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United Nations Industrial Development Organization

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ENGINEERING DESIGN AND TOOL CENTRE

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Preparatory Assistance Study
Project Engineering and Management Services Unit (PEMSU)

Report

[illegible] International Limited

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

ENGINEERING DESIGN AND TOOL CENTRE
ADDIS ABABA

PREPARATORY ASSISTANCE STUDY FOR THE PROJECT ENGINEERING AND MANAGEMENT SERVICES UNIT (PEMSU)

REPORT

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EXECUTIVE SUMMARY

This Project Preparatory Assistance Study into the proposed Ethiopian Project Engineering and Contracting Unit (PECU) has shown that there is now a justified need for the project to proceed.

However because of the changed Ethiopian environment with its new emphasis on a mixed, more market driven economy and its strengthened industrial base, it has been necessary to redefine the project into one which is contingent with the environment and which can be established, within the project's four year timescale, as a viable enterprise.

The overall aim of PECU has been redefined as:

"to facilitate an increase in the level of domestic sourcing in projects which will result in both job creation and a reduced demand for foreign exchange."

The concept of a large centralised contractor has therefore been rejected for a variety of reasons including the fact that project owners already have some capability in this area and that there is a substantial under-utilised installed fabrication/manufacturing capacity available for use in domestic sourcing.

It is now proposed to establish a small institution comprising:

* Domestic Sourcing Promotions Unit (DSPU)
* Design House (DH)
* Project Management Services Unit (PMSU).

initially as one of the operational divisions of Engineering Design and Tool Centre (EDTC). In recognition of its changed role and objectives the unit has been renamed. Project Engineering and Management Services Unit (PEMSU). Its inclusion within EDTC is supported because it is understood that EDTC is to be delinked from the National Metalworks Corporation.

Because of the nature of the tasks to be undertaken by PECU, the high rewards for success and the penalties for failure, and the coached on-the-job approach to staff training, it has been necessary to provide a substantial package of technical assistance.

The UNDP/UNIDO budget for this techical assistance is estimated at 2.12 million $ US, and the Government's contribution at 5.33 million Birr.

Since the allocated office accommodation within the new EDTC complex is expected to be available for use in March 1991, this is the proposed commencement date for the PEMSU Project.

1. INTRODUCTION

1.1 The Ethiopian Industrial Sector

The industrial sector in Ethiopia employs less than 1% of the total workforce, accounts for no more than 6% of the total exports and contributes lower than 11% to the GDP.

Industrial output is dominated by the state. In 1986/7 there were 369 establishments and although evenly split in terms of establishments between the state and the private sector, around 97% of capitalisation and value added was attributable to the state. Overall in recent years there has been little change in these balances.

The state sector is dominated by the Ministry of Industry which controls ten major corporations:

* textiles
* beverages
* food
* leather and shoe
* sugar
* tobacco and matches
* metal works
* chemicals
* cement
* printing

and a number of share companies in which the state has a major share.

They are all import dependant with around 40% of their raw materials and 98% of capital goods imported.

The National 10 year Perspective Plan (1984 - 1994), the details of which have been subject to a number of amendments, contains five major objectives for industry:

* increase the quantity and quality of basic consumer goods such as foods, textiles and pharmaceuticals, to raise the standard of living of the population

* expand and establish capital and intermediate goods industries supporting agriculture and other sectors of the economy

* strengthen handicrafts and small scale industries

* contribute towards the improvement of the balance of payments through export promotion and import substitution

* lay the base for a development of heavy industries.

Implementation of the accompanying ambitious Capital Expenditure Programme has been erratic in recent years and overall is running at around 3.4 times the level of Ordinary Capital Expenditure. The trend of higher average levels of foreign components, now approaching 70%, combined with an increasing shortage of foreign exchange has led to a further slowdown in the rate of uptake of new projects.

This trend in higher levels of foreign components in major projects is the result of a combination of the nature of the plant and technology employed, the limitations of the domestic engineering base and the shortage of basic materials for conversion into plant items.

Ordinary Capital Expenditure, that is new investments made for replacement, debottlenecking, minor additions and renovations of existing establishments in the Ministry of Industry sectors has been fairly well spread between corporations in recent years and the highest expenditures has been in beverages, textiles and food.

A component of the Government's emerging economic and enterprise policies places greater emphasis on improved business performance in the public sector. One of the expected consequences will be a progressive change of emphasis for projects from large new capital projects to more ordinary capital expenditure projects of the type described above.

Increased emphasis is now being given to developing the engineering industries skills capability and capacity base, and a wide range of new initiatives to achieve this have already been taken. For example new facilities such as the Spare Parts factory at Akaki have been established, and facilities such as the Engineering Design and Tools Centre are under development. These are expected to provide support to ordinary capital projects, help to reduce foreign currency demands and begin to stimulate new employment opportunities.

The limitations of foreign currency is one of the key factors which has led to a very low utilisation of installed capacity; estimated by some to be as low as 30% largely through raw materials shortages. Thus there is a large pool of under utilised facilities in industry which could be utilised to support the development of indigenous skills and capabilities.

1.2 PECU and its Origins

In 1983 UNIDO commissioned project preparatory studies into the development of a domestic capability within the Ministry of Industry's National Metalworks Corporation in engineering design, contracting and toolmaking. This resulted in a project to develop a triple function institution comprising:

* Engineering Design Centre (EDC) for the design and manufacture of prototype machinery and equipment which would be suitable for large scale commercial domestic manufacture and for training engineers in engineering and design

* Tool Centre (TC) for the design and manufacture of tools, dies, jigs and fixtures and for training engineers in tool design and production

* Project Engineering and Contracting Unit (PECU) to provide a national contractor to undertake work in the field of plant and utilities embracing systems engineering, inspection, erection supervision and technical document preparation.

During the formulation of the project document DP/ETH/83/024/D/01/37 Engineering, Design and Tool Centre (EDTC), it was decided not to proceed at that time with the PECU component. However it was agreed that a space provision would be made in the new EDTC building.

1.3 The Study

In 1990 UNIDO commissioned a further project preparatory assistance study, DP/ETH/89/009, into PECU to develop a revised project document that would take account of the changed environment of Ethiopia, in particular the new economic and industrial policies. A copy of the Terms of Reference for this study is included in
Annex A.

The field work of this study was carried out in Addis Ababa by two consultants from WS Atkins during the period 26th March to 14th April 1990.

In advance of and during the first few days of the field work, desk research was undertaken, largely from the Consultants library of in-house materials recently prepared for the Ethiopian BME subsector strategy study. A listing of reference documents is provided in Annex B.

Interviews and discussions were carried out in Addis Ababa with a range of national organisations, institutions and individuals in the public and private sectors and a copy of the work programme is provided in Annex C.

On completion of the fieldwork a verbal presentation, followed by detailed discussions, were held with local representatives of UNIDO, the Minister of Industry, senior executives of the National Metalworks Corporation and the EDTC National Project Coordinator. This was followed by a debriefing with UNIDO's technical specialist, Hans J Fritz, in Vienna on 17th April.

2. A FRAMEWORK FOR THE DEVELOPMENT

2.1 Objectives and Scope

The original overall aim for PECU was to establish a core of domestic expertise in engineering contracting.

Engineering contracting may be defined as those stages in the project cycle from post project appraisal to initial operation of the new facility.

There is more than sufficient evidence to demonstrate that Ethiopian industry already has a considerable, although under-utilised, expertise at varying levels of sophistication, in most stages of the project cycle. It would therefore be more appropriate to see the overall aim of PECU as increasing the domestic sourcing of projects rather than establishing a core of expertise.

This is a recognised national need since the current low level of domestic sourcing of projects, including civils work averaging around 30%, is a real constraint on industrial development in a country with severely limited foreign exchange. Therefore one of the underlying aims of PECU must be to reduce the levels of foreign exchange requirements, by increasing the level of domestic sourcing in development projects.

As the difficulties of the nation's economy and the numbers available for employment have both increased without matching growth in job creation, increasing the levels of domestic sourcing will also, once the slack in the present system has been taken up, stimulate job creation.

In order to develop the nation's industrial base the country has implemented over the years a large number and range of major industrial development projects.

As part of management's task of improving business performance, an aspect which under the new economic and industrial policies is expected to be of increasing priority, there will be a need to consolidate earlier investments and to implement refurbishment, debottlenecking and performance improvement projects. These programmes compared with the major projects are on a much smaller scale and generally do not require large inputs of new technology. This has become an established pattern in some Corporations such as Textiles, and it is expected to become a major activity in others. For example a major study by WS Atkins for the National Metal Works Corporation has made recommendations for this kind of activity to be pursued. Such programmes lend themselves to domestic sourcing and will provide ideal opportunities for the further development of the domestic capability.

The Government's new economic policy initiatives are intended to provide the framework for and the creation of an enabling environment to foster the development of the private sector. It is also understood that international development agencies are planning to provide funding support for enterprise development.

The private sector is already involved, as far as it is permitted, in domestic sourcing and has a major role to play in raising it's level. It is evident that once the sector's confidence has been re-established it will grasp the business opportunities presented by increased domestic sourcing and this will very quickly lead to job creation because there is little under-employment in the sector.

Development projects can be seen as having two classes of engineering components, namely:

- proprietary equipment
- and general equipment and production services.

The former are of a specialist nature and usually form a part of one time investments and require a high level of specialist process technology for their design and manufacture. This is not an area of work envisaged for PECU. PECU's activities should be concerned with the general engineering aspects which have a wide application in industrial projects.

The overall aim of PECU is therefore redefined as:

to facilitate an increase in the level of domestic sourcing in projects which will result in both job creation and a reduced demand for foreign exchange

and accordingly the unit has been renamed the Project Engineering and Management Services Unit (PEMSU).

2.2 Human Resource Development

It is now recognised that unless sufficient attention is paid to the human resources aspects of developments, it is unlikely that physical facility provisions will be successfully put into efficient and effective productive use within a reasonable time scale.

Successful productive use of facilities is dependent upon the level of usable skills and knowledge of the employed human resources. Skills and knowledge are developed through education and training. Conventionally industrial development schemes have been provided by various forms of on-the-job training for workers and of fellowships for management and technical staff.

In the past, the majority of fellowships for developing countries were provided for higher education normally at first or second degree level. Whilst this helped to raise overall levels of higher education attainment, rarely did such fellowships provide directly usable industrial skills. It was necessary to spend

a further considerable period of time to develop the necessary range of specialised applied skills.

The levels of educational attainment in developing countries have continued to climb in recent years and in countries such as Ethiopia, with its increased output from the University of Addis Ababa, there are resources with technical knowledge which have not been exposed to or developed the necessary applied skills.

Accordingly the nature of fellowships has changed to comprise a small knowledge component to fill identified shortfalls through short courses, and a much larger job experience component.

Further it has become apparent that insufficient fellows are returning with the necessary developed usable skills to enable them to meet the needs of their assigned jobs even to a reasonable standard of performance.

It is therefore considered necessary to change the approach to the training of management and technical staff. The Consultant is of the view that the training design process should be carried out in more detail with greater attention to an individual's task needs, and by:

* bringing the trainer and training to the individuals work centre

* developing applied skills through extended live work assignments with the direct coaching support.

2.3 Developing Domestic Sourcing and its Effects on Projects

During the early stages of a nation's industrial development when very limited capability is available locally, the technology and the facility are purchased as a "package" which will usually include operational assistance. This is the quickest and easiest way of bringing a new capital asset into productive use.

However the vast majority of these projects' costs have to be met out of scarce foreign exchange.

This approach to project implementation is the "natural" route selected by foreign advisers and indigenous experts who have been educated and trained in developed countries. They have a somewhat limited interest in and appreciation of, local problems and aspirations and have a strong elitist bias in favour of the latest most sophisticated technologies developed in the industrialised countries, the most exotic scientific fashions of the day, and adoption of elegant engineering and design solutions which are essentially suited to their own backgrounds. This natural orientation has a strong influence on the range of possible solutions to practical problems which are seriously considered. Too often appropriate technology, that is that level of applied technology which is contingent with the stage of a country's industrial development, whether it is based upon traditional or new skills and knowledge, is rarely considered.

A systematic approach to domestic sourcing involves the exploitation of appropriate technologies since it is these which the nation's resources will first of all be able to manage fully and well. Thus an elitist orientation away from appropriate technology can seriously prejudice the development of domestic sourcing as it places the focus on proprietary equipment and processes which almost by definition employ advanced technologies which are appropriate in developed countries.

As a country's industrial capability develops the local content of projects can be increased without prejudicing their start-up or operation. This participation in itself strengthens the industrial base, increases industrial output, promotes new employment and business opportunities as well as reducing demand for foreign currency.

As domestic sourcing increases, the concept of a project changes from a single "package" to one of an increasing number of work packages. This represents a distinct change in approach from the "top down" to a "bottom up". Thus

what is seen most usually by those with elitist orientations as a difficult challenge to be mastered, the task of unpackaging, disappears.

Progressively the roles and responsibilities of foreign contractors are transferred to the project owners and the convenience and advantage of delegation to a third party is progressively lost as more and more is handled locally by nationals. Such disadvantages are generally accepted to outweigh the overall gains and benefits of increased domestic sourcing.

2.4 Institutional Aspects

An agency which is designed to stimulate and participate in the development of domestic sourcing needs to be carefully located within the nations institutional arrangements. PEMSU is a practical operational function which will support all sectors of industry and their perception of it will have a major impact on their preparedness to respond to its initiates and to take up its services.

Therefore in defining the institutional arrangements for PEMSU, the following criteria/conditions must largely be satisfied:

- independence from, rather than dependence upon, project owners
- allied to most if not all industrial sectors, not just a few
- close to practical operations
- not perceived as an instrument of the government system
- freedom to act and with the potential for rapid decision making.

2.5 Conclusions

The overall aim of PEMSU is therefore to facilitate an increasing level of domestic sourcing in projects to reduce the project demands for foreign exchange and stimulate employment creation.

In order to bring PEMSU into effective operation quickly, special attention needs to be paid to human resources development with an emphasis on the development of useable job skills through coached live on-the-job assignments.

PEMSU will have a vital role in stimulating domestic sourcing and careful attention needs to be paid to its institutional arrangements. It is important that it is seen by all those involved as impartial and not as an instrument of either government or of a particular industrial concern.

Domestic sourcing of projects normally starts with inputting general engineering and then over an extended period progresses into proprietary equipment and processes.

Finally the top down concept of unpackaging is inappropriate for Ethiopia at this stage of its development. A bottom up approach to project definition and implementation is considered much more appropriate.

These are the key aspects of the framework against which the study and review of PEMSU has been undertaken.

3. PROGRESS TO DATE IN DOMESTIC SOURCING OF PROJECTS

3.1 Overview

A review of the development of domestic project implementation demonstrates that a capability exists at all the stages of the project cycle and that increasingly project owners, particularly of smaller ones, no longer see projects as single packages to be purchased from a foreign general contractor.

It was evident from discussions that for projects involving repeats of, or similar processes, there is generally adequate expertise within the organisation concerned to lead the project. The extent of this capability varies. The Textile Corporation is well developed in this respect, others such as the Chemical Corporation, are developing rapidly and others such as the Metal Works Corporation have made little progress. This variation is also reflected in organisations' attitudes to, and progress in, raising their levels of domestic sourcing.

However for those parts of projects which are dominated by new technologies and or proprietary processes and equipment, the necessary expertise should continue to be imported as this is overall the most cost effective method of provision.

The Consultant has also concluded that sufficient capability has already been developed by the more progressive project owners to enable some of the larger projects to be developed and implemented as "work packages" rather than as a "single package". However the capacity of this expertise is limited and therefore its application has to be carefully managed to avoid overstretching which would cause consequential problems and penalties in projects.

Against this background the Consultant expected and has indeed found, that a significant level of domestic sourcing is already taking place in Ethiopia's industry.

Significantly there is a wealth of hardware, much of which was installed to support capital projects, which is under-utilised and in some cases lying idle. The Consultant is satisfied that there is already in place sufficient capital plant within the country to raise immediately the levels of domestic sourcing without recourse to major capital investments.

It is recognised that this hardware is widely distributed in the industrial sector and is notionally designated for other tasks. The acute material shortages currently experienced, a situation that is not foreseen to change significantly during the coming years, will continue to ensure that capacity lies grossly under-utilised. Accordingly it is proposed that they are employed in alternative productive uses.

Appendix D, Examples of Domestic Sourcing, presents some of the more significant examples that have been identified by the Consultant.

3.2 Progress in Domestic Sourcing Against the Project Cycle

3.2.1 The project cycle

The planning and implementation of capital projects can be categorised into the following project cycle:

* ideas and concept development
* feasibility study
* project appraisal
* scheme development
* detailed engineering
* contract strategy and instruments
* manufacture/purchase

* installation
* commissioning.

A mixed sourced capital project follows the same cycle but additional management effort is required to ensure that the benefits can be enjoyed without having to endure the very real penalties that can occur when time, cost or quality control are weak.

3.2.2 Ideas and concept development

There are many sources of ideas for projects; from foreign contractors and suppliers, foreign governments and internally generated.

Generally marketing aspects are rarely considered to the necessary depth and there is no evidence that any real consideration is given to defining an appropriate technology and the potential for domestic sourcing.

3.2.3 Feasibility study

Feasibility studies seem to be carried out with varying levels of detail and it appears that those carried out by suppliers bear an inherent bias. Few are carried out fully in accordance with either UNIDO's or the World Bank's guidelines. Typically consideration of markets aspects, often lacks depth and professionalism and little if any thought is given to appropriate technology or domestic sourcing.

3.2.4 Project appraisal

Until recently most project appraisals were carried out by the Industrial Project Services (IPS) who at one time were part of the Ministry of Industry and are currently part of the Development Projects Agency (DEPSA). A new unit has been established within the national planning agency, the Project Appraisal Department and this recently took over the task from IPS.

It is said that consideration is given to local sourcing and that it is part of the appraisal process. However this is based on a high level financial considerations which by their nature cannot address the necessary details of practicability.

3.2.5 Scheme development

For major projects this has invariably been left by project owners to their appointed contractor or consultant, however for the smaller ordinary capital projects, project owners' staff now carry out the work.

3.2.6 Detailed engineering

For major projects this is normally delegated to a foreign contractor. Traditionally he has little interest in domestic sourcing preferring the total package approach which gives him maximum control and reward but with consequential foreign currency penalties for project owners. There are notable exceptions such as in the Textiles and Cement Corporations where determined efforts are and continue to be made to increase domestic sourcing but only within their own boundaries.

Some of the detailed engineering, particularly the process components, of the increasing number of smaller projects in the pipeline is being carried out by project owners' staff. However the capacity and capability for general engineering and industrial buildings design is very limited and is seen as another limiting factor in developing further domestic sourcing.

3.2.7 Contract strategy and instruments

The development of contract strategies for current projects is limited to establishing the scope of supply for the main plant supply contract and the local civil contract and defining their interfaces.

Typically there are three classes of supply for which contract instruments are required:

* foreign design and f.o.b supply and supervision of construction which enable performance guarantees to be included. The actual instruments or conditions range from inter-government protocols to normal international transactions

* local supply of civil and plant erection services. These services and materials are normally supplied under FIDIC conditions of contract where the work is placed outside the project owners organisation. BATCODA is usually responsible for agreeing the terms of contract for the works which are normally undertaken by a civils engineering contractor

* supply of domestically sourced equipment and other components of industrial projects as subcontractors of industrial projects, as subcontractors of the general contractor or as direct suppliers or contractor to project owners.

