	Machines for use with plastics, rubber and similar materials
27	Scouring, cleansing, degreasing equipment and the like
28	Painting equipment
29	Furnaces and drying apparatus
30	Quality control

C COMPONENTS

C Components	
1	Mechanical: simple, of one or few parts
2	Mechanical: composite, medium complexity and weight
3	Mechanical: composite, high complexity and/or weight
4	Hydraulic
5	Pneumatic
6	For vacuum circuits
7	Electrical: for control circuits
8	Electrical: for power circuits
9	Electronic
10	Measuring: linear, angular and plane
11	Lubrication
12	Cooling, with water or liquid circulation
13	Refrigeration industry (excluding compressors)
14	Steam and gases, corrosive and non-corrosive
15	Instruments for the measurement of temperature, flow-rate, pressure, humidity, electrical values, and the like
16	Optical
17	Branch-specific components, metallic
18	Branch-specific components, non-metallic

FINAL PRODUCT

USE OF KNOW - HOW

Group	KH No.	Description of the Know-How (KH)
I - PRODUCT & RELATED	01	Selection and definition of the product - Marketing
	02	Basic research laboratories
	03	Applied research laboratories
	04	Planning offices
	05	Setting-up pilot projects
	06	Setting-up prototypes
	07	Sales office: sale of non-standard equipment
	08	Normal product design and planning
	09	Design and planning of complete installations, mini-engineering
	10	Internal and other technical standards
	11	Specification of services, components and spare parts
	12	Project analysis according to methods and processes
	13	Technical documentation and library
	14	Technical literature accompanying the product
II - PRODUCTION PREPARATION AND SUPPORT	15	Production processes and methods
	16	Own methods of manufacture
	17	Timekeeping
	18	NC, CNC, optical and other special processes
	19	Conception and design of auxiliary manufacturing equipment
	20	Own production of auxiliary manufacturing equipment
	21	Metrology
	22	Manufacturing orders, job cards and similar
	23	Production planning. Forecasting of hand-over dates
	24	Purchase of raw materials, semi-finished parts and components
	25	Contracts and outside manufacture
	26	Quality control of (24)
	27	Quality control of (25)
	28	Tooling: maintenance, calibration, assembly, manufacture, etc.
29	Setting-up work, cutting materials, etc.	
30	Installation of machinery	
III - PRODUCTION	31	Direct with machinery : A) continuous or long runs B) short runs or single units
	32	Direct without machinery : A) continuous or long runs B) short runs or single units
	33	Direct: assemblies : A) continuous or long runs B) short runs or single units
	34	Production work-force
	35	Foremen and chargehands
	36	Quality control during work
	37	Final quality control
	38	Special and/or standard performance testing
	39	Production management
IV - VARIOUS TECHNIQUES	40	Stock and warehouse administration
	41	Maintenance of machinery, equipment and plant
	42	Sales staff
	43	After-sales service
	44	Systems department
45	Data processing	

SCHEDULE FOR UNIDO EXPERTS

QUARTERS

Experts	Year																															
	Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	
1	Chief Technical Advisor (CTA)																															
2-6	-Ind. Engineer/Machine Tools																															
	-Ind. Engineer/Textile Machinery																															
	-Ind. Engineer/Transport Eqpt.																															
	-Ind. Engineer/Const. & Mining Eqpt.																															
	-Ind. Engineer/Agricultural Eqpt.																															
7-10	-Expert/Institutional Structure																															
	-Industrial Economist																															
	-Expert/Manpower training																															
	-Expert/Standards & Quality Control																															
11-13	-Ind. Engineer/Tool & Die Mfg																															
	-Ind. Engineer/Foundry & Forging																															
	-Ind. Engineer/Heat Treatment																															
14-17	-New Sector																															
	-New Sector																															
	-New Sector																															
	-New Sector																															
50	-Consultants																															

Schedule for UNIDO Experts

Note on Subcontracting

It is recognised that there is a need to improve the subcontracting operations in the Engineering sector.

