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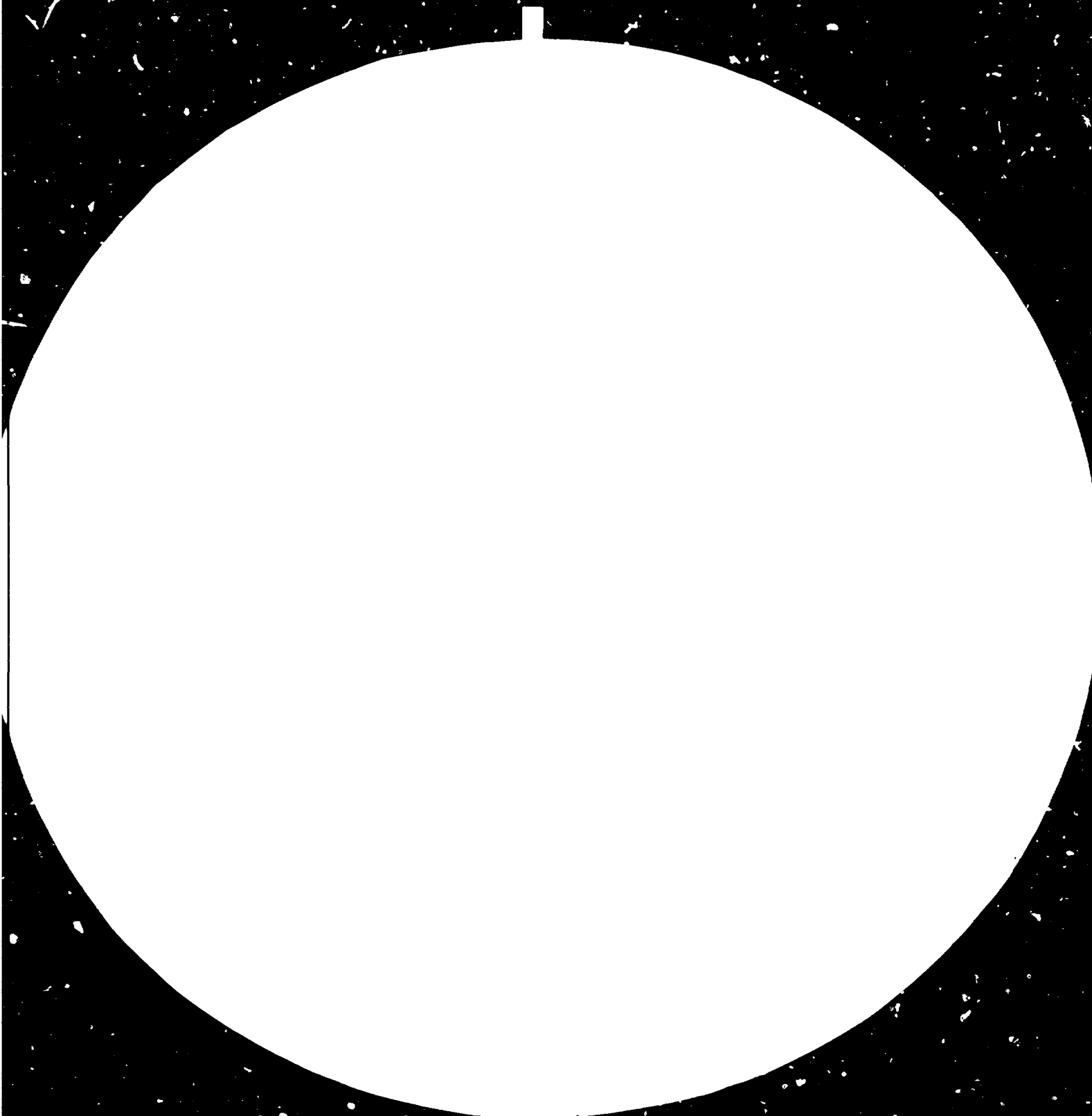
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ESTABLISHING A PLASTICS TECHNOLOGY CENTRE*

by

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A. Introduction

The United Nations Industrial Development Organisation, more commonly known as UNIDO, is concerned with assisting the industrial development process in developing countries. It works on a Government level approach and it is open to the Government of any developing country to make a specific request for assistance. How then can UNIDO specifically assist the development of the plastics industry? Experience over the past years has shown that positive and practical assistance can be rendered to the plastics industry through an institutional approach.