The form of contracts used for cross-corporation trading and private sector trading is unclear largely because the level of such activities is still very small.

3.2.8 Manufacturer/purchase

There is a large manufacturing capacity available in Ethiopia which could be used for production of locally sourced components of projects. The facilities outside the NMWC are fragmented throughout the industrial base, in the public sector often as maintenance workshops which were constructed as part of large projects and in the private sector as fabrication shops.

The capacity of these facilities is substantial and largely under-utilised through lack of materials and the existence of perceived intertrading restrictions between Corporations.

3.2.9 Installation

Most of the Corporations have developed plant erection capabilities to an extent that enables them to erect plants under foreign supervision for projects where decisions have been made to locally source these services.

3.2.10 Commissioning

This is carried out by both project owners and their contractors with the allocation of responsibility dependent upon the nature of plant and process. Generally proprietary items are the responsibility of the plant suppliers.

This is however an activity which is largely outside the concept and scope of PEMSU.

3.3 Domestic Fabrication Facilities

The development of fabrication facilities in the public sector has been significant and has been achieved largely through the provision of equipped workshops at major project sites as part of the main supply contract. Dedicated facilities at Kality Steel Factory and Akaki Spares Parts Factory are also available to support local sourcing, but the latter is only just coming on line.

As a result there is a significant fabrication capability which is widely distributed within the Corporations. However there is little knowledge of this capability and its capacity, except in general terms, in the world outside the owning plant. For much of the time, more than 50%, many of these facilities remain unused through lack of internally generated workload and a shortage of raw materials.

The private sector has been severely constrained by business regulations, supply of plant and material with the result the majority of the capability is

based on light facilities, many of which are self made, which are employed in making small call specialist items.

The result is that this potentially vibrant business community is all but excluded from participating in the locally sourcing of capital projects thus denying the project owners the benefits of a fast response which is a basic requirement of successful local supply.

The Consultant has noted that the private sector have an established pattern of sub-contracting amongst themselves to provide the complete range of capabilities required for a particular job. This multi-sourcing activity is particularly evident in the Asmara business community, unlike that of Addis Ababa, and includes to a limited extent transactions between Corporations and between these and the private sector.

This business practice demonstrates experience of the fundamental procedures - commercial, technical, co-ordination and managerial - that will be applicable in local sourcing of capital projects.

3.4 Civil Engineering

Ethiopia has had for many years a substantial capability in civil engineering design and construction. However there is very little design capability for industrial buildings.

The strength of the sector has its foundations in a vibrant private sector which post the 1974 revolution was brought into the public sector.

The majority of civil engineering construction companies are within the responsibility of the Ministry of Construction. The water industry now has its own contracting organisation and there is still a small private sector. It is noted that it is a private sector company which was awarded the contract for the construction of the EDTC building.

All civil engineering organisations are licensed by BATCODA who is also responsible for the central allocation of resources.

Whilst no adverse comments were made during the study on the technical capability of the sector, much unfavourable comment was made about efficiency and achievement of agreed targets. Although a part of these deficiencies can be traced to the inherent low business efficiency of a large public sector contractor the major cause is undoubtly shortages of materials. This is hardly surprising when the planned workload is almost four times that of the availability of resources.

One area where there is an identified shortfall in technical capability is in the design of industrial buildings. Foreign design contractors are used for all but the smallest and simplest buildings for which there is now a capability within HASIDA.

Therefore whilst PEMSU can make a contribution to the development of a capability in industrial buildings design it should not attempt to be involved in other areas of civil engineering as there is already a sufficient technical capability to meet its needs for a many years to come.

3.5 Attitudes and Orientation to Domestic Sourcing

The whole range of attitudes and orientations to domestic sourcing can be found in Ethiopia. Some Corporations such as Textiles, Chemicals and Cement are, within the limits placed upon them, favourably disposed to domestic sourcing to the extent that they have, usually within their own boundaries, developed a real capability. This contrasts with for example the Coffee and Tea Corporation who in spite of their relatively low applied technology and simple process plant are only partially involved in domestic sourcing and the National Metal Works Corporation whose contribution is minimal.

It is recognised that involvement in domestic sourcing makes project management more complex and difficult. Thus in an environment where recognition and rewards for commercial initiative and innovation, which by definition is difficult and demanding, are rated much lower than those given for volume production, there is a reluctance to become involved in domestic sourcing.

Given that the concept should be pursued with vigour there is a need to influence project owners to take positive action. This could be achieved by means of legislation but it is the Consultants view, and indeed the view of the majority of industrial managers interviewed, that this would be inappropriate. An approach based upon the provision of an enabling environment, advisory and support services and a policy requirement on project owners, is considered to provide the basis by which the best results will be achieved.

However without a combination of an agreed requirement and target, checking mechanisms (managers will often put a lot of energy into defeating and bypassing a requirement which makes their job more difficult and demanding), and a support service, the rate of growth of domestic sourcing will be, as a natural process, very slow.

3.6 Refurbishment and Improvement Projects

As indicated earlier, not all projects undertaken by Corporations are major developments in new product or technology areas. As part of managements task of improving business performance there is a need to consolidate earlier investments and carry out refurbishment, debottlenecking and performance improvement projects. This has become an established pattern in some Corporations, as in the Textiles Corporation for example, and is expected to become a more common activity in other sectors. In the metals sector for example a current major study by WS Atkins includes recommendations for this kind of approach.

Those Corporations actively involved in smaller scale projects are now tending to take the lead and to manage more and more of these projects themselves. Another demonstration of a basic capability upon which to build.

Similar examples of such initiatives can also be found in the private sector.

3.7 Project Owners and their Role

The direct ownership of a project is considered by the Consultants to be a fundamental requirement as is the assignment of implementation responsibilities and subsequent operational accountability. This is a prerequisite if the correct commercial decisions are to be made which will provide an operational facility within a financially viable framework.

As a result of the increasing economic difficulties of the country and the severely limited foreign exchange, project owners have found that the simplest and often the quickest method of getting a project off the ground and into routine operations is to employ a foreign general contractor. In effect delegating almost all of the tasks in return for a fee.

It is quite normal today in developed countries for project owners to use general contractors as their management agents for large capital project and as a mechanism for resourcing peak demand. By contrast in the past companies developed very large internal project capabilities. The current trend is to limit the "in-house" capability to specialist process technology, which is often secret, and for general technology to be "bought in" as required. Therefore the development of total in-company project engineering capability is in the view of the Consultants to be avoided.

Although development projects in Ethiopia are generally not on a massive scale, a pattern which is expected to continue, it is suggested that the main reason why project owners continue to use general contractors is that the necessary management and engineering skills for major projects are perceived as not being available locally. In addition the local management of projects

is made much more difficult, and some suggest impossible, by the acute shortage of materials.

This deficiency of management skills is true but only within certain limits. There are examples of project owners managing projects themselves, with and without foreign technical assistance, albeit on a generally smaller scale. Even 10 years ago this was happening and today the numbers of examples are increasing. This demonstrates that there is a basic foundation upon which to build.

4. THE BENEFICIARIES AND RECIPIENTS OF DOMESTIC SOURCING FOR PROJECTS

All parties involved in the process, that is:

* **domestic suppliers** through increased business activity which if managed well will yield improved business performance

* **project owners** whose projects should be completed at lower total and foreign currency cost and who will then have available a local supply chain for repair and replacement in the future

* the **nation's** economy because the demand for foreign currency for a given project should be reduced by adding value locally which enables either that currency and any accompanying debt service payments to be put into reserves or as will be the situation in Ethiopia for many years to alternative use

* the **labour market** for which new employment opportunities will emerge will directly benefit from increased levels of local economic activity.

The overwhelming majority of the manufacturing industry is vested in the Public Sector. It is dominated by the ten major corporations of the Ministry of Industry and under the current ten year plan the major part of the nation's capital investment will be located within these corporations. In addition there are a number of other important organisations, such as those concerned with tea and coffee and utilities providers, water and electricity, which are also involved in major capital projects.

It is understood that plans are being developed for some restructuring of the public sector, however its precise nature and form has yet to be finalised and revealed. It seems most likely that it will be based upon devolved responsibility and authority, increased autonomy and independence, and a requirement for improved and sustained economic performance. At some time in the future a degree of privatisation and joint venture arrangements can be expected, but it is thought likely that the extent of changes achieved in the next few years will be limited in the industrial sector.

Although recent changes in enterprise ownership and fiscal policies, some of which have yet to become legal instruments, has placed increased importance to the development of the private sector, it is most unlikely in the foreseeable future that there will be many large capital investment projects in the private sector. In time it is foreseen that there will be an increasing number of foreign joint venture companies and these will involve major capital projects. However even under the most favourable scenarios of a mixed economy, the government will be a major if not a majority shareholder in industry. So although such companies will operate and trade as though they are private sector companies the government will continue to influence their initial development and any subsequent major expansion.

The expected substantial growth in the private sector in the coming years, outside the major joint ventures with the government, are most likely to be in SME's. They will generate a significant number of small capital projects but the greatest benefit to them will be business growth through increased opportunities in domestic sourcing of public sector projects.

Since the services of PEMSU are targeted at the owners of large and small capital projects it is clear that the majority of PEMSU's customers will be the various emerging forms of public sector companies.

In the absence of really radical the public sector will remain the dominant force in Ethiopian industry and the major beneficiary of increased domestic sourcing.

5. CAPABILITIES AND NEEDS IN ENGINEERING CONTRACTING

5.1 Overview

The review of progress in domestic sourcing has shown that in spite of the inherent difficulties of carrying out this activity in Ethiopia, considerable progress has been made in terms of developing the necessary physical facilities and core of expertise and experience.

The overall situation is ready for exploitation especially in view of the Government's new economic and enterprise ownership policies.

PECU was conceived as a general contractor to unpackage major projects and to implement the unpackaged domestic components. Thus the activities of PEMSU were defined in terms of the components of an engineering contractor and included the following:

- project engineering
- detailed design
- manufacture
- contracting
- costing
- inspection
- coordination of local manufacture
- quality control
- erection
- commissioning.

However since that time the circumstances in Ethiopia have changed and further very significant changes are predicted. Therefore it has been necessary

to reconsider these components in order to develop a revised definition. This has been carried out within the framework defined in section 2 and the review contained in section 3 illustrates the level of progress already achieved in domestic sourcing.

5.2 The Overall Approach to Projects

Some newly industrialising countries have limited technological capability and operational experience and therefore they rely on foreign expertise for developing their industrial base. Thus major development projects are conceived and perceived as very large packages of work to be undertaken by a foreign general contractor and not as projects to be undertaken and managed by the project's owners. The custom and practice of utilising turnkey contracts as the mechanism for the creation of facilities is in management and technological development terms convenient and comfortable for project owners so there is a natural reluctance to think of and execute projects in other modes.

It is recognised that this approach may well have been appropriate in the 1980's when the local capability to implement projects was limited. However the increasing experience of project preparation and implementation means that it will be more appropriate to adopt a modified approach in the 1990s, which will be more related to that followed by the developed world. This practice is in place and is being developed further by corporations such as Cement, Chemicals and Textiles. In addition, as the frequency and spread of small scale development projects increase, those involved will strengthen their capability and confidence to tackle bigger and bigger projects in this way.

This "bottom up" approach to the development of projects presents a project as a series of small packages of work - process and plant requirements - and thereby eliminates what is often seen as a technically specialist task of "unpackaging". Thus the process of identifying the potential for domestic sourcing is simplified.

5.3 The Project Cycle

The following sections present the conditions that are considered by the Consultant to be necessary to increase the level of domestic resourcing in the capital projects.

5.3.1 Ideas and concept development

Although in an ideal world considerable thought should be given during initial stages of project definition to appropriate technology and domestic sourcing, in practice, it is rarely achieved.

In a sense this is less important because it is the subsequent stages of the feasibility study and project appraisal where such issues must be the subject of detailed consideration.

Finally it is much better to allow the ideas and concepts to be generated and allow subsequent stages to resolve the detailed practical aspects.

5.3.2 Feasibility study

Feasibility studies should be carried out in accordance with either the World Bank or UNIDO guidelines. Both approaches normally yield the same investment decision but since the new Project Appraisal Department we are told, employ the World Bank methodology then this approach should always be followed. Scenarios which include partial or total local sourcing should be included in the analysis as well as a definition of technology which will strengthen and build on the indigenous industrial base.

The process of selecting the technology should be based on a wider range than those for equivalent projects in the developed world. It must be recognised that a process definition that can be justified as "appropriate" for a developed sector may not be the most "appropriate" for a less developed sector where

labour costs are lower and justify a choice of higher labour intensive, cheaper and less sophisticated indigenously supplied plant.

The configuration of capital assets for a project must therefore be selected to maximise the use of resources in which Ethiopia holds a commercial advantage such as the cost of labour, and employ technology which is "appropriate" to the nation's capability and capacity.

5.3.3 Project Appraisal

The project appraisal process should provide a more detailed review of domestic sourcing and appropriateness of technology.

In principle the project appraiser should satisfy himself that all reasonable efforts have been made to include the majority items from the general list of locally available products and services.

This reference information is generally not available and its provision is a task to be undertaken by PEMSU.

5.3.4 Scheme Development

The purpose of this stage is to establish the detailed technical specifications that will form the brief for detailed engineering.

The outputs will typically include:

- the outline arrangement of the facility
- the process routes
- mass flow diagrams
- functional specifications for the production equipment
- functional specifications for the services equipment
- building and civils outlines.

Domestic capabilities exist although rarely used, to undertake this level of scheme development for straightforward projects which have already been subjected to thorough feasibility analysis. For projects which require novel process plants and equipment the local project leadership should supplement their expertise from other sources.

The Consultants have noted that a core of local expertise exists largely within the project owning organisations. These have accumulated considerable process knowledge and experience in existing process technology.

Therefore it is considered that the project team should be based at these expertise centres in preference to the alternative local consultant or overseas contractor. This organisational approach has distinct advantages of placing accountability for the implementation of the project in terms of content, time, capital cost and ultimately of its overall production performance with the user.

5.3.5 Detailed engineering

It will be necessary to progressively develop a local capability in detailed engineering covering designing to codes of practice, plant layouts and the production of detailed drawings for manufacture/fabrication.

This study has indicated that project owners already have a degree of process engineering capability and it is the Consultants view that this should be strengthened in-situ and not outside. Consequently PEMSU is seen to be a provider of general engineering services for domestic sourcing and it is this core capability that should be developed through this project.

The normal progression for developing such a capability is to start with the production of detailed drawings for manufacture/fabrication based initially upon foreign contractors' layout drawings. The second phase is then to develop locally produced layouts and designs and from these the detailed manufacture/fabrication drawings. This is the process that is seen to be appropriate for PEMSU.

However this development process must be carefully controlled so that the unit's inexperienced resources can be nurtured and developed through assignments at a pace and level consistent with their capability and capacity. Without such control, the demands from projects may become excessive and unrealistic and result in a failure to deliver quality products on time. This would be a great disservice to domestic sourcing and would constrain its growth.

Taking this into account the Consultant considers that the first disciplines to be covered should be structural engineering, mechanical and fluids services and electrical layout schematics.

5.3.6 Contract strategy and instruments

It is important to ensure that the contractual instruments that are used to implement projects with higher levels of domestic sourcing maintain a satisfactory level of obligation on the contractors to perform within the overall project obligations.

Clearly any fragmentation of the traditionally single foreign implementation contract reduces single point accountability and therefore necessitates a very carefully developed strategy to be put in place.

Given that:

- the scope of local supply to capital projects lies mainly in the Basic Metals Sector

- there is not a large contractor in existence in the sector who could absorb the overall responsibility and contingent penalties for default

- there is a very wide capability and capacity in the sector which is fragmented throughout the public and private sectors and which is largely untapped,

there are two ways in which the opportunities for local sourcing can be realised:

* by collecting the facilities together into a large organisation which could undertake to meet the total demand under a single contract

* by utilising the existing resources in their current proven organisations through multiple contracts.

The first option would provide the project owner with the simplest contractual relationship at the cost of total disruption to the existing organisations. This would introduce significant drawbacks not least of which would be to stifle the innovative initiatives that are essential for successful completion particularly in a developing industry where materials and skills are scarce. The second option would overcome the drawbacks of the first but require the project owner to exercise more control of the multiplicity of contracts.

The second option is recommended so that the project owner continues to be the central party responsible for the implementation of a project. He will need to develop further skills in the project control methods that are necessary to manage the implementation of multi-sourced projects which are supplied under separate contracts by local organisations.

This approach also offers the opportunity for immediate use of the dormant capability without delay for institutional changes to be implemented or new hardware commitments in foreign exchange. Project performance can be secured in part through careful planning of the contracts that will have to be let to complete projects which have progressively increasing locally sourced contents.

The foreign elements will continue to be negotiated in much the same manner that they are at the present.

It will be necessary to establish conditions of contract to cover the supply of services and equipment which are obtained locally. Certainly while this supply route is in a fledgling development phase both the contractors and clients roles will be simplified if suitable standard conditions can be agreed.

Therefore two key roles of PEMSU are foreseen:

* advise on contract strategy
* advice on contract instruments and contract management.

5.3.7 Manufacture/purchase

Before the existing facilities can be brought into general use to support local sourcing initiatives, it will be necessary to identify and publicise their capabilities. This activity will be particularly important in enabling the project owner to identify the scope for local sourcing and subsequently directing the work to the capacity centre that can perform the required process. It is likely that some jobs may have to moved between fabricators to enable all the work to be completed.

The majority of manufacturing operations have very limited design capacity and to cope with new demand they will need to be supported with a design capability either internally or externally so that the typical one off project component can be produced without the need for recourse to patterns. Since for the first few years the focus will be on a general engineering and design. This will be an important service for PEMSU to provide.

The supply of raw materials to the manufacturing facilities will have to be arranged to meet the time and cost constraints of the projects either by project owners or in time through some form of stockholding service. Without an effective material supply, the current norm, little can be achieved.

5.3.8 Installation

The present patterns can be expected to continue but additional local services may be required to cope with the additional work load.

In the longer term it may be possible to seek other opportunities in the overseas market for these experienced installation teams where the labour rate advantages could be exploited.

5.3.9 Commissioning

Again the present patterns are expected to continue with project owners teams taken an increasing share of the workload.

5.4 Future Development of Export Capability

Industries in a developing country must adopt the duel focus of economic import substitution and export development.

Much thought is being given to this for Ethiopia and one of the ideas emerging is for a duty free zone in which to carry out conversions using Ethiopia's competitive advantage of low labour cost and its special trading arrangement with Europe and surrounding African states.

However the Consultant believes that before such advantages can be fully exploited it is desirable to consolidate the existing capability in order to provide an even stronger base upon which to build export led ventures.

In this context there appear to be two possibilities for developing an export potential within the project based sector:

* the development of teams of technicians who could be contracted to work on overseas capital development projects

- the development of Joint Ventures which would provide for foreign technology inputs and materials which would have value added in Ethiopia by employing the economical labour rates. This would also result in the further development of the local industrial base.

There are longer term targets which are however largely outside the scope of this project.

6. THE PROBLEMS OF MATERIALS SUPPLY

Developing the industrial and economic base, achieving high levels of utilisation of facilities and the growth of domestic sourcing in capital projects are all constrained in Ethiopia by the acute shortages of materials.

This shortage is largely caused by the limited availability of foreign currency for the purchase of essential imports and the route cause of the problems can be found in the very difficult state of the Nation's economy.

For projects the situation is made more difficult because of the slow response and somewhat inflexible centralised national planning system and in the light of the actual availability of foreign currency an over ambitious capital project portfolio.