Most craft-based manufacturing units attempt to produce all components themselves partly due to the fear of competition and a jealous guarding of know-how.

Many large public companies find it necessary to manufacture most components themselves because of the unreliable quality and delivery of parts manufactured by subcontractors.

In order to produce quality engineering products at a reasonable price it is necessary to change the above attitudes.

There are many advantages in subcontracting:

1. It can concentrate scarce skills.
2. It reduces total overhead costs.
3. It encourages competition
4. It encourages quicker response to new technologies or improved manufacturing methods.

There are many small workshops already existing where considerable ingenuity and skill is demonstrated in the manufacture of quite complex mechanisms. Many operations are carried out by practical crafts-men working with elementary or primitive tools.

Whilst complex shapes are often faithfully reproduced, "hidden" qualities such as material composition, metal hardness, tolerance levels, tensile strength and the presence of faults such as blowholes or cracks are ignored.

The overall target should be either to encourage the formation of new enterprises or to up-grade these small enterprises so that they can produce quality items to acceptable tolerances in quantity production runs as opposed to the present "one off" methods.

It is suggested that the public enterprises take the lead in developing these subcontracting operations.

It will be essential that the Principal unit is able to guarantee a continuing requirement and there should be a high level of co-operation between the two parties.

The Principal may supply drawings and any jigs, templates or special tools. If necessary raw materials may also be provided. The two parties will agree on the methods of quality measurement. There should be no move to simply purchase at minimum price at the expense of quality.

There are number of possible ways in which the above can be achieved, but a laissez - faire attitude will not be sufficient.

The Principal units should be asked or identify the type of product required giving the following information.

1. Raw material specification
2. Approx. weight of component
3. Method of manufacture.
4. Off take required.

It would be advisable to produce this information by filling in a simple form so that the information can be used to identify the type and size of the demand. They should also identify their present and potential suppliers wherever possible giving their experience of any problem areas.

The questionnaire may be based on the following form.

(see over)

Code No: (to be left blank)

PRODUCT DATA FOR SUBCONTRACTING

Name/Address of the factory: _____

Phone: _____ Cable: _____ Telex: _____

-
1. Name of the Product: _____
2. Is it a component or an assembled unit
- A. In the case of component:
3. Approximate finished weight: < 1 kg , 1 - 5 kg , > 5 kg
4. Material:
- Mild Steel , Alloy Steel , Non ferrous Metals ,
Plastic , Rubber , Others (Pl. specify) _____
5. Manufacturing Method: _____
- Casting , Forging , Die Casting ,
General Machining , Special Machining
6. Precision:
- Single Piece/
Rough work , General Production/
Medium precision , Tool Room/
High precision
7. Off take: _____ per month, over _____ years.
- B. In the case of an assembled unit, a short note highlighting the above details

-
8. Present Sub-Contractors: (A list to be attached if subcontractors are more than one, mentioning their name and address)
-

-
9. Specify any problem area:

1. Use of Existing Manufacturing Units

Data given by this means will identify the general weaknesses of existing units which we believe will include:

- a) Difficulty in producing fine tolerance components.
- b) Inability to analyse raw material.
- c) Lack of measuring techniques.

There will also be problem in producing high quality castings, precision in heat treatment and perhaps lack of capacity in die casting.

Assistance should then be given, wherever possible using existing Institutions e.g. Central Testing Laboratory could advise the Principal and Subcontractor on method of measurement and the type of testing equipment to be used. If necessary, bringing in outside help.

2. New enterprises

A second approach could be to set up entirely new enterprises.

Qualified engineers with modern practical experience (e.g. post graduates from PAK-SWISS TRAINING CENTRE) who wish to participate should be assisted. Perhaps government could provide the premises and services under special terms. The Principal could lease machinery and guarantee off-take for a few years.

CGDU

The function of CGDU in the subcontracting operations would be

1. To record sub-contractors details and abilities.
2. To identify any general requirements.
3. To liaise between the parties and Institutions.
4. To recommend bringing in outside assistance wherever necessary.