Thus any moves towards the planning and implementation of a capital projects portfolio which is consistent with the availability of foreign currency would begin to alleviate the materials shortages problem. At the time of this study the Consultant was unable to identify that such moves have been initiated.

The general moves towards a mixed economy and the envisaged changes in the national planning system will not by themselves have a major impact upon materials shortages as it is generally expected that foreign currency for the purchase of imported materials will continue to be constrained for many years to come.

Those project owners who are already involved in domestic sourcing have been able to somewhat reduce the impact of materials shortages by including in their foreign supply contracts the materials needed for local conversion.

Sometimes this works and sometimes it does not because of the rate at which purchases are able to be made.

To be successful suppliers of domestically sourced services must provide a rapid response, supply on time and also assist project owners to resolve promptly the myriad of construction and commissioning problems that always arise due to "errors and omission", "punch lists" and last minute changes. This timely response is critical to project completion which in turn dictates the time to reach steady state operations and achievement of a viable business performance.

Such responses cannot be provided without materials.

Ways and means must be found to provide such materials without resorting to hoarding. Without them the successful growth of domestic sourcing will be constrained and slow, and generate unfavourable attitudes to domestic sourcing currently in some project owners. The private sector will also be reluctant to exploit the new business opportunities unless the current materials supply arrangements are changed to provide reliable availability at competitive prices.

In developed countries it is a stockholder who generally provides these materials at short notice which enables the contractors to respond quickly.

Such services did exist before 1974, but today they are not available.

Running a cost effective stockholder service is not an easy task since it requires special management skills, a technical capability, understanding of the market - supply and demand, and an international purchasing organisation which can gain from the economics of large scale purchasing.

In the present state of the economy and industry the Consultant believes it is unlikely that a stockholder service will naturally emerge for many years because of the economic situation will continue limit foreign currency

availability for materials purchasing. It is the Consultants view that it will be necessary to provide some form of stimulus.

As a first stage in this stimulation process the Consultant suggests that a special study is carried out to:

* define the core requirements, the "stock book" of preferred sizes and materials

* identify international stockholders and local enterprises who may be prepared to engage in a stockholding joint venture

* investigate the sources of external financial support for such a venture

* propose a strategy and mechanism for bringing a stockholder service into commercial operation

* examine the financial aspects.

Initial estimates suggest that a consultancy input of 24 man months concentrated over a six month period would be required to carry such a study.

It is understood that the Government and the Ministry of Industry is very aware of the problem and is giving consideration to this form of initiative within the context of its new economic and business policies. However it will need the support of an international funding agency in order to carry out the initial study indicated above.

The Consultant believes an effective basic stockholding service is a prerequisite for the rapid growth of domestic sourcing of capital projects.

7. BLUEPRINT FOR THE FUTURE

7.1 Overview

The study has shown that there is:

* capability and capacity in place to immediately begin to raise the level of domestic sourcing

* a wide range of positive and negative attitudes amongst project owners to increasing domestic sourcing

* a lack of general awareness and understanding of where, when and how increased domestic sourcing can take place

* project owner organisations who are developing capabilities in managing projects.

It must therefore be the aim for the next decade to continue to expand domestic sourcing using a combination of the NMWC fabrication shops, the maintenance/fabrication facilities of other sectors and the private sector.

Against this background it is the Consultant's view, taking into account the changing economic and enterprise policies of the government, that it would be inappropriate to attempt to establish PEMSU as a general contractor as such organisations will naturally grow in response to market forces.

The establishment of additional fabrication/manufacturing facilities is also considered unnecessary because of the very large under-utilised capacity available now and in the future as a result of materials supply constraints.

The Consultant also considers that the development of local sourcing in Ethiopia has not reached the stage where cost effective interventions into local sourcing of proprietary equipment and processes would be beneficial. This judgement is based in part on an analogy of the real costs of locally produced spare parts at Akaki which are representative of the costs that would normally be incurred manufacturing proprietary equipment in small quantities.

An approach to stimulation of domestic sourcing by government regulation whether through legal instruments, quotas or conditions of project approval has been rejected. It is believed such interventions would encourage project owners to put a considerable amount of energy into "beating" and "bypassing" the system on the one hand or lead to overburdening of local capacity through unrealistic and excessive demands. Both would lead to a level of commitment and success far below that which could be achieved by voluntary means.

The Consultant therefore proposes an approach to the development of domestic sourcing in Ethiopia to reflect its current stage of development and which is based upon:

* strengthening and developing the existing capabilities for project management, general engineering, fabrication and installation

* encouraging project owners using information and promotional activities at all stages of the project cycle to take local sourcing initiatives and to make voluntary commitments to raise their content

* initiating demonstration projects

* providing support and advisory technical services to assist project owners in areas of perceived need

* providing support and advisory technical services to support domestic suppliers, in the public and private sectors to support their successful entry into the market.

The rate of growth of domestic sourcing is at this stage difficult to predict but the general view is that once the principles and practices have been established and confidence developed by suppliers and project owners the rate of growth could be rapid. Under such circumstances the Consultant does not consider it appropriate to lay, through PEMSU, the foundations for a large institution but rather to create small cells of expertise that can grow in situ or as separate entities in line with demand for their services. Equally at this time it is not possible to define whether this second phase of growth should be within the public or private sectors or through forms of partnership or joint venture.

The activities and services required to support the development strategy are:

* Design House providing general engineering design services in industrial buildings, mechanical services, structural engineering and electrical services

* Domestic Sourcing Promotion Unit

* Project Management Services Unit providing time and cost control, contracts and inspection services

* Stockholder Services.

In its original concept the unit contained the first three of the above, the fourth, stockholder services, was not previously considered. Successful domestic sourcing is in part dependant upon a fast responsive supply sector. Under current conditions of extreme shortages of materials a fast response is difficult if not impossible. Thus in the short term and as proven elsewhere a fast response stockholder service will have a major influence on the growth of domestic sourcing.

It is recommended that these services, with the exception of those of the Domestic Sourcing Promotion Unit, should not, from the outset, be provided

free of charge. The aim must be to develop these services into viable businesses within a few years. (This of course will exclude the initial costs of specialist external advisers and for a period capital charges). It is important that market forces are applied as soon as possible to sharpen efficiency and effectiveness and to provide a sound foundation for long term success.

The required activities and services, with the exception of stockholder facilities are developed in detail below. The stockholder services require additional investigation which is outside the scope of this study and therefore only an outline has been provided below.

7.2 Activities and Services

7.2.1 Design house

It is foreseen that the design house will initially have a limited capability to carry out design services in:

* industrial buildings
* mechanical services such as pipework, heating and ventilating
* structural engineering
* electrical services primarily distribution and simple control systems

to support domestic sourcing initiatives by project owners using local suppliers.

The demand for design house services will largely relate to non direct production items, but will extend into production operations where the technology is low and non proprietary. So for example they could be involved in the design of direct production facilities for tea and coffee processing which is essentially low technology and non proprietary but are unlikely to be involved in the direct production facilities of a new chemical plant which involves new technology and/or major proprietary items.

There are no established design houses upon which to call largely because these services have traditionally been supplied by foreign general contractors and consultants. In the private sector there are individuals who make their design skills available to manufacturers, often as secondary employment.

Therefore overall there is seen to be a shortage of these services and so an initial capability is proposed for PEMSU.

The study has shown that process technology, consistent with the current level of applied technology, is unique to and available within the Corporations. It should therefore not be replicated outside as this is unnecessary and would be wasteful of the nation's scarce process engineering resources. Technology outside this category can be purchased from external agencies by project owners' process departments.

Thus since process technology is held within the project owners organisations no provisions are proposed for this very wide range of services within PEMSU.

The design house will produce complete detailed designs for the project components contracted to them and this will include:

* plant/equipment sizing
* detailed layouts
* detailed designs
* equipment schedules
* materials lists
* construction/fabrication details
* standards
* and possibly a construction/fabrication programme for input into the projects master programme.

In detail these activities will be project and discipline specific.

Since the services of the design house will have some professional similarities to the activities of existing institutions it is expected that they will develop professional linkages with them. These include the design service of EDTC in respect of equipment and parts and with the small industrial buildings design service provided by HASIDA. However in view of the very different nature of the tasks to be undertaken and target markets the new design house should be independent.

However it is proposed that the design house should initially be an integral part of PEMSU.

7.2.2 Domestic sourcing promotion unit

This unit is envisaged to be temporary in that once domestic sourcing has become a routine project management activity its services will no longer be required. The Consultant foresees a life span of less than ten years.

The overall task of the unit is to make strategic interventions into the project cycle to influence project owners thinking and action on domestic sourcing. The key intervention point are:

* **the first intervention** must occur at the beginning when the scope of works is identified. It is important that the scope is reviewed to identify those activities that can be undertaken in Ethiopia. These may include some aspects of design, manufacture, erection and commissioning

* **the second intervention** will occur at the feasibility study when the various options are technically assessed and costed. At this stage the general terms of reference for the project are established and these should include the agreed sourcing policy

* **the third intervention** will occur at the project appraisal when the feasibility study is assessed by a body who are outside the reporting lines of the project owning organisation

* **the fourth intervention** point will be at the design and sourcing phase when the commercial enabling instruments are established.

The unit will therefore be assigned the following principle functions:

* to develop and maintain a detailed information base of demand and supply for domestic sourcing

* to actively promote domestic sourcing to project owners and suppliers by means of promotional campaigns, literature, seminars and personal intervention

* to advise project owners at the feasibility stage of sources of domestic components and services on a project by project basis

* to make available to those government departments and agencies responsible for authorising projects the appropriate information on sources of domestic supply and services

* to identify and initiate some demonstration projects in domestic sourcing

* to advise project owners on appropriate contract and project management strategies which will facilitate effective and efficient domestic sourcing.

These activities are difficult and quite complex but crucial to the success of a voluntary approach to developing domestic sourcing in Ethiopia. The success of the unit will be judged by its ability to influence those project owners who at this time are unfavourably disposed to increasing domestic sourcing in their projects.

There is little experience of marketing and promotional activities and of domestic sourcing in the country. The unit by its nature requires staff with a

range of skills which cannot be acquired through conventional training. It is the Consultant's view that such expertise can only be developed to the high standard required by "learning through doing" with professional technical coaching support. Thus it is foreseen that for the first few years the unit will require continued external specialist support.

It will be necessary to carry out very careful recruitment and selection to establish an appropriate team for this demanding role. The conventional approach of "assigning" staff is not considered appropriate on this occasion.

It is envisaged that the following tasks will be undertaken by the unit:

* carry out a techno-market survey of supply and demand covering the next few years

* identify a limited range of demonstration projects on domestic sourcing and take the necessary influencing action to ensure successful implementation

* provide specialist advice to project owners and third parties on domestic sourcing

* develop a strategy for stimulating domestic sourcing in line with resources availability and capability and the demands identified by the market survey

* develop and implement a promotion plan, for what is the core business of the unit

* develop and establish a mechanism for regular updating of the information base.

The rewards for success and the penalties for failure are both high and in view of this it is proposed that the external specialist plays a leading role in the unit in the first 1-2 years.

7.2.3 Project management services unit

The management of multi sourced contracts is not an easy task, especially for large projects which have significant domestic and foreign components. Although it has been custom and practice, and still is to a greater extent for major projects, to delegate this responsibility to a foreign general contractor, increasingly project owners are or will take over this responsibility. Initially this is being done on smaller projects and in time it can be progressed to the larger projects.

The Consultants view is that there is an overall shortfall of expertise in the application of project management techniques and therefore propose that a small unit is established in PEMSU to begin to fill this gap and provide a training service, possibly in conjunction with the Ethiopian Institute (EMI), to train project owners staff in the longer term.

Initially the principal activity areas have been identified as follows:

* time and cost control
* non civils estimating and quantity surveying
* contracts preparation and management
* inspection services.

Most of these activities once mastered become largely routine and will be based on standard procedures and systems.

Although such procedures and systems are well established in foreign contracting and project management services consultants, such systems and procedures will not necessarily be appropriate for Ethiopian conditions and therefore should not be purchased for transplantation. Appropriate systems

and procedures for Ethiopia at its current stage of development should be based upon appropriate frameworks, concepts and tools and therefore fully developed systems may need to be revised. These revisions should not use the "blank piece of paper" approach but should be based on a combination of the recently produced Ministry of Industry Draft Project manuals and other local experiences. This should not be contracted out to an "expert" but developed as a joint activity between Ethiopians, with some experience and appropriate education attainment and a practical external specialist.

This simple and practical approach is particularly important in inspection services. Initially the focus will be on ensuring that domestic components have been manufactured/fabricated in accordance with the drawings so that they actually fit on arrival at site and that the correct material has been used. At site the inspection will simply be in terms of erection and plant alignment and general fit. At a later stage additional dimensions will need to be inspected as well as welds, first by visual inspection and later, beyond the duration of this project, by NDT testing. At some stage quality assurance procedures will need to be developed, put into place and their implementation by suppliers checked.

Thus the first activity of the Project Services Unit is to develop appropriate systems and procedures and then develop their expertise by application to the demonstration projects and subsequently in support of project owners and domestic suppliers as well as providing client training.

7.2.4 Stockholder services

The Nation's acute material shortage, which is generally accepted as unlikely to be resolved within the time scale of the project, will continue to have a constraining effect upon the growth of domestic sourcing. The emerging private sector is foreseen as potentially the major force in domestic sourcing in view of the Government's new policies on the mixed economy and enterprise ownership. Even so it is likely that the private sector will, because

of its embryonic stage of development be constrained more than a public sector supplier.

A mechanism should therefore be found to alleviate this situation.

The Consultant is of the view that a mechanism could be found to facilitate the establishment of a local raw materials stockholding service. The most attractive configuration being some form of private sector joint venture in conjunction with a successful international stockholder. This would enable the proven resources, buying power and management expertise to be utilised for a new enterprise in Ethiopia.

It is proposed that a further study is made to identify the operational parameters that a stockholder would be required to achieve. The study should:

* define the core requirements, the "stock book"

* identify international stockholders and local entrepreneurs who may be prepared to develop a joint venture to set up and operate such a service

* investigate the sources of external financial support for such a venture

* propose a strategy and mechanism for bringing a stockholder service into operation

* examine the financial aspects.

Initial estimates to carry out this study indicate that a duration of six months and a total consultancy input of 24 man months. However this aspect is outside the scope of PEMSU and EDTC and therefore a new, probably assisted government - Ministry of Industry initiative is required.

7.3 Organisational and Institutional Arrangements

7.3.1 Institutional arrangements

In the original project proposals, the unit was to be established as part of the Engineering Design and Tool Centre which itself would be an agency of the National Metal Works Corporation.

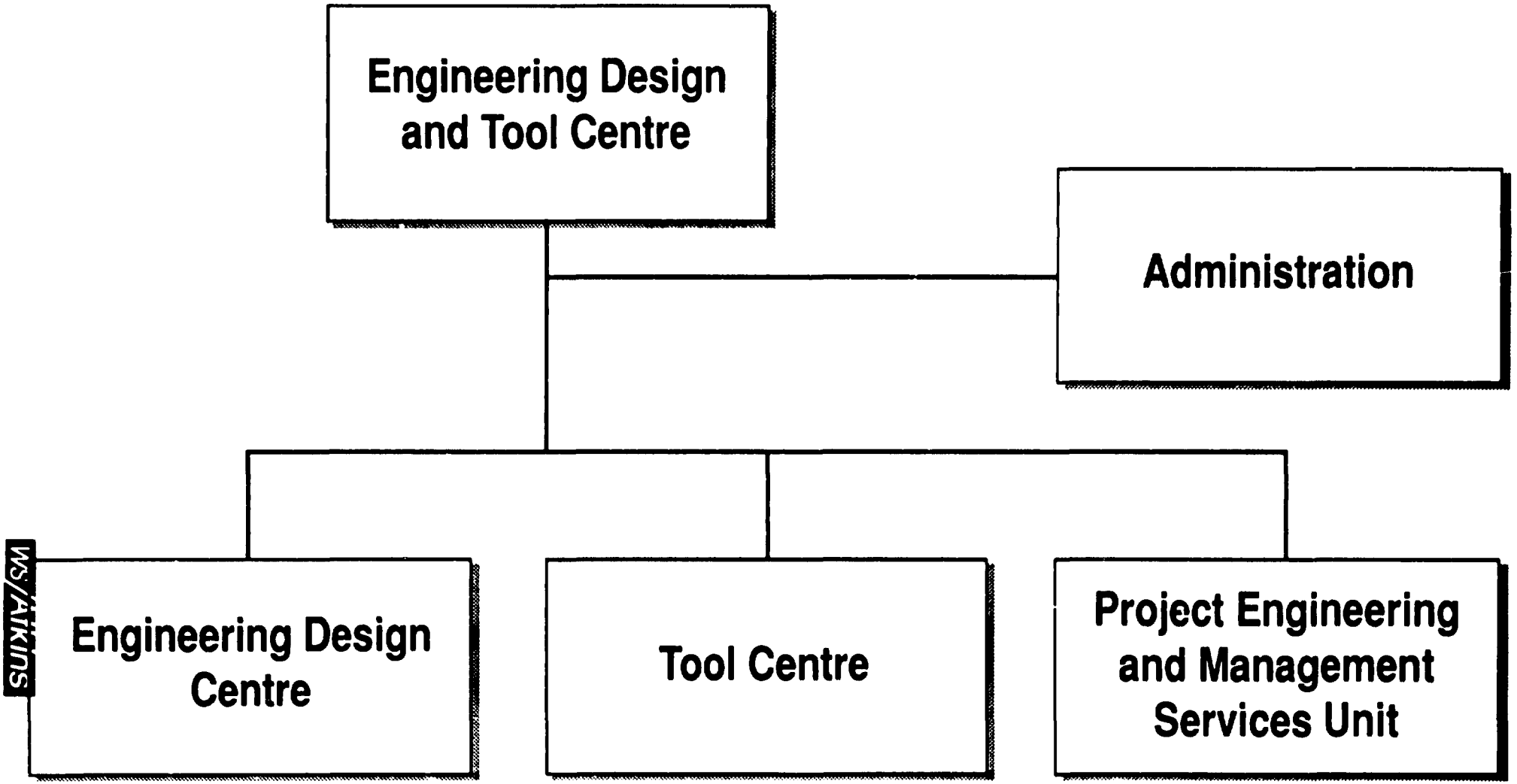
Whilst the Consultant supports the concept of PEMSU as part of the EDTC, as shown in Figure 7.1, Organisation of EDTC, if for no other reasons than it is to provide it's office accommodation and supporting administrative services during this fledgling stage, the Consultant does not support the direct linkage and dependency of PEMSU with the National Metal Works Corporation.

The basic metals and engineering sector is traditionally the provider of domestic sourced project components. However in Ethiopia there are substantial fabrication/manufacturing capabilities fragmented in the Corporations and it is important that they are not marginalised in the new initiatives as their capabilities need to be exploited. It is considered that this alienation is a real possibility with direct linkages with the NMWC as it will be seen as a service by and for the NMWC and not really for all project owners and domestic suppliers.

Such unfavourable perceptions could be developed in the embryonic and very important private sector and would discourage them taking up the new business opportunities.

Therefore the Consultant is of the view that PEMSU and its parent EDTC should not be directly linked to and be managerially dependant upon the NMWC.

Figure 7.1 Organisation Charts - EDTC



The industrial sector is predominantly in the public sector, a situation which will not significantly change for many years and therefore PEMSU and its parent EDTC has to be linked with the Ministry of Industry. This should not be as a department but as some form of independent agency, ideally an enterprise agency to reflect its target of financial viability.

There are a number of units which are functioning, under development, or planned, which are conceptually involved in the practical, rather that the theoretical development of various aspects of the engineering industries. These include PEMSU, EDTC, Engineering Department of HASIDA, the Demonstration Foundry project, and sector based activities such as the CPMPII workshop of the Ministry of Tea and Coffee.

It is understood that active consideration is being given by the Government and the Ministry of Industry to a reorganisation of a number of agencies, enterprises, projects and departments and that there is the possibility that similar existing and proposed operational units within the Ministry, will be brought together into a single agency. In principle this has the support of the Consultant who foresees an agency comprising at least EDTC, PEMSU, HASIDA Engineering Workshops and the Demonstration Foundry. Such a grouping could be described as the Ministry of Industry sponsored Engineering Development Enterprise.

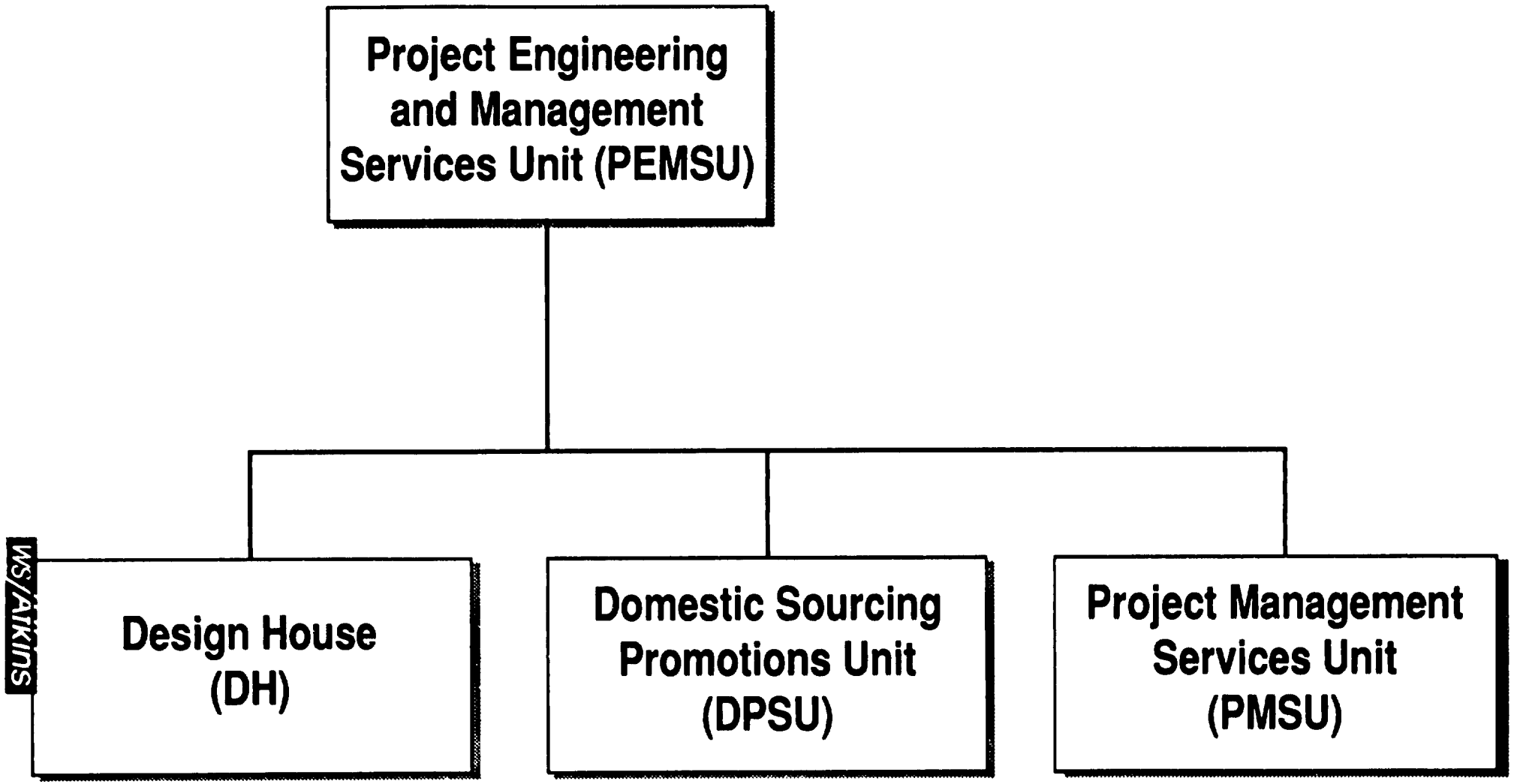
7.3.2 Organisational arrangements

The overall organisation structure for PEMSU is given in Figure 7.2 and this shows a three functional structure, namely:

- Domestic Sourcing Promotions Unit (DSPU)
- Design House (DH)
- Project Management Services Unit (PMSU).

which initially will collectively form one of the divisions of EDTC.

Figure 7.2 Organisation Charts - PEMSU



Overall responsibility will therefore be vested in the General Manager of EDTC, the NPD, and administrative support services will be provided to the division by EDTC.

The manning schedule, covering the duration of the project is shown in Figure 7.3. This shows an overall manning level, excluding the NPC and administrative support services of 25.

PEMSU is not seen as a direct provider of substantial new employment opportunities but through it services as a stimulator of new employment in other organisations.

For PEMSU to succeed and to gain a reputation then it must quickly develop small team who "get it right" first time.

Accordingly the numbers envisaged for PEMSU are small. This is a deliberate, carefully considered decision. The Consultant believes that quality not quantity should be the guiding principle and only when the units are proven in the market place should a next phase of expansion be considered.

Even with such small numbers the Consultant considers it prudent to have a phased recruitment which means that the total complement will not be in post until 20 months into the project.

Job descriptions for the key posts of PEMSU are provided in Annex F.

7.4 Facilities and Equipment Requirements

7.4.1 Accommodation

Provisions for office accommodation have been made in the new EDTC complex currently under construction. Essentially this comprises the top floor of the office block which is considered in overall space terms to be an adequate provision.

Figure 7.3 - Manning Schedule

	Dates in Post
Head of PEMSU	On commencement
Secretary	On commencement
Head of Design House	Month 3
Design Engineer - pipework	Month 10
Design Engineer - HVAC (heating, ventilating and air conditioning)	Month 10
Design Engineer - structural	Month 10
Design Engineer - electrical	Month 10
Design Technician/Draughtsperson - pipework	Month 6
Design Technician/Draughtsperson - HVAC	Month 6
Design Technician/Draughtsperson - structural	Month 6
Design Technician/Draughtsperson - electrical	Month 6
Head of Domestic Sourcing Promotions Unit	
Techno - Commercial Engineer 1	Month 1/ Month 13*
Techno - Commercial Engineer 2	Month 1
Techno - Commercial Engineer 3	Month 6
Techno - Commercial Engineer 4	Month 6
Documentation Officer	Month 2
Word Processing Operator	Month 3
Head of Project Management Services Unit	Month 6
Project Planner 1 Month 9	
Project Planner 2 Month 20	
Project Planner 3 Month 20	
Cost Control Engineer Month 9	
Contracts Engineer 1	Month 9
Contracts Engineer 2	Month 20
Inspector Engineer Month 9	
Inspector Technician	Month 20

Note. Administration Support is assumed to be provided by EDTC.

* assumes that during year 1 the role is carried out by the Head of PEMSU after which one of the techno-commercial engineers will be promoted to the Head of DSPU and a replacement then recruited.

However some minor modifications are required to the layout, refer to space plan in Figure 7.4.

7.4.2 Equipment and supplies

In addition to the usual national provisions of standard office accommodation including desks, chairs, bookcases, filing cabinets, notice boards, a range of special equipment is required as follows:

Domestic Sourcing Promotional Unit

One PC, with software for document preparation
One PC, with software for the data base activities
One laser printer
Two saloon cars

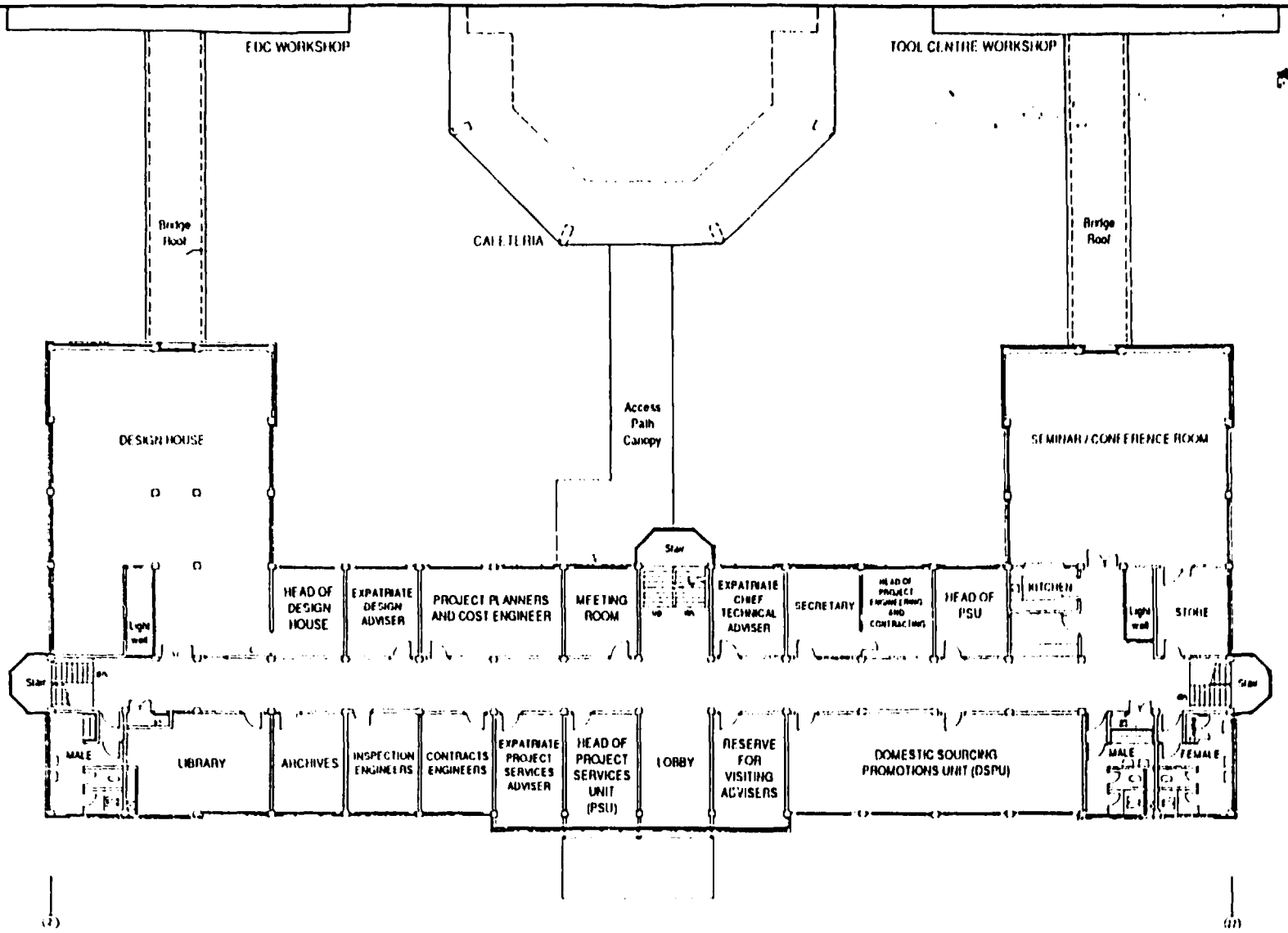
Design House

8 Design stations
One CAD station

note no reprographics equipment is required as sufficient will be in place when EDTC is commissioned.

Project Management Services Unit

Two PC's with software for project management services
One dot matrix printer
One basic inspection kit
One estate car for the inspection team
One advanced inspection and testing kit



WS/Atkins

OFFICE BUILDING

SECOND FLOOR PLAN

PECU OFFICE ACCOMODATION

WS Atkins International Ltd

ENGINEERING DESIGN AND TOOL CENTRE PROJECT, ADDIS ABABA, ETHIOPIA

FOR

GOVERNMENT OF ETHIOPIA and UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANISATION

DRAWING No 1

REVISION

General Equipment

One PC with software for document preparation
One laser printer
One fixed bed photocopying machine
Two overhead projectors with screens
Report binder machine
Supply of consumable stores
One 15 seater general purpose staff service vehicle
Provision for the purchase of technical documents, books, periodicals and standards
Hardware requirements for the provision of sound and vision services in the conference room.

7.5 Technical Assistance

The development of PEMSU cannot be achieved within a reasonable timeframe without substantial technical assistance support. This support is needed to guide, train and to assist the staff of PEMSU in most aspects of their work.

PEMSU's services are to be based upon a diverse set of specialisations for which there is very little local support available in terms of volume and level of expertise. Therefore all of the specialisations will require a degree of support. In addition the approach to training with a predominance of "learning by doing" creates an additional demand for technical assistance.

It is envisaged that a total of 104 man months of technical assistance will be required allocated as follows:

	Man Months
Technical Assistance Team Leader	36
Design Adviser	30
Project Management Services Adviser	12
Contracts Adviser	6
Inspection Adviser	3
Marketing Adviser	3
Computing Adviser	2
Training Adviser	6
Home Office/Ad Hoc Consultancy Support	6

In the context of the relatively small numbers of employees of PEMSU this level of technical assistance may be perceived as high. However it only represents the equivalent of two full time specialists for the duration of the project.

Bearing in mind the importance, target and risks of PEMSU, the Consultant believes that this level is essential if the desired effect is to be achieved within the project time scale. Any dilution of the key technical advisers will put the success of the project at risk.

Having given careful consideration to the alternative arrangements for the supply of this technical assistance, the Consultant has concluded that it should be supplied by a large international engineering and management consultancy organisation as a single contract rather than as a series of individual or small group contracts.

A large organisation is better able to provide a balanced synergistic team, continuity, the necessary home office and backstop support and to effect a rapid replacement, substitution or supplementation of assigned staff to reflect changing project needs from its permanent resources. This could not be done with an individual or a range of small contracts.

Outline terms of reference for the subcontractors are given in Annex H.

7.6 Training Arrangement

7.6.1 Overall approach

Against the framework developed in Section 2.2, it is proposed that training for PEMSU staff will be based upon:

* on-the-job training in PEMSU on real tasks and with coaching support from the technical assistance team

* on-the-job training for core team of the Design House in a design contractors office

* short study tours for a small number of key staff.

7.6.2 On-the-job training

A detailed individual training plan will be prepared in accordance with the systematic approach to training for all staff of PEMSU.

Those involved in training outside PEMSU, namely

* design house core team comprising Head of Design House and the four design engineers

* the selected staff who will be participating in study tours, namely, General Manager EDTC, Head of PEMSU, Head of DSPU, Head of PMSU and the Inspector Engineer.

will have the appropriate components including in their plans.

The plans will be prepared by the Heads of Departments with the support of their assigned technical advisors and the training advisor.

Overall responsibility for implementation of the plans will be vested in the Head of PEMSU and the Heads of operational units, but the majority of the technical training will be provided by the technical assistance team. They will normally adopt a coaching role but from time to time more formal activities are envisaged.

All training will be tasked based and learning achieved by "doing" rather than watching or listening.

7.6.3 Training of design house staff

The core team will receive 6 months on-the-job training in an overseas design contractors office. The remaining staff will be trained in accordance with the procedure given in 7.6.2 above.

For the training of the core team it will be necessary to let a contract with an international contractor who has a design house and who is involved in an Ethiopian contract.

The outline suggested terms of reference are given in Annex H.

It will be the responsibility of the Technical Assistance Contractor in conjunction with Head of PEMSU to initiate the necessary action to identify a suitable contractor and to organise the training.

Proposals for training should be evaluated by the Technical Assistance Team Leader and his Training Advisor and it is expected that they and the Head of PEMSU will visit the contractors design office to monitor progress and achievement against the original training plan. It is suggested that a UNDP/UNIDO representative should participate in such monitoring visits.

7.6.4 Short study tours

These will be provided for:

* General Manager EDTC
* Head of PEMSU
* Head of DSPU
* Head of PMSU
* Inspector Engineer.

The suggested duration of the tours is 3 months and it is expected that the majority of the time will be spent in at least three of the less developed countries of the world including India and the Phillipines. Their purpose will be to observe, question and study their areas of applied technology in similar environments. Ideally the fellow should take with them a series of operational problems and seek out advice on their resolution by those who have faced similar issues. Consideration should be given to the tour being carried out a team exercise.

These fellowships will be designed, organised and supervised by the Technical Assistance Contractor.

8. PROJECT PLANS AND BUDGETS

8.1 Project Plans

A four year period is considered to be required for the initial establishment of the teams of core expertise as effective functions within EDTC.

Detailed plans have been prepared covering:

* key event schedule
* activity/outputs - work plan
* manpower - national staff
* technical support manpower - international staff

8.1.1 Key event schedule

Key Event	Target Data
Project Commencement	March 1991
Commencement of DSPU Activities (Market Survey)	August 1991
Commencement of Design House Activities (Design Assigment)	January 1992
Commencement of DSPU Promotional Campaign	January 1992
Commencement of PMSU Activities (Demonstrate Project Assignments)	March 1992
Completion of First Demonstration Project	December 1992
Commencement of First Independent Design Contract	January 1994
Commencement of First Independent Project Services Assignment	January 1994

8.1.2 Work Plans

These are presented in bar chart format as Figure 8.1.

8.1.3 National staff manpower plans

These are presented in bar chart format as Figure 8.2.

8.1.4 Technical assistance manpower plans - international staff

These are presented in bar chart format as Figure 8.3 and job descriptions for each post have been included in Annex F.

8.2 Budget Estimates

8.2.1 UNDP/UNIDO Budget

The overall UNDP/UNIDO budget has been estimated at 2.08 mill $ US. This excludes provisions for contingency and inflation. No budget estimate has been prepared for the local components.

The key elements of this budget are:

	$ US
Technical Assistance Subcontract	1,630,00
Design House Training Subcontract	87,500
Study Tours	65,500
Equipment	287,000
Miscellaneous	50,000
Total	2,120,550

This budget estimate is presented by UNDP/UNIDO budget head in Figure 8.4 and in Annex G is presented the basis of the calculations.

Figure 8.1 Work Plan

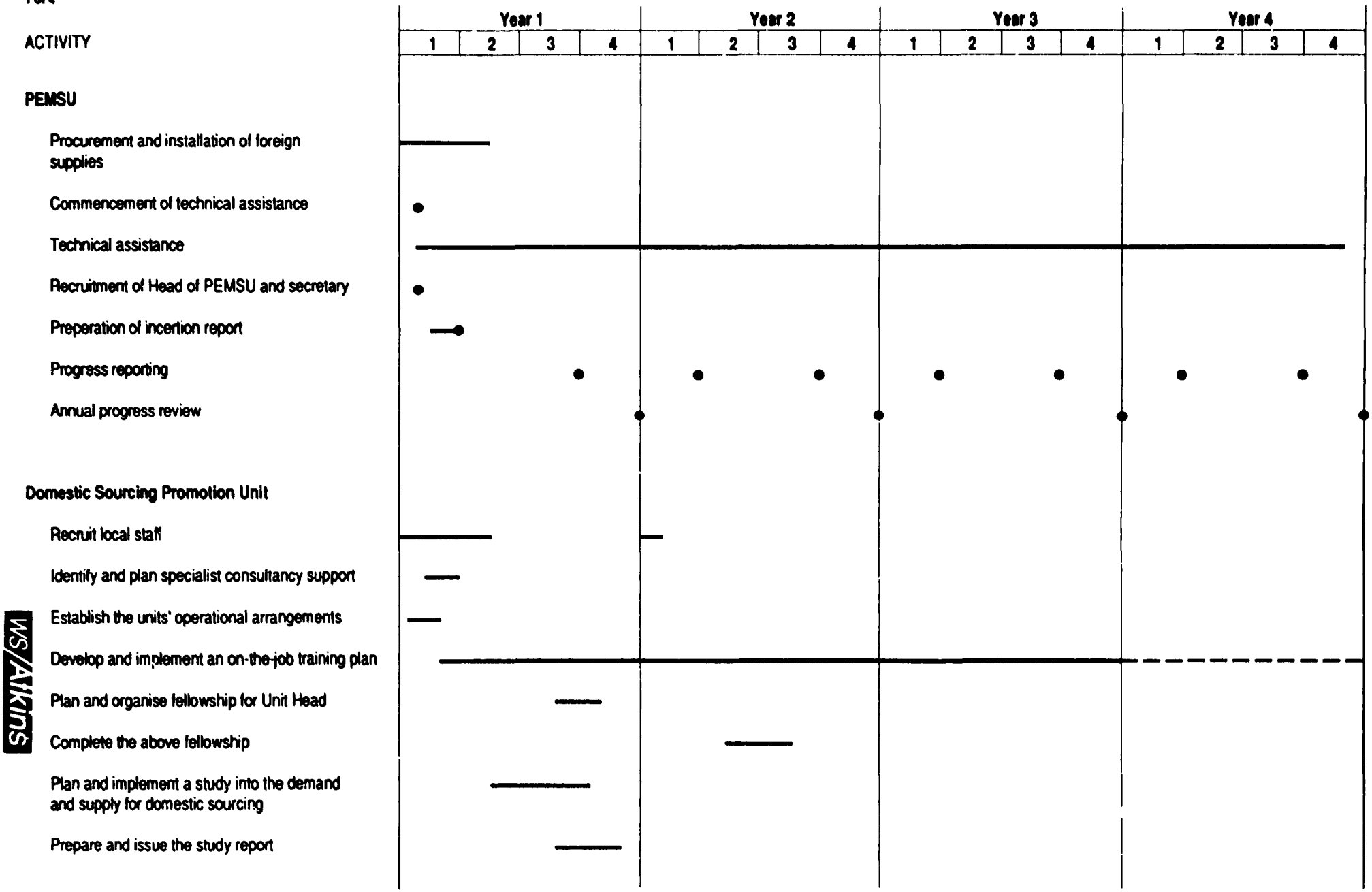


Figure 8.1 Work Plan

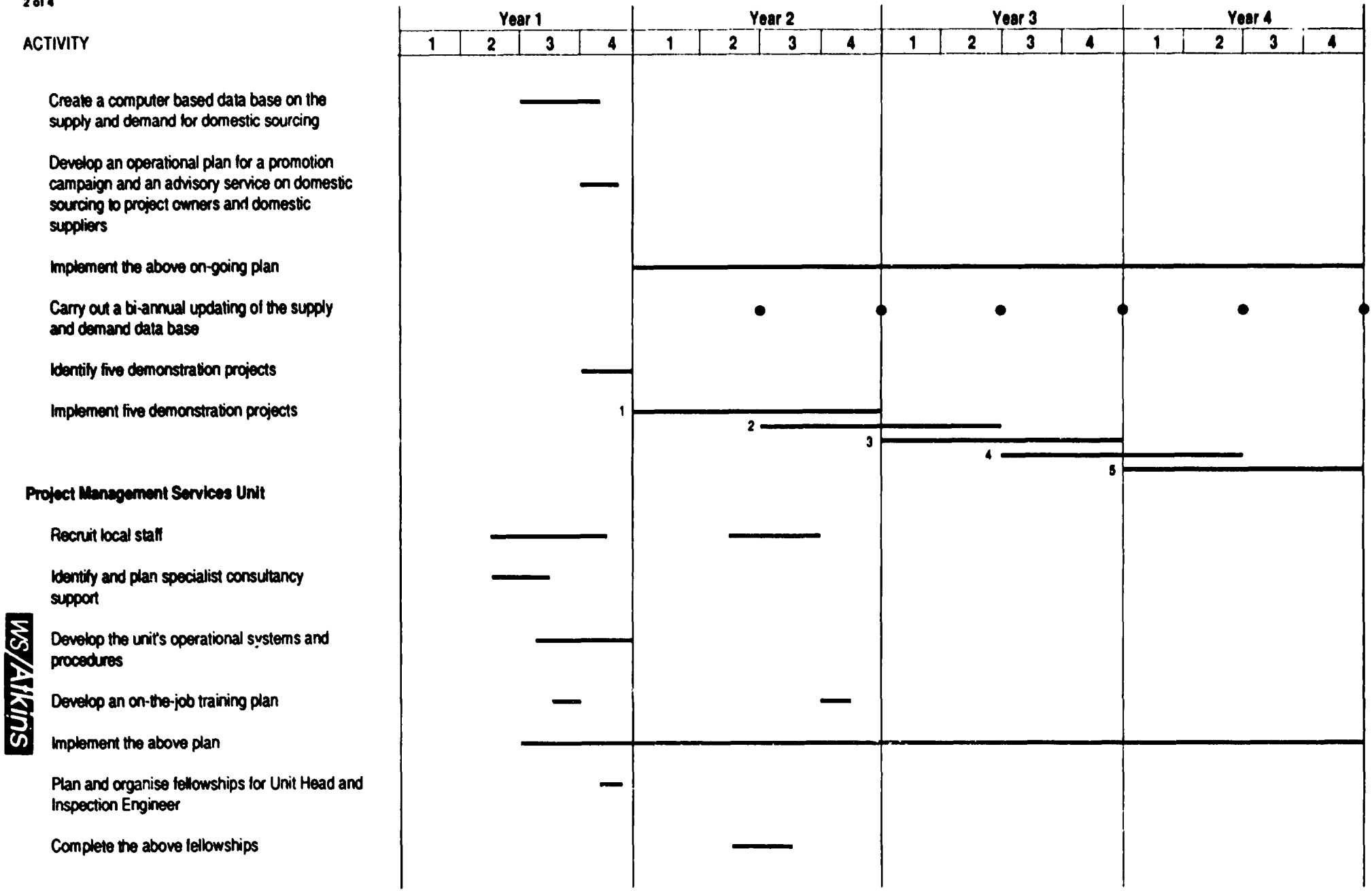


Figure 8.1 Work Plan

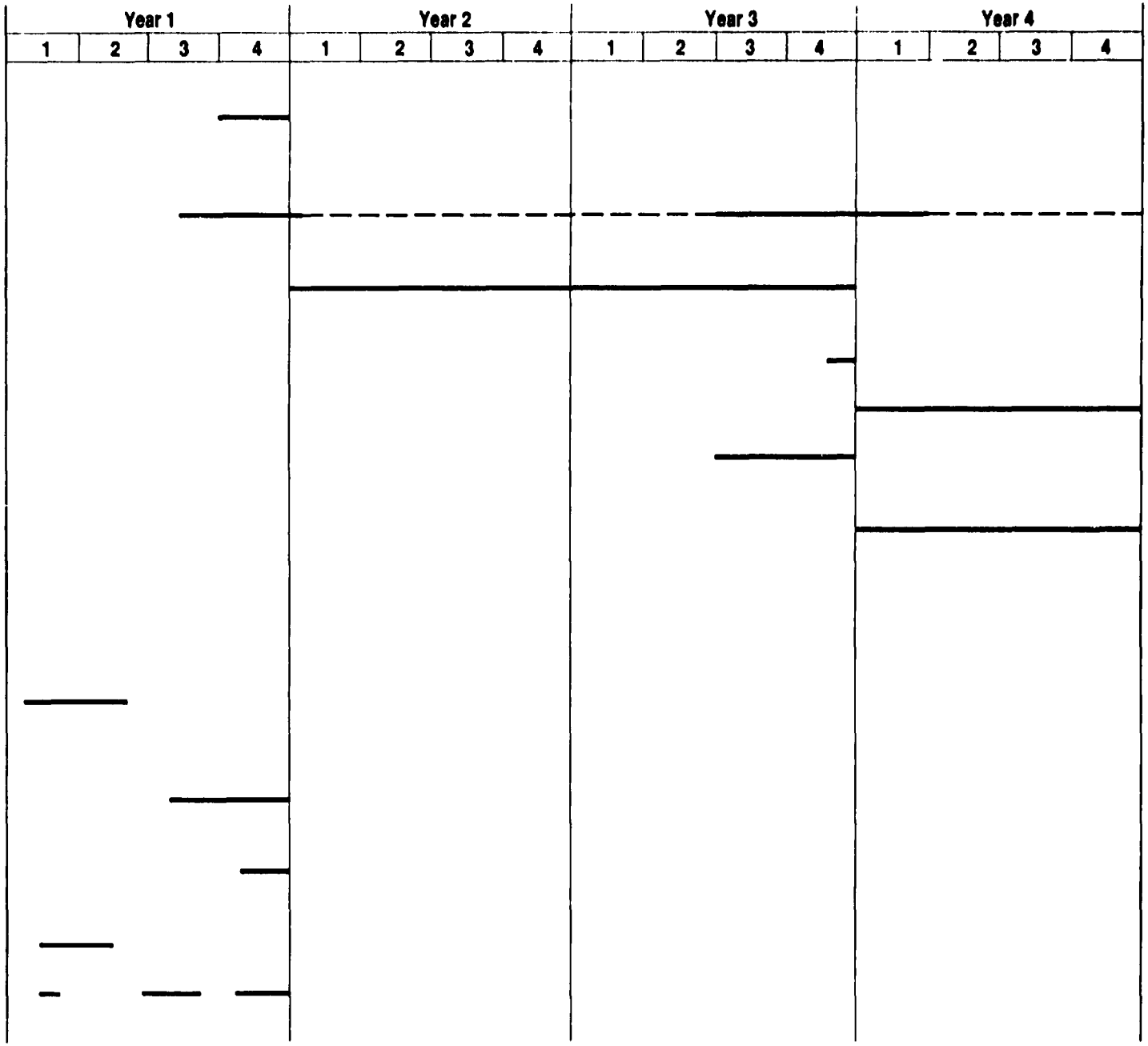


Figure 8.1 Work Plan

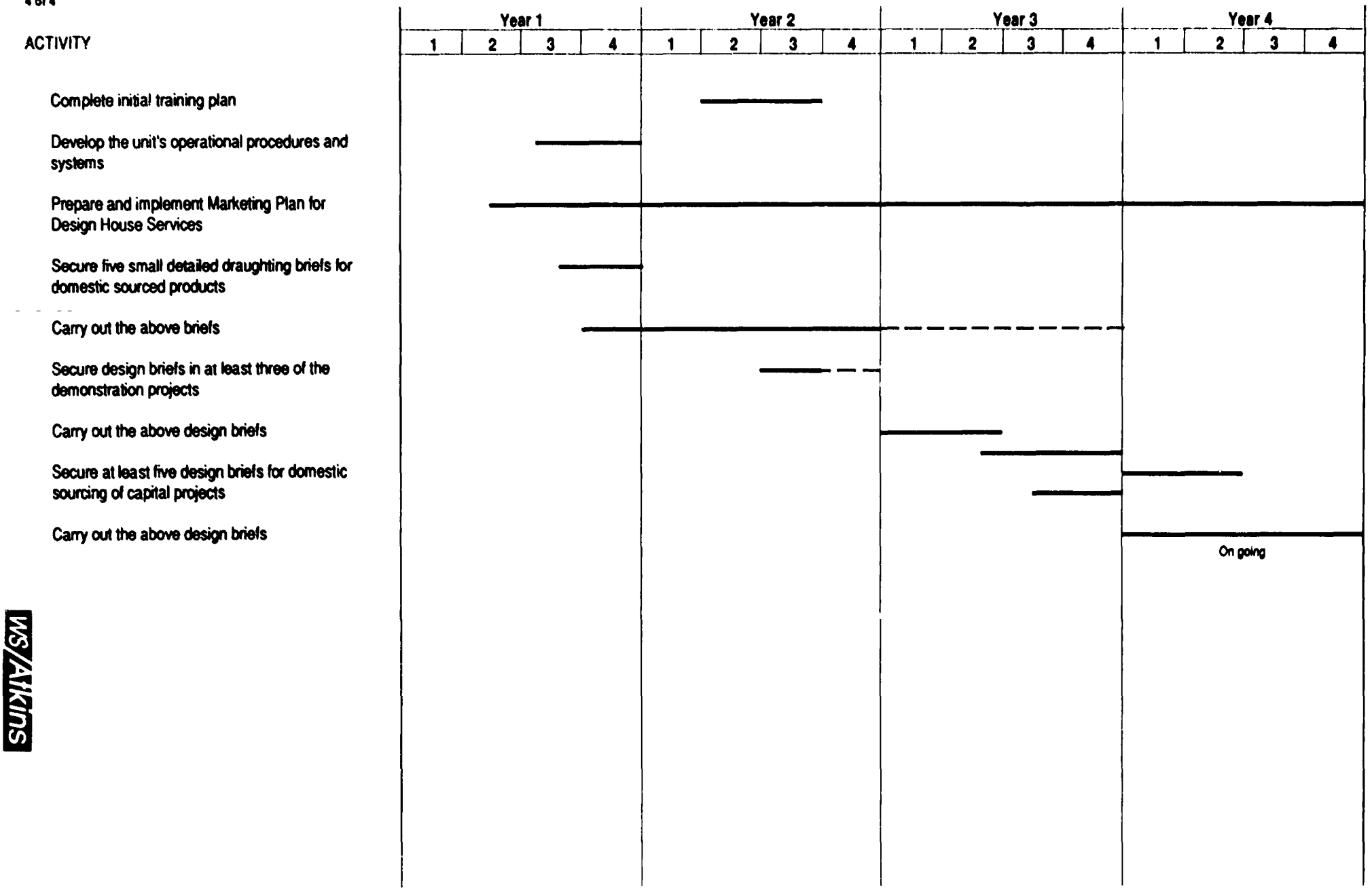
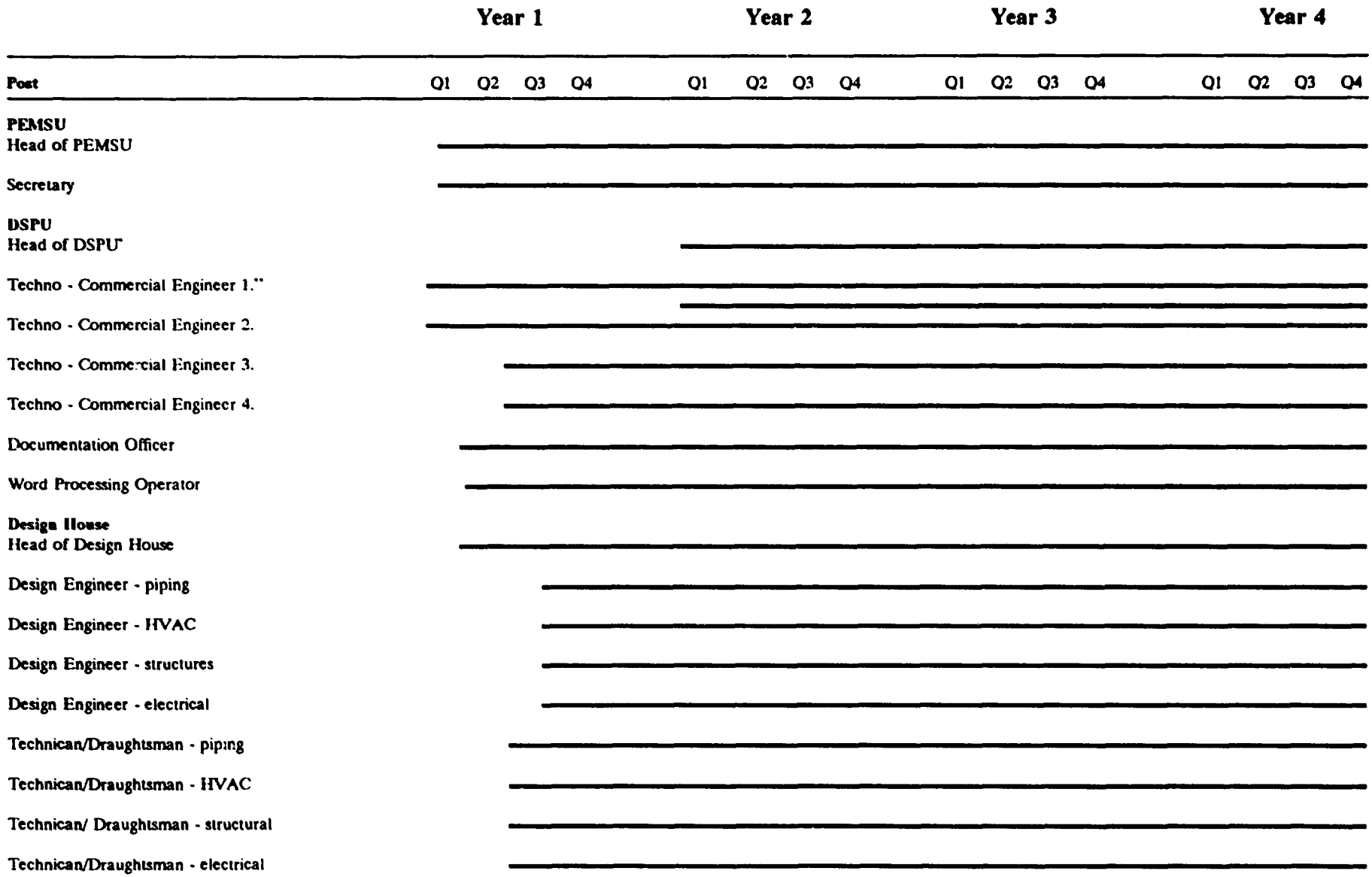


FIGURE 8.2 MANPOWER - NATIONAL STAFF



* for the first 12 months the post will be held by the Head of PEMSU.

** assumes post holder will be promoted to Head of DSPU after 12 months and a replacement then recruited.

FIGURE 8.2 - NATIONAL STAFF

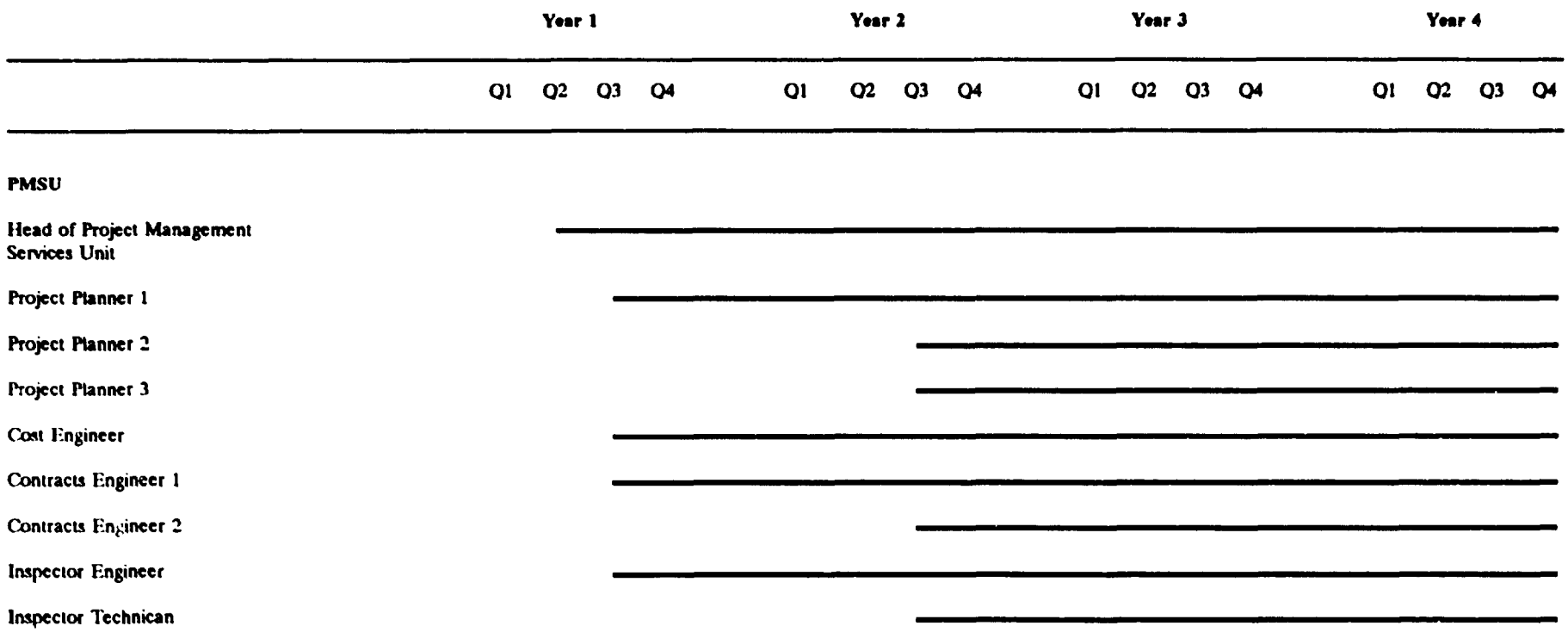


Figure 8.3 Technical Assistance Manpower - International Staff

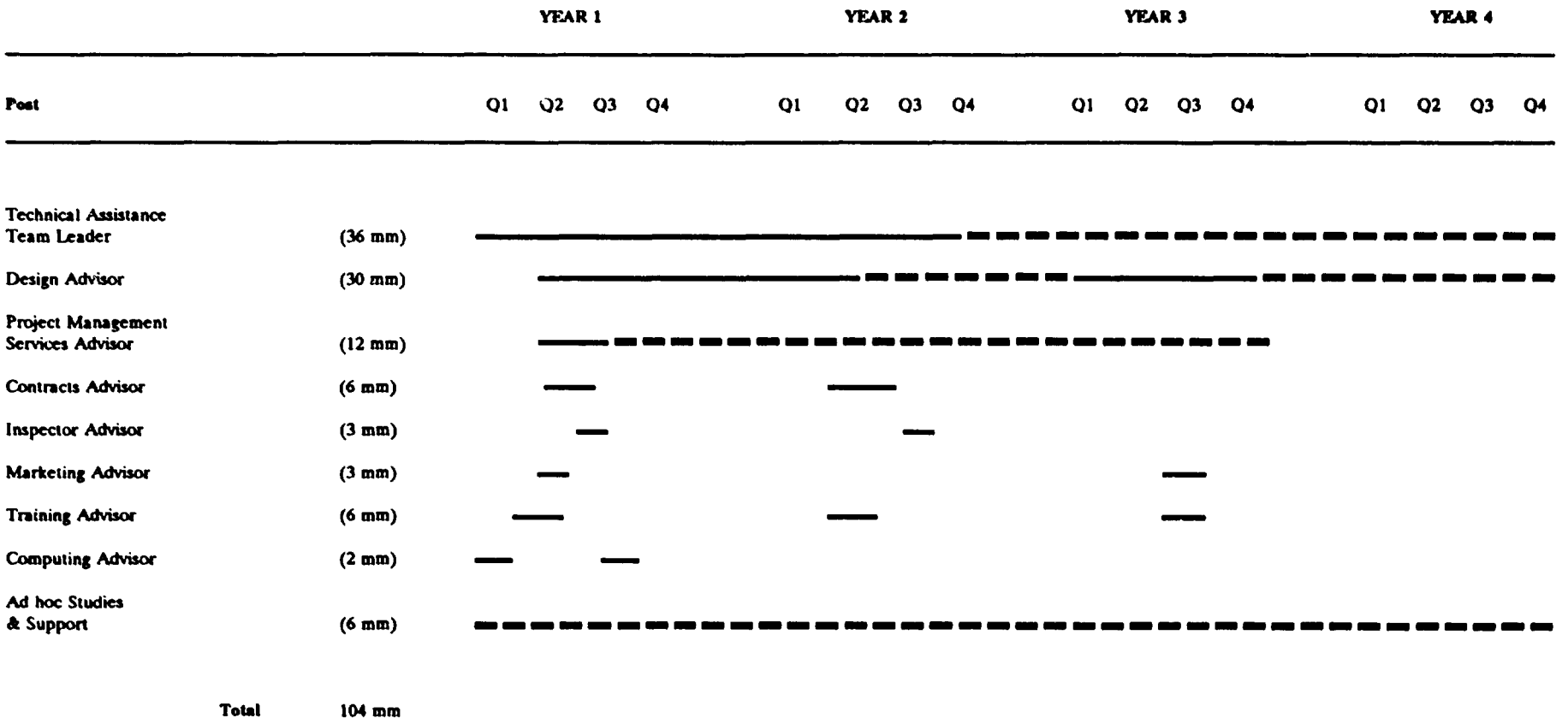


Figure 8.4 Budget For UNDP/UNIDO Contribution

Item	Total	Year 1	Year 2	Year 3	Year 4
15.00 Project Travel	30,000		30,000		
16.00 UNIDO Evaulation Mission	15,000			15,000	
SUBCONTRACTS					
21.01 Technical Assistance	1,630,000	610,000	445,000	400,000	175,000
21.02 Design House Training	87,500		87,500		
29.00 TOTAL SUBCONTRACTS	1,717,500	610,000	532,500	400,000	175,000
TRAINING					
32.00 Study Tours	65,500		65,500		
39.99 TOTAL-TRAINING COMPONENT	65,500		65,500		
EQUIPMENT					
41.00 Expendable Equipment	72,400	29,500	12,900	17,500	12,500
42.00 Non-Expendable Equipment	215,150	98,400	104,250	12,500	
49.99 TOTAL-EQUIPMENT COMPONENT	287,550	127,900	117,150	30,000	12,500
MISCELLANEOUS					
51.00 Sundries	5,000	1,250	1,250	1,250	1,250
59.99 TOTAL MISCELLANEOUS COMPONENT	5,000	1,250	1,250	1,250	1,250
99.99 PROJECT TOTAL	2,120,550	739,150	746,400	446,250	188,750

Outline Terms of Reference for the two subcontracts are provided in Annex H.

8.2.2 Government budget

The budget for the Ethiopian Government contribution has been prepared by the General Manager - EDTC and is included as Figure 8.5.

The budget estimate is 5.33 million birr and the key element are:

	Birr	(000's)
Personnel	1,383	
Equipment	2,900	
Miscellaneous	1,050	
Total	5,333	

8.2.3 Overall budget

UNDP/UNIDO Contribution	2.12	mill $US
Ethiopian Government Contribution	5.33	mill birr

Figure 8.5 Budget Estimate for Government Contribution

(in Birr, ie. 1US$ = 2.07 Birr)

BUL	ITEM			SALARY PER MONTH	TOTAL		YEAR 1		YEAR 2		YEAR 3		YEAR 4	
					MM	BIRR	MM	BIRR	MM	BIRR	MM	BIRR	MM	BIRR
10.0	Personnel Costs													
1.0	EDTC common staff (1/3 of total)			2,000	42	84,000	6	12,000	12	24,000	12	24,000	12	24,000
1.1	Management & staff function			3,500	42	147,000	6	21,000	12	42,000	12	42,000	12	42,000
1.2	Administration & Finance			1,500	42	63,000	6	9,000	12	18,000	12	18,000	12	18,000
1.3	Support Personnel													
		Sub-Total	1.0	7,000	126	294,000	18	42,000	36	84,000	36	84,000	36	84,000
2.0	PEMSU													
2.1	Head of PEMSU			1,500	48	72,000	12	18,000	12	18,000	12	18,000	12	18,000
2.2	Secretary			700	48	33,600	12	8,400	12	8,400	12	8,400	12	8,400
		Sub-Total	2.0	2,200	96	105,600	24	26,400	24	26,400	24	26,400	24	26,400
3.0	DSPU													
3.1	Head of DSPU			1,500	36	54,000	-	-	12	18,000	12	18,000	12	18,000
3.2	Techno-commercial Engineer 1			1,000	48	48,000	12	12,000	12	12,000	12	12,000	12	12,000
3.3	Techno-commercial Engineer 2			1,000	48	48,000	12	12,000	12	12,000	12	12,000	12	12,000
3.4	Techno-commercial Engineer 3			1,000	45	45,000	9	9,000	12	12,000	12	12,000	12	12,000
3.5	Techno-commercial Engineer 4			1,000	45	45,000	9	9,000	12	12,000	12	12,000	12	12,000
3.6	Documentation Officer			800	46	36,000	10	8,000	12	9,600	12	9,600	12	9,600
3.7	Word Processing Operator			800	45	36,000	9	7,200	12	9,600	12	9,600	12	9,600
		Sub-Total	3.0	7,100	313	312,800	61	57,200	84	85,200	84	85,200	84	85,200
4.0	DESIGN HOUSE													
4.1	Head of Design House			1,500	45	67,500	9	13,500	12	18,000	12	18,000	12	18,000
4.2	Design Engineer - Piping			800	38	30,400	2	1,600	12	9,600	12	9,600	12	9,600
4.3	Design Engineer - HVAC			800	38	30,400	2	1,600	12	9,600	12	9,600	12	9,600
4.4	Design Engineer - Structures			800	38	30,400	2	1,600	12	9,600	12	9,600	12	9,600
4.5	Design Engineer - Electrical			800	38	30,400	2	1,600	12	9,600	12	9,600	12	9,600
4.6	Technician/Draughtsman - Piping			600	42	25,200	6	3,600	12	7,200	12	7,200	12	7,200
4.7	Technician/Draughtsman - HVAC			600	42	25,200	6	3,600	12	7,200	12	7,200	12	7,200
4.8	Technician/Draughtsman - Structural			600	42	25,200	6	3,600	12	7,200	12	7,200	12	7,200
4.9	Technician/Draughtsman - Electrical			600	42	25,200	6	3,600	12	7,200	12	7,200	12	7,200
		Sub-Total	4.0	7,100	365	289,900	41	34,300	108	85,200	108	85,200	108	85,200

Figure 8.5 Budget Estimate for Government Contribution Cont/

BUL	ITEM	SALARY PER MONTH	TOTAL MM	TOTAL BIRR	YEAR 1 MM	YEAR 1 BIRR	YEAR 2 MM	YEAR 2 BIRR	YEAR 3 MM	YEAR 3 BIRR	YEAR 4 MM	YEAR 4 BIRR
5.0	PROJECT MANAGEMENT SERVICES UNIT											
5.1	Head of Project Management Services Unit	1,500	42	63,000	6	9,000	12	18,000	12	18,000	12	18,000
5.2	Project Planner 1 (Engineer)	1,200	39	46,800	3	3,600	12	14,400	12	14,400	12	14,400
5.3	Project Planner 2	1,200	28	33,600	-	-	4	4,800	12	14,400	12	14,400
5.4	Project Planner 3	1,200	28	33,600	-	-	4	4,800	12	14,400	12	14,400
5.5	Cost Control Engineer	1,200	41	49,200	5	6,000	12	14,400	12	14,400	12	14,400
5.6	Contracts Engineer 1	1,200	41	49,200	5	6,000	12	14,400	12	14,400	12	14,400
5.7	Contracts Engineer 2	1,200	28	33,600	-	-	4	4,800	12	14,400	12	14,400
5.8	Inspection Engineer	1,200	41	49,200	5	6,000	12	14,400	12	14,400	12	14,400
5.9	Inspector Technician	800	28	22,400	-	-	4	3,200	12	9,600	12	9,600
	Sub-Total 5.0	10,700	316	380,600	24	30,600	76	93,200	108	128,400	108	128,400
19.99	TOTAL PERSONNEL COMPONENT 1.0 to 5.0	34,100	1,216	1,382,900	168	190,500	328	374,000	360	409,200	360	409,200
40.0	"EQUIPMENT" COSTS											
	- Building - Office & other facilities provided in EDTC Premises (1/3 of total cost)			2,500,000		2,500,000		-		-		-
	- Office furniture & local equipment			150,000		100,000		20,000		30,000		-
	- Office supplies			250,000		50,000		60,000		70,000		70,000
49.99	TOTAL "EQUIPMENT" COMPONENT			2,900,000		2,650,000		80,000		100,000		70,000
51.00	MISCELLANEOUS											
	- Port clearance and inland transport of UNDP supplied Vehicles & Equipment			50,000		40,000		10,000		-		-
	- Operation and Maintenance			900,000		180,000		240,000		240,000		240,000
	- Sundries			100,000		40,000		20,000		20,000		20,000
59.99	TOTAL MISCELLANEOUS			1,050,000		260,000		270,000		260,000		260,000
99.99	GRAND TOTAL			5,332,900		3,100,500		724,000		769,200		739,200

N.B.

1. The Government Budget is presented above along UNIDO Budget Lines, as far as possible, for ease of cross comparison.
2. Prior years expenditures such as building ... etc. are shown under "Year 1" column.

ANNEX A TERMS OF REFERENCE FOR THE STUDY

TERMS OF REFERENCE

for

Preparatory Assistance

Project Engineering and Contracting Unit (PECU)

in Ethiopia

DP/ETH/89/009

BACKGROUND:

In 1986 a consulting firm formulated a project document which comprised:

An Engineering Design Centre (EDC) a Tool Centre (TC) and a Project Engineering Contracting Unit (PECU).

The Engineering Design Centre and the Tool Centre were combined (EDTC) and approved in April 1987. Its implementation is well under way while the Project Engineering and Contracting Unit (PECU) was excluded of implementation, since it was suggested to study in greater details its functions and activities, including its institutional framework.

The annotated format for project formulation framework (PFF) was prepared by the Government and submitted to UNDP for consideration. A copy of the PFF is attached.

In order to be able to define the project scope, its duration, inputs, activities and expected outputs in detail, engineering services for preparatory work are required.

SCOPE OF THE REQUIRED PREPARATORY ASSISTANCE:

The contractor is required to study all available background information on the PECU before fielding the experts.

The teamleader of the expert(s) will be briefed for a period of 1 to 2 days at UNIDO prior to his fielding to Addis Ababa.

In Addis Ababa he will be working with one senior national expert designated by the National Metalworks Corporation (NMC) who will assist the mission in maintaining close contact with UNDP and the concerned national organizations, institutions and factories. Relevant official documents and, if required, other national specialists will be made available to the contractor's personnel.

In Addis Ababa the teamleader will undertake a survey of beneficiaries and recipients of PECU and will assess the capabilities and needs in project engineering, such as unpackaging of investment projects (the unpackaged part is suitable for local sub-contract) detailed design, manufacture, contracting, costing, inspection during and after local manufacture, co-ordination of locally manufactured packages with imported part of investment project, quality control, erection and commissioning, etc.

The contractor's teamleader may need to call for a second specialist in the area of "inspection and expediting" if required to cover all the above tasks. The duration of the contractor's teamleader in the field is expected to be in the order of 1.5 to 2 months.

During this period optionally he might call on the services of a second specialist of a period of 0.5 months. Upon completion of the field work the teamleader will prepare a first rough draft report reflecting the outcome of the surveys and assessments with draft recommendations for setting up of a PECU taking due consideration of the local situation.

This draft report which will also highlight the technical assistance requirements for setting up the PECU in terms of its most suitable location, relations with other institutions and factories and the required inputs, such as expertise, training and required specialized equipment with expected project outputs, will be discussed and finalized in principal in a meeting with UNDP and the Government before the departure of the teamleader. After completion of the fieldwork by the teamleader, he will be debriefed at UNIDO headquarters during a two days period.

After debriefing of the contractor's teamleader at UNIDO headquarters, the contractor will prepare in his home office a draft final report reflecting the outcome of the fieldwork. In addition, he will prepare a draft project document in accordance with the UNDP's latest format and the guidelines in section 302 00 of the PPM, copy of which is attached.

The contractor has to provide UNIDO with 10 copies of the above-mentioned draft final reports in English language one month after the date of debriefing of the contractor's teamleader at UNIDO headquarters. The reports must be suitable for submission to the Government.

QUALIFICATION OF CONTRACTOR'S TEAMLEADER:

Mechanical Engineer with extensive experience in general project engineering, sub-contracting of engineering manufacturing packages to foreign companies. This experience should have been preferably acquired by the expert through sub-contracting arrangement, concluded by him in a developing country. The qualifications of the optional additional specialist depend on the contractor's experts experience.

PROPOSED TIME SCHEDULE:

Award of contract	x
Briefing and fielding of teamleader	x plus 2 weeks
Execution of fieldwork (during this period, if required, fielding of optional additional expert)	x plus 2 to 2.5 months
Submission of draft final report after debriefing at UNIDO headquarters	x plus 3 to 3.5 months
UNIDO's comments to the contractor	x plus 4 months

ANNEX B REFERENCE MATERIAL

Project Officers Manual, Ministry of Industry

Industrial Projects Implementation Manual, Ministry of Industry

EDTC Project Formulation Document (original version)

EDTC Project Document (final version)

EDTC Needs Survey Report, February 1990 (Internal EDTC report)

Sub-Saharan Africa From Crisis to Sustainable Growth. World Bank

Original Project Brief for PECU Preparatory Assistance Study

Objectives, Powers, Functions and Organisation of IPS (internal document)

Proclamation No.330 of 1987 Establishment of DEPAS

Legal Notice 110/87 IPS Establishment Regulations

The Transformation of the CPMP II Workshop into Agricultural Equipment Manufacturing Enterprise, Selameab Wolde Tsadk November 988 Ministry of Coffee and Tea Development

Manual for the Preparation of Industrial Feasibility Studies UNIDO

WSA Working Papers and Reports BME Sub-sector Development Study - Working Papers Institutional Visits

- Working Papers Factory Visits
- Stage I Report
- Stage II Report

South No.113 March 1990 - Dressed for Designer Deals

ANNEX C WORK PROGRAMME

PECU PROJECT

26/3	WSAI	KS Desikan WSAI - AA
	NMWC	Staff of Projects Dept
	UNIDO	Peter Manoranjan Country Director, Jorgen Brisson Asst.to Senior Industrial Development Field Adviser
27/3	NMWC	Ato Getachew Head of Projects
	EDTC	Mergaye Azeze Project Manager/NPC
28/3	EDTC	Mergaye Azeze
	NMWC	Demonstration Foundry Project Manager Selameab Tsadik
	UNIDO	Jorgen Brisson
29/3	NMWC	Ato Yeheyes DGM Developments
	Chemicals	DGM Developments Fikre Mariam
30/3	IPS	DGM Negash Tekeste
	EDTC	Mergaye Azeze
	NMWC	Ato Getachew Head of Projects
	UNIDO	Jorgen Brisson
31/3	Textiles	DGM Developments Fikre Bugiane
2/4	ETDC	Mergaye Azeze
	DEPSA	GM Commissioner Mamo Baheta, Bruck Kebede GM IPS
	Ayele	Ayele Getaneh GM, Ararssa Hordofa Technical Manager, Ayele Metal Works Enterprise
	UNIDO	Jorgen Brisson
	UNDP	Linda Starodub Asst Res Rep (PSU)
3/4	Cement	Amare Mergaya Planning Department
	Chemicals	DGM Developments Fikre Mariam
	Education	Geofry Last Adviser to Ministry of Education
4/4	Maru	Maru Tefera GM Maru General Metal Works
	AfDB	S Nnebe-Agumadu Resident Representative
	Textiles	Tsegay Habteh-Yimer Head of Planning and Programming
	ETDC	Mergaye Azeze
5/4	ONCCP	Makonnen Abrakam, Head of Projects Appraisal Dept.
	Gigel	Seyum Messele General Manager Gilgel Gibe Hydro Project
	UNIDO	Peter Manoranjan, Jorgen Brisson
	Cement	Atnaf Seged Adamu DGM Developments
	IPS	Girma Milky Consultant

6/4	Public Holiday	
7/4	EELPA	Belay Azeze DGM Generation and Transmission, Asnake G/Amlak Director Construction Dept.
9/4	ETDC	Eng Mergaye Azeze
	Coffee	Ato Asrat Washed Coffee Development Project
	BAPCODA	Ato Rasa GM
10/4	ASP	Gebrekiros Habtu GM Akaki Spare Parts Factory
	HASIDA	Abebe Negash Head of Engineering Dept
	WSAAI	Percy Rob WSI Agriculture
11/4	IBRD	P Goering World Bank Resident Representative
12/4	ETDC	Mergaye Azeze
	UNIDO	Peter Manoranjan, Jorgen Brisson
	MOI	Minister of Industry Tadewos Harege Werk
	NMWC	Col. Alula Berhane GM, Ato Yehayes DGM
13/4	Public Holiday	
14/4	EDTC	Mergaye Azeze

ANNEX D EXAMPLES OF DOMESTIC SOURCING

During the course of this study and that of the Consultants recent Strategy Study for the BME subsector a wide range of examples of domestic sourcing for projects were identified. Some of these are very large and others on a small scale and the results achieved of some have been very successful whilst others experienced great difficulties.

Below is given a brief description with comment on a small selection:

The Washed Coffee Project

This Ministry of Coffee and Tea project financed by the World Bank was initially set up in the early 70's as an import substitution operation. The initial objective of Phase Two in the 1980's was to produce 30 pulp machines from imported raw materials and proprietary components (plumber bearing blocks, discs, motors and vee belts) using a machine as a pattern. No drawings or templates were made so that each machine produced is unique.

The Ministry recently engaged a local private sector consultant to review the status of the workshop operation and make recommendations as to the way forward. Their report showed that the author had researched the operation, current business and future potential of the workshop thoroughly and reached realistic conclusions of the current situation and offered useful recommendations for the future.

It is clear from both the report and the visit to the workshop that there is a distinct need to increase the productive labour force to raise the utilisation of the facility and reduce the over bearing administration overheads.

Although the workshop has achieved its initial objectives of increasing domestic sourcing and has shown some real hard currency savings, the overall cost of the pulpers could have been significantly reduced had the shop management possessed more experience, or been better trained, in production methods and control techniques.

The question that remains to be answered is whether the business can successfully be developed as recommended within its present environment and its weak management.

ACME - Truck Assembly

This plant was set up twenty years ago with the plan that 80% local content would be achieved, the reality is that 25% has been achieved. This supply has largely been from the private sector or share companies,that is bodies by Maru Tefera,springs from the Ethiopian Spring Company and some locally produced batteries and tyres.

The recent new agreement assumes the achievement of 80% local content within ten years.

Participation in local sourcing of components from the National Metalworks Corporation has so far been nil, yet there is a range of simple components that could be produced by existing NMWC factories. These include for example small forgings which are within the equipment capabilities of the Kotebe tools factory providing some new tooling is produced.

Participation in supply to the automotive industry of even small parts has to be based on punctual supply at competitive prices to acceptable quality standards. These requirements will require a basic change in the NMWC's approach to supplying in terms of pricing method, delivery and quality.

Textiles Corporation Projects

The Corporation has an established practice of local sourcing. Typically they purchase HVAC designs and proprietary equipment for their new factories as well as the required materials from which the ducting is locally fabricated in the plants workshops. The initial drive for this approach was to limit shipping costs by reducing the freight cube. The equipment necessary for the fabrication is included in the main contract scope of supply and it has been clearly demonstrated that the fabrications required are well within the capabilities of local expertise.

The Corporation have demonstrated that elements of projects can be successfully fabricated in Ethiopia, also that their project controllers are able to exercise time and cost control in the management of their projects.

Mughar 2 Cement Project

This project involves the supply and erection of a second cement plant adjacent to the first unit which was completed in the early eighties.

During the first project a team of electricians from EELPA were employed and trained to assist the Cement Corporation's foreign contractors to assist with the project's routine electrical installation work. This team has been further trained and are undertaking the complete electrical installation on the second plant. In addition a very large workshop was established for the plan which includes in it's inventory a capability to fabricate a wide range of plant items. This capability is, it is understood, being exploited during the second project.

The Cement Corporation is understood to be giving consideration to the possibilities of self manufacture/fabrication of kilns for fu[illegible] whilst

they may have most of the necessary plant and have obtained detailed drawings and calculations from their Eastern European contractors such a move is considered by the Consultants as inadvisable at this stage as it could possibly delay or result in an inefficient plant. The Corporation should concentrate on non-proprietary items for local sourcing.

Caustic Soda Project - Chemical Corporation

The Chemical Corporation have developed skills which allow them to implement local sourcing policies in their projects. The current Caustic Soda project is a good example.

The plant, associated technology and designs were purchased from the Eastern Block. The site erection work is to be undertaken by Ethiopian labour managed by the Corporation under supervision by the foreign contractor who is ultimately responsible for the plant performance. The erection activity includes all civils and structures work by contractor and chemical plant, electrics and pipework by the Corporation staff. Some tanks have also been fabricated locally by NMWC. The construction of civil works and shipment of plant have been identified as causing delays to the project.

The nature of chemical plants is such that particular expertise is required in erection as demonstrated by the need for coded welders for example. It is therefore demonstrated that the Corporation has some of the necessary skills for locally sourcing which can be developed to include further local participation.

Silo Project

A number of years ago an Italian contractor was awarded a contract to supply a number of grain silo systems which were to be installed at various locations in Ethiopia.

The contract with the Italian contractor covered the supply and erection of the complete systems. Ethiopian contractors were engaged to provide the civil works and Maru Tefera carried out some fabrication work for the conveyor systems and undertook the total erection of the silos and conveyor systems.

This project illustrates a proven experience of local private sector contractors participating as sub-contractors to a foreign main contractor.

Gilgel Gibe Hydro-electric Power Project

This is a very large capital project that has been under implementation for a number of years and involves a technology transfer from North Korea.

The first example in this was the decision to prepare all designs and detailed engineering drawings in Ethiopia by a joint Korean - Ethiopian team. This is understood to have proceeded very well.

Typically with a large inter-ministerial project there have been some conflicts of interests and difficulties with cross ministerial coordination. It is understood that actions have been taken to resolve many of these p[illegible]ever

with EELPA responsible for the power house, the Ministry of Construction's civils contractor responsible for infrastructure and the Water Authority's civil contractor responsible for the tunnels and dams, project management, planning co-ordination is a major problem.

These dislocations and materials shortages have undoubtedly contributed to the difficulties of managing, what in Ethiopian terms is a mega project, and have caused the project programme to be extended by 10 years and there is a clear shortage of the necessary project planning and management skills to enable the project to be completed in accordance with the revised programme.

The plan provides for a substantial amount of local sourcing and the management of this will not be easy. It is said that the Koreans, now supported by Austrian hardware, have the basic technology, but they have very limited experience of this kind of project. There are serious risks of further delays without the injection of high calibre project management expertise and in the view of the Consultants an urgent need to audit the project and to develop more realistic project plans and programmes.

Nevertheless the project has demonstrated that there is an embryonic project engineering and management capability in Ethiopia in multi disciplined projects.

Design and Construction of Civil Works

Most civil works are constructed by one of the public sector national construction companies who have a proven capability in basic civil works design and construction with the exception of industrial buildings design. There have been instances where the resources were not sufficiently competent in more specialist tasks, for example slip forming techniques, but these have been acquired through on-the-job training by foreign contractors. In the case of slip forming this was provided by the Cubans.

Progress is constrained by acute materials shortages which now extend beyond rebar and cement and seem to include almost all imported items and those locally produced which require imported raw materials. For example the Chemicals Corporation do not have the necessary raw materials for paint manufacture which has caused a shortage of paint.

The capacity of the sector is as a result less than 30% of its programme.

It is understood that decisions to initiate around 400% of sector capacity, do not generally include a realistic assessment of the aggregated materials demand against material availability. Thus in the continuing foreign currency shortage conditions demand will continue to outstrip supply.

The impact of material supply shortages in the civil construction sector is likely, unless some new form of planning and control is in place, to be repeated in other sectors when serious efforts are made to increase the levels of domestic sourcing in capital projects. Delays in the supply chain of a capital plant are more disruptive to a project's objectives by delaying the start-up and revenue earning capability of a total plant package which will normally have a relatively high level of pre-committed hard cu[illegible]ure.

These implications could easily overshadow the benefits of domestic sourcing in terms of programme, total capital and foreign exchange commitments.

The Consultants have concluded that to achieve successful domestic sourcing of components to capital projects very serious consideration has to be given to establishing mechanisms for material reliable supply within project timescales.

APPENDIX E

JOB DESCRIPTIONS

Job Description

Post	Technical Assistance Team Leader
Qualifications	Chartered Engineer - Graduate in Mechanical Engineering. Diploma/Certificate in Business/Commerce/Marketing
Experience	At least 10 years experience in the design, manufacturer and installation of capital projects. Experience in domestic sourcing and markets/promotional work in developing countries.
Language	Fluency in English
Key Accountabilities	Accountable to the General Manager of EDTC and the Head of PEMSU as appropriate for the: - provision of professional technical assistance services in accordance with the provision of the Technical Assistance Contract - behavour and performance of all members of the Technical Assistance team and for achievement of agreed task objective on time and to budget - delivery of cutputs as defined and agreed in the inception report - timely response to request for ad hoc services in accordance with the terms of the contract - identification of a suitable contractor for the training of PEMSU design staff and for quality assurance of these training activities
Key Tasks	Advisor to the General Manager of EDTC/NPO and Head of PEMSU Management of all technical assistance provisions. Participation in PEMSU staff selection. Identification of suitable contractor for the training of design house staff. Specialist advisor to the Domestic Sourcing Promotions Unit (DSPU). Leading the DSPU team during the first phases of their markets and promotions work. Design and implementation of system and procedures for DSPU. Organising and supervision of all training activities. Mechanical engineering support to the Design Advisors and the Design House staff.
Duration/Schedule	36 Man months Months 1 - 24 full time Months 24 - 48 part time

JOB DESCRIPTION

Post	Project Management Services Advisor
Qualifications	Chartered Engineer
	Post Graduate Diploma in Project Management
Experience	10 years operational experience in project management services (time and cost control) in capital projects.
	3 years experience of developing countries.
Language	Fluency in English
Key Accountabilities	Accountable to the leader of the Technical Assistance Team, the Head of PEMSU and the Head of PMSU, as appropriate for the:
	- provision of a professional project advisory service and the achievement of agreed objectives for assigned tasks on tire and to budget
	- delivery of PMSU outputs as defined and agreed in the inception report
	- behaviour and performance of the post holder and any assigned international staff.
Key Tasks	Principal adviser to PMSU.
	Design and implementation of system and procedures for PMSU.
	Advising on staff recruitment.
	On job coaching of PMSU staff.
Duration/Schedule	12 man month
	Month 6 - 12 full time Month 12 - 36 part time

JOB DESCRIPTION

Post	Design Adviser
Qualifications	Chartered Engineer, Graduate in Structural Engineering
Experience	10 years operational design experience in capital projects. 3 years experience of developing countries.
Language	Fluency in English
Key Accountabilities	Accountable to the Leader of the Technical Assistance Team, the Head of PEMSU and the Head of the Design House as appropriate for the: - provision of a professional design advisory service and the achievement of agreed objectives for assigned tasks on time and to budget - delivery of Design House outputs as defined and agreed in the inception report - behaviour and performance of the past holder and any assigned international staff.
Key Tasks	Principal adviser to the Design House. Design and implementation of systems and procedures of the Design House. Advising on staff recruitment. On job coaching of Design House Staff. Initial supervision of the Design House Technical Team.
Duration/Schedule	36 man months Month 6 - 18 full time Month 18 - 24 part time Month 25 - 36 full time Month 36 - 48 part time.

JOB DESCRIPTION

Post	Contracts Adviser
Qualifications	Chartered Engineer, Certificate/Diploma in Contracts
Experience	10 years experience as a contracts engineer.
	Some experience of developing countries.
Language	Fluency in English
Key Tasks	Advisor to the Technical Assistance Team Leader on contracts strategy and management.
	Advisor to PMSU on contracts and contract management.
	Preparation of PMSU contracts manual.
	Preparation of PMSU contract strategy manual.
	Training of PEMSU staff in contracts and contract management.
Duration/Schedule	6 man months Months 5 - 7 Months 18 - 20

JOB DESCRIPTION

Post	Inspection Adviser
Qualifications	Chartered Engineer, Graduate Mechanical/Structural Engineer
	Certificate/Diploma in inspection
Experience	15 years experience in inspection and expediting for capital projects.
	Experience of developing countries.
Language	Fluency in English
Key Tasks	Advisor to the Technical Assistance Team Leader and PMSU on inspector services.
	Design and implementation of procedures and systems for PMSU inspectors unit, staff training and advise on recruitment.
Duration/Schedule	3 Man months Months 8 - 9 Month 20

JOB DESCRIPTION

Post	Marketing Adviser
Qualifications	Degree/Diploma in marketing and business studies
Experience	10 years industrial market research in the engineering industry which should include survey and promotional work. Experience of working in developing countries.
Language	Fluency in English
Key Tasks	Advice to TA Team Leader on the marketing of PEMSU services. Assistance with the design and implementation of the D PSU market survey and the development of the domestic sourcing promotion strategy. Assistance with the training of DPSU staff.
Duration/Schedule	3 man month Month 4 - 5 Month 31

JOB DESCRIPTION

Post	Computing Adviser
Qualifications	Degree/Diploma in Mathematics/Business Studies/Computing
Experience	5 years experience in software application on PC's, including databases, wordprocessing and planning/cost control packages.
Language	Fluency in English
Key Tasks	Advice to Technical Assistance Team Leader on computing for PEMSU. Development and installation of software for the DSPU data base and PMSU project management system. Instailation of word processing software. Training of PEMSU staff in the use of computers.
Duration/Schedule	2 man month Month 3 Month 10

JOB DESCRIPTION

Post	Training Adviser
Qualifications	Degree/Diploma in Training
Experience	10 years industrial experience of which 5 years in a training role. 3 years experience in developing countries.
Language	Fluency in English
Key Tasks	Advice to Technical Assistance Team Leader and PEMSU on staff training. Quality assurance of all PEMSU training. Assistance with the preparation of training plans and programmes.
Duration/Schedule	6 man months Month 5 - 6 Month 17 - 18 Month 30 - 31

JOB DESCRIPTION

Post	General Manager EDTC and National Project Director
Qualifications	BSc/MSc in mechanical engineering Post graduate diploma in Management
Experience	15 years experience which must include the following • engineering design, project engineering and maintenance in a manufacturing organisation • project engineering and management of major capital project • high level government - industry liaison • high level government-funding agency liaison • management of a corporate entity
Language	Fluency in English
Key Tasks	Management of EDTC and leader of the EDTC management team. Government and funding agency liaison. Preparation of EDTC's corporate policy and mission statement, corporate plan and budgets. Responsible for achievement of EDTC's corporate plan and budget staff development. Representing EDTC on national and international technical bodies/committees. National Project Director for EDTC and its associated projects.
In-post Data	From commencement

JOB DESCRIPTION

Post	Head of PEMSU
Qualifications	BSc/MSc in mechanical engineering. Post Graduate diploma in management.
Experience	10 years industrial experience as a practising engineer which must include periods in major projects and manufacturing.
Language	Fluency in English
Key Tasks	Member of the EDTC management team and head of the PEMSU management team.
	Overall responsible for all PEMSU activities.
	Setting up and leading, with the assistance of the TA Team leader, the Domestic Sourcing Promotion Unit.
	Preparation of the unit plans and budgets.
	Liaison with key clients.
	Monitoring the unit performance.
	Staff development.
In-post Data	from commencement

JOB DESCRIPTION

Post	Head of Domestic Sourcing Promotions Unit
Qualifications	BSc/Msc in mechanical engineering.
Experience	10 years industrial experience as a practising engineer, including periods in major projects and manufacturing.
Language	Fluency in English
Key Tasks	Member of the PEMSU management team.
	Responsible for all activities of the Domestic Sourcing Promotions Unit.
	Liaison with clients, and leading all promotions activities.
	Preparation of the unit plans and budgets.
	Monitoring of the unit performance.
	Staff development
In-post Data	from month 13*

* this assumes that the Head of PEMSU will assume the role for the first 12 months and then be replaced by internal promotion.

JOB DESCRIPTION

Post	Techno-commercial Engineer (4)
Qualifications	Degree in Engineering/Business Management/Economics.
	Certificate/Diploma in Management/Commence.
Experience	3 years general industrial experience.
Language	Fluency in English
Key Tasks	Member of the DSPU team carrying out assigned tasks in market studies, domestic sourcing promotions and advisory services to project owners and domestic suppliers.
	Participation in seminars and presentation.
	Preparation of promotional material.
In-post Data	- post 1 from month 1 and 13* - post 2 from month 1 - post 3 from month 6 - post 4 from month 6

* assumes the initial post holder will be promoted to Head of the Unit after one year

JOB DESCRIPTION

Post	Documentation Officer
Qualifications	Graduate in Engineering/Business Studies/Commerce
Experience	3 years commercial experience.
Language	Fluency in English
Key Tasks	Preparation and publication of promotions material.
	Maintenance of data base.
	Organising and participating in promotional seminars.
	Participate in general promotional activities.
In-post Data	From month 2

JOB DESCRIPTION

Post	Word Processing Operator
Qualifications	Vocational Training Certificate in Typing/Office Practice.
Experience	2 years experience as a typist/secretary
Language	Fluency in English
Key Tasks	Document preparation for DSPU using word processing and desk top publishing facilities.
In-post Data	from month 3

JOB DESCRIPTION

Post	Secretary to Head of PEMSU
Qualifications	Educated to 12th Grade
	Vocational Certificate in Secretarial/Office Studies
Experience	5 years as secretary.
	Bilingual typing ability.
Language	Fluency in English
Key Tasks	Secretarial services to the Head of PEMSU and general support to managers of the three operator units.
	Maintenance of correspondence files.
	Operation of WP facility and maintenance of files.
In-post Data	from commencement.

JOB DESCRIPTION

Post	Head of Design House
Qualifications	BSc/MSc in Structural/Mechanical Engineering
Experience	10 years industrial experience including periods in design and major projects.
Language	Fluency in English
Key Tasks	Member of PEMSU management team.
	Responsible for all activities of the Design House.
	Liaison with Heads of Design sections in EDTC.
	Preparation of the Design House plans and budgets.
	Monitoring of the Design House performance.
	Leading the Design House sales/marketing activities.
	Client liaison.
	Leading Design House assignments.
	Staff development.
In-post Data	from month 3

JOB DESCRIPTION

Post	Design Engineer - Piping
Qualifications	BSc in Mechanical Engineering
Experience	1 years industrial experience in pipeworks studies
Language	Fluency in English
Key Tasks	Detailed Design and Draughting of piping schemes.
	Supervision of assigned technician.
In-post Data	From month 10

JOB DESCRIPTION

Post	Design Engineer - Structural
Qualifications	Bsc in Structural Engineering
Experience	1 years industrial experience in structural studies
Language	Fluency in English
Key Tasks	Detailed Design and Draughting of structural engineering schemes.
	Supervision of assigned technician
In-post Data	From month 10

JOB DESCRIPTION

Post	Design Engineer - HVAC
Qualifications	Bsc in Mechanical Engineering
Experience	1 years industrial experience in HVAC studies
Language	Fluency in English
Key Tasks	Detailed Design and Draughting of HVAC schemes
	Supervision of assigned technician
In-post Data	From month 10

JOB DESCRIPTION

Post	Design Engineer - Electrical
Qualifications	BSc in Electrical Engineering
Experience	1 years industrial experience in electrical distribution schemes.
Language	Fluency in English
Key Tasks	Detailed Design and Draughting of electrical distribution schemes.
	Supervision of assigned technician
In-post Data	From month 10

JOB DESCRIPTION

Post	Technician/Draughtsperson - pipework
Qualifications	Certificate/Diploma in Mechanical Engineering
Experience	2 years industrial draughting experience in piping
Language	Fluency in English
Key Tasks	Preparation of engineering drawings to client specification in accordance with codes of practice and national/international standards.
In-post Data	from month 6

JOB DESCRIPTION

Post	Technician/Draughtsperson - Structural
Qualifications	Certificate/Diploma in Structural Engineering
Experience	2 years industrial draughting experience
Language	Fluency in English
Key Tasks	Preparation of engineering drawings to client specification in accordance with codes of practice and national/international standards.
In-post Data	from month 6

JOB DESCRIPTION

Post	Technician/Draughtsperson - HVAC
Qualifications	Certificate/Diploma in Mechanical Engineering
Experience	2 years industrial draughting experience in HVAC
Language	Fluency in English
Key Tasks	Preparation of engineering drawings to client specification in accordance with codes of practice and national/international standards.
In-post Data	from month 6

JOB DESCRIPTION

Post	Technician/Draughtsperson - Electrical
Qualifications	Certificate/Diploma in Electrical Engineering
Experience	2 years industrial draughting experience in electrical distribution systems
Language	Fluency in English
Key Tasks	Preparation of engineering drawings to client specification in accordance with codes of practice and national/international standards.
In-post Data	from month 6

JOB DESCRIPTION

Post	Head of Project Management Services Unit
Qualifications	BSc/Msc in Engineering.
	Certificate/Diploma in Project Management.
Experience	10 years experience in major projects of which five years should be in project management and control.
Language	Fluency in English
Key Tasks	Member of PEMSU management team.
	Responsible for all activities of the PMSU.
	Monitoring of PMSU performance.
	Leading the PMSU sales/marketing activities.
	Client liaison
	Leading the PMSU training activities in association with an local training institute.
	Staff development.
In-post Data	from month 6

JOB DESCRIPTION

Post	Project Planner
Qualifications	Degree in Engineering
Experience	5 years experience in project planning
Language	Fluency in English
Key Tasks	Preparation and monitoring of project plans.
	Client liaison.
	Advising client on project planning.
	Representing the client at meetings with contractor.
	Promotion of project planning services.
	Assisting in PMSU training activities.
In-post Data	There are three posts with the following in-post dates.
	post 1 - from month 9 post 2 - from month 20 post 3 - from month 20

JOB DESCRIPTION

Post	Cost Control Engineer
Qualifications	Degree in Engineering
	Certificate/Diploma in Cost Management/Control
Experience	5 years experience in project cost control
Language	Fluency in English
Key Tasks	Cost monitoring and forecasting for projects.
	Client liaison.
	Advising client on project cost control.
	Representing the client at meetings with contractors.
	Promoting PMSU services.
	Assisting in PMSU training activities.
In-post Data	from month 9

JOB DESCRIPTION

Post	Contracts Engineer (2)
Qualifications	Degree in Engineering
	Certificate/Diploma in Contracts
Experience	5 years experience as an industrial contractor engineer.
Language	Fluency in English
Key Tasks	Monitoring contractors performance.
	Advising on the contractural aspect of client problems with contractors.
	Assisting client with contract preparation and contract evaluation.
	Representing the client at meetings with contractors.
	Participating in PMSU training activities.
	Promoting PMSU services.
In-post Data	post 1 from month 9 post 2 from month 20

JOB DESCRIPTION

Post	Inspection Engineer
Qualifications	Degree in Mechanical Engineering
Experience	5 years experience in inspection of domestic sourced project components at their manufacturing site and the construction site as appropriate.
Language	Fluency in English
Key Tasks	Carrying out inspections of domestic sourced project components at their manufacturing site and the construction site as appropriate.
	Advising/instructing suppliers on deficiencies and required remedial actions.
	Reporting on subcontractors performance and capability.
	Representing the client at subcontractors meetings.
	Advising client on inspection service requirements.
	Promoting PMSU training.
	Participating in PMSU training activities.
In-post Data	from month 9

JOB DESCRIPTION

Post	Inspection Technician
Qualifications	Certificate/Diploma in Engineering
Experience	5 years experience in an operational and supervisory role in engineering component manufacturer.
Language	Fluency in English
Key Tasks	Carrying out routine inspections of domestic sourced component at manufacturing and installation sites as appropriate. Preparing inspection report and in conjunction with the Inspector Engineer advising on remedial action requirement. In conjunction with the Inspector Engineer preparing report on the capability and performance of subcontractors.
In-post Data	from month 20

ANNEX F

BUDGET ESTIMATE CALCULATIONS

F.1 Budget Estimate for Technical Assistance Subcontract

Requirement

A total of 104mm of technical assistance in Ethiopia of which:

Technical Assistance Team Leader
Design Adviser
Project Management Services Advisers

will be essentually long term and the remainder short term.

Thus there will be	78mm of long term assistance 20mm of short term assistance
This will be supplemented with	6 man month of home office/back stop support/ad hoc consultancy

Assumptions

Local Provisions

The following element are assumed to be provided in local currency through the implementation agency.

- local accommodation
- local travel
- local subsistence
- office accommodation
- international travel including prepaid excess baggage provisions
- international telex and telecom facilities.

Standard Costs

Professional fees for 1 man month of long term technical assistance = 15,000 $ US.

Professional fees for 1 man month of short term technical assistance = 18,000 $ US.

These rates assume senior experienced staff on accompanied status.

Professional fees for 1 man month of home office/back stop/ad hoc consultancy support = 15,000 $ US.

Lump Sum Provisions

For documentation, report preparation and international communications in the home office - 10,000 US $.

Budget		US $
Professional fees	- long term staff	*1,170,000
	- short term staff	360,000
	- home office/back stop/ ad hoc consultancy support	90,000
Documentation Provision		10,000
	Total	*1,630,000

* includes an element for local subsistence estimated to be 120,000 Etb

F.2 Budget Estimate for Design Home Staff Training

Requirement

A team of five will spend 6 months in a Northern European Contractors Design Office.

The head of PEMSU with either the Technical Assistance Team Leader or the Design Adviser will visit the trainees twice during their training for a period of one week. It is considered advisable that a UNDP/UNIDO representative participates in one of these visits, but no financial provision for this have been made.

Assumption

A subsistence rate of 2000 $ per month for trainees

A subsistence rate of 120 $ per day for short term visits

Lump sum per trainee for books etc 1000 $.

Air fares at 1500 $/return trip.

Management fee lump sum 15,000 $.

Costs		US $	
Subsistence - 2000 x 6 x 5	=	60,000	
Books etc provision - 100 x 5	=	5,000	
Air fares - 1500 x 5	=	7,500	
Management fee	=	15,000	
Costs of Supervising Visits (1200 x 20 + 1500 x 4)	=	8,400	*
		95,900	

* include under budget line 15 but excludes cost of UNDP/UNIDO representative participation

F.3 Budget Estimate for Study Tours

Requirement

A team of five will spend 3 months on a tour of at least three has developed countries.

Assumption

Average daily allowance for accommodation and subsistence of 100 $ US.

Lump sum provision per person for the purchase of books, periodicals and technical documents and for photocopying of 1000 $.

Typically three country economy air fare will cost 3000 $ US.

Budget		$ US
Travel Cost 5 x 3000 $	=	15,000
Accommodation Subsistence 91 x 5 x 100	=	45,500
Books etc provision 5 x 1000	=	5,000
Total	=	**65,500**

F4 EQUIPMENT AND SUPPLIES

Item No	Description	Number Required	Examples UK Suppliers	Budget Estimate $US CIF exc Ethiopian Taxes
1.	**Document production Stations**	2		
	Hardware (per Station)			
	IBM Model 50Z Computer			
	1 MB RAM			
	1 - VGA colour graphics screen and controller			
	1 - 60 MB Hard Disk and Controller			
	1 - 3.5inch 1.44MB Floppy drive			
	1 - 5.25inch 1.2 MB Floppy Drive			16,000
	1 - set ports inc 2 serial and 1 parallel			
	1 - set of signal and power cables			
	Software (per station)		Bytes Computing Supplies*	
	Word Perfect version 5		Ewell, Surrey	
	Lotus Freelance			
	Lotus 1-2-3			
			Technology Business Computers Ltd*	
			Croydon, Surrey	
2.	**Data base station**	1		
	Hardware			
	IBM Model 70-121 Computer			
	4 MB RAM			
	1 - VGA graphics screen and controller			11,500
	1 - 120 MB Hard Disk and Controller			
	1 - 3.5inch 1.44MB Floppy drive			
	1 - 5.25inch 1.2 MB Floppy Drive			
	1 - set ports inc 2 serial and 1 parallel			
	1 - set of signal and power cables			
	Software			
	Word Perfect version 5			
	Lotus Freelance			
	Lotus 1-2-3			
	Foxbase Professional			

* Systems suppliers should be used in preference to hardware suppliers and IBM computers have been selected so that maintenance can be carried out locally.

Item No	Description	Number Required	Examples UK Suppliers	Budget Estimates $ US CIF exc Ethiopian Taxes
3.	**Project Planning and Cost Station**	2		
	Hardware (per station)			
	IBM Model 70-121 Computer 4 MB RAM 1 - VGA colour graphics screen and Controller 1 - 120 MB Hard Disk and Controller 1 - 3.5 inch 1.44MB Floppy Drive 1 - 5.25 inch 1.2 MB Floppy Drive 1 - set ports inc 2 serial and 1 parallel 1 - set of signal and power cables			
	Software (per station)		Bytes Computing Supplies* Ewell, Surrey	25,00
	Word Perfect version 5 Lotus Freelance Lotus 1-2-3 Pertmaster Advanced		Technology Business Computers Ltd* Croydon, Surrey	
4.	**CAD station**	1		
	Hardware			
	IBM Model 70-121 Computer 1 - Maths co-processor 4 MB RAM 1 - 12"x 12" Graphics tablet with 3 button puck 1 - 16 Colour graphics system with 15"x15 monitor with on board processor and 2Mb of RAM with AutoCAD ADI's and EGA drivers. 1 - Hercules screen and controller for second screen 1 - 100 MB Hard Disk and Controller 1 - 3.5inch 1.44MB Floppy drive 1 - 5.25inch 1.2 MB Floppy Drive 1 - set ports inc 2 serial and 1 parallel 1 - set of signal and power cables			24,500

* Systems suppliers should be used in preference to hardware suppliers and IBM computers have been selected so that maintenance can be carried out locally.

F4 EQUIPMENT AND SUPPLIES

Item No	Description	Number Required	Examples UK Suppliers	Budget Estimates
	Software AutoCAD revision 10 Word Perfect version 5 Lotus Freelance Lotus 1-2-3			
5.	**Plotting Facility** 1 - A0 plotter compatible with HPGL drivers and suitable for plotting on A5 - A0 film and paper stationary. 1 - Plot station using an IBM AT compatible with the same specification as the machines for document production listed above (hardware & software). 1 - set of signal and power cables	1	Bytes Computing Studies* Ewell, Surrey	22,500
6.	**Backup system** 1 - 120 MB external tape streamer (MCA) 7 - Tape streamer controller boards to be located in each computer and work with the external streamer.	1	Technology Business Computers Ltd* Croydon, Surrey	6,500
7.	**Laser Printing Facilities (each comprising)** 1 - HP laser Jet 2/3 or compatible with 1MB memory. RS 232 interface 1 - set of soft fonts 1 - intelligent serial line switching between 4 computers stations and one printer 1 - set of signal and power cables	2		8,300
8.	**Dot Matrix Printing Facility** 1 - Epson EX1000 or compatible printer with Parallel interface 1 - intelligent Parallel line switching between 4 computers stations and one printer 1 - set of signal and power cables	1		1,600

* Systems suppliers should be used in preference to hardware supplies and IBM computers have been selected so that maintenance can be carried out locally.

Item No	Description	Number Required	Examples UK Suppliers	Budget Estimates $ US CIF exc Ethiopian Taxes
9.	**Drawing Stations (each comprising)** 1 - Twin pedestal counter balanced drawing stand, adjustable for height and angle. Fitted with drafting machine with 360 degree head adjustable zero for use with A) drawing sheets. 1 - Reference desk 1500 x 750 1 - draughtsman swivel chair with five star base and adjustable height 1 - set draughting pens and pencils 1 - Compass set 1 - Misc scales, templates, stencils and pencil sharpener	8		20,000
10.	**Photocopying machine** 1 - Fixed bed photocopy machine A3/A4 with collator, enlargement and reduction capability	1	Ease Business Supplies Ltd Addlestone, Surrey Sutton Dyeline Sutton, Surrey	16,000
11.	**Overhead Projector** Kinderman Famulus 3	2		2100
12.	**Tripod Screen** Mentor Model 3A 1600mm x 1600mm	2		400#
13.	**Transparency Machine** 3M Model 45	1		1000
14.	**Loose Head Binding Machine** GBC Image Maker 2000	1		650

expendable item

Item No	Description	Number Required	Example UK Suppliers	Budget Estimates $ US CIF exc Ethiopian Taxes
15.	**Basic Inspection Kit** 3 - tapes 3m, 5m and 30m 1 - Folding rule 1 - 6" vernier 1 - 0 to 1" micrometer 1 - set 1" to 4" adjustable micrometer 2 - Straight edges 12" and 24" 1 - Internal and external callipers 1 - Set feeler gauges (inch and mm) 1 - Plumb bob and line 1 - Machine level 1 - 12" level 1 - Tri-square 1 - Adjustable square 1 - set scribers, auto-punch, chalks.	1	RS Components Corby, Northants Buck & Hickman Dagenham, Essex	1000#
16.	**Advanced Inspection Kit** 1 - Dumpy level 1 - Theodolite 1 - Set of dyepenetrant 1 - set thread form gauges 1 - Set of radius gauges 1 - 4'-0" level	1		5000#
17.	**Saloon Car** 1600cc petrol engine four door sedan	2	Nissan Cars	24,000
18.	**Estate Car** 1600cc petrol engine five door	1	Ford Cars Toyota Cars	12,500
19.	**Staff Service Vehicle** 12/15 seater mini bus	1		20,000

expendable item

F4 EQUIPMENT AND SUPPLIES

Item No	Description	Number Required	Example UK Suppliers	Budget Estimates $ US CIF exc Ethiopian Taxes
20.	Supply of consumable items for four years Magnetic media tapes and discs Photocopier/laser printer toner Paper for reports, calculations, letters etc, note books Envelopes continuous computer stationary Photocopier/laser printer paper File covers Assorted adhesive tapes Drawing inks Pencils, leads and rubbers Labels	provision	Sandhurst Market Horsham, Surrey ESSE Business Suppliers Weybridge, Surrey	50,000#
21.	Set of Reference books Selected BSI Civils and structures standards Selected DIN engineering standards Selected reference books	provision	BSI London	16,000#
22.	Set of conference room audio and projection systems 35 mm slide projector Audio system inc. amplifier, microphone and loud speakers	1	Education Supplies Co London Sandhurst Marketing Horsham, Surrey	3,000
				TOTAL 287,500 $ US

expendable item

ANNEX G

OUTLINE TERMS OF REFERENCE FOR SUBCONTRACTS

G 1 Technical Assistance

G 2 Design House Training

G.1 Outline Terms of Reference for the Technical Assistance Subcontract

The role of the Technical Assistance Contractor is to provide the necessary range of long and short term specialist advisers to guide, assist and train the staff of PECU during its formative years.

Specifically the contractor is required to provide expertise in respect of:

* design engineering - predominately structural engineering but including pipping, HVAC and electrical works
* project management - time and cost control
* contracts
* inspection
* training
* marketing
* computing.

which will be controlled and co-ordinated by a chief technical advisor.

Additional home office support and back stop support services will be required.

It has been estimated that a total of 98mm of technical assistance will be required and that the contribution of long term specialist will be:

* chief technical advisers	- 36 months
* design advisers	- 30 months
* project management advisers	- 21 months

These technical assistance requirements are front end loaded and it is expected that the long term specialist will initially be full time resident in Ethiopia.

Note: It is assumed that this document will be supplemented by appropriate charts and tables from the main text and other appendices.

G.2 Outline Terms of Reference for the Design House Staff Training Subcontractors

The role of the training contractor is to provide on-the-job training in a contracting design house for the core team of PECU design house staff. It is expected that the contractor will use a current Ethiopia assignment for the majority of the training assignments.

Training will be required as follows:

* Head of Design House.
  - operation and management of a design house
  - management of a design contract
  - checking and quality assurance of design activities
  - detailed design practice in his own discipline - probably structural engineering

* Designer Engineer - Structures
  - detailed design practice in structural engineering
  - work planning and control
  - managing and interpretations of a design house brief
  - working to standards and codes of practice
  - design calculations

* Design Engineer - piping
  - detailed design practice in piping covering utilities and low pressure process lines for simple plant
  - work planning and control
  - managing and interpreting a design brief
  - working to standards and codes of practice
  - design calculations

* Design Engineer - HVAC
  - detailed design practice on HVAC systems for simple and low risk/hazard plant and equipment
  - work planning and control
  - managing and interpreting a design brief
  - working to standards and codes of practice
  - design calculations

* Design Engineer - Electrical

  - detailed design practice on electrical distribution and simple control systems
  - work planning and control
  - managing and interpreting a design brief
  - working to standards and codes of practice
  - design calculations

It is envisaged that this training will in the main be carried out on-the-job through the trainee being given a series of increasingly complex design tasks for the contractor work in Ethiopia, not less than 6, over a period of 6 months.

They will be assigned a tutor to coach, guide and appraise them and their progress is to be formally reviewed, written and verbal, every month.

Where necessary they should participate in in-house relevant training programmes.