In the past, it has been possible for plastics polymer producers to provide their customers, the plastics processors, with technical information and technology concerning their products, and has given the industry much practical assistance in both processing, product development, and application. With the main line polymers reaching large scale production to the extent that they are referred to as 'commodity materials' the profit margins have been significantly reduced, and the amount of finance which polymer producers can now allocate to provide such services also has been significantly reduced. Moreover, it would appear that such services are likely to be reduced even further in the foreseeable future. On the other hand the need of technological support for processors to enable them to successfully develop both industrial and agricultural application markets is progressively increasing as these application developments become more and more technically oriented. One answer lies in the processor setting up his own Research and Development (R & D) department. Unfortunately, there are generally few processors of sufficient size who can afford to undertake such a step since effective R & D requires a high cost investment in resources of both skilled and trained manpower as well as in specialised equipment. In most countries with a plastics industry about 85 per cent of processors are small scale units, and the financial resources are not available for such an investment, even if the proprietors wished to pursue such a step.

UNIDO have identified an alternative solution to this problem. It is the provision of a centralised facility, within the country, which can serve the R & D needs of the plastics industry. Such a facility, called a Plastics Technology Centre (PTC), is established with specific emphasis on practical-oriented development work and service to the industry as its main criteria of operation.

The need for technological support of the plastics industry to assist its contribution to the development of the industrialisation process is often self-evident and the Government department concerned ensures that outline provision of a PTC is included in the Government's planning programme. In other cases the industry is left to its own resources in the mistaken belief that plastics are just household goods without the decision-makers being aware of the contribution that plastics can make towards the economic development of both industry and agriculture through the development of specialised products for use in these application areas.

The industrial applications cover a very wide area of industries, of which the following are an example:

- Building and construction (housing and civil engineering)
- Electrical
- Electronics and telecommunications
- Engineering
- Furniture
- Medical
- Packaging
- Textiles
- Transport

while in agriculture the applications cover:

- Water conservation and management
- Growing
- Produce collection and packaging
- Fertilizer packaging, transport and distribution
- Livestock housing
- Machinery and tools

In such cases the responsibility lies with the plastics industry, and specifically Plastics Trade Associations, or other interested bodies or persons to bring to the attention of the appropriate Government department the need of technological support for the plastics industry to enable these specialised applications to be suitably developed. By this means the plastics industry can make a positive contribution to the economic advancement of the country thus aiding the Government's development plan.

B. Project proposal for a PTC

When Government accepts the principle that the industry requires technological support then, generally, they take the initiative to identify the specific needs by a process of consultations with the various interested parties. It is at this point that Plastics Trade Associations can play a positive and active role since most of the technical and technological needs of their industry are readily available from within their membership.

By such processes the outline requirements for a PTC are evolved and a project proposal can be formulated. At this point in time it is very desirable that a small but active ad-hoc committee should be formed which can then proceed to more detailed considerations. The committee should have appropriate representatives both from Government and from the plastics trade association. It will be concerned with developing an organisational outline framework for the PTC, determining its location and identifying its director. Later, with the addition of other representatives it can be transformed to act as the Governing Board of the PTC, which will be responsible for the policy and control of the Centre.

C. United Nations assistance

It is necessary at this point to provide some information on the method by which United Nations assists developing countries. Funds are allocated, by an agreed formula, to each developing country for a five year period. These funds are administered by the United Nations Development Programme (UNDP) and are known as the Indicative Planning Fund (I.P.F.). Within Government various Ministries are concerned in the preparation of their Country's Development Plan, and it is Government, with advice of UNDP, who decide how these IPF funds will be utilised to implement the development plan.

It is important therefore that provision of a PTC by means of a UNDP funded project should be included in the Government's development plan so that it can be considered for funding through the IPF.

While the bulk of UN financial assistance to a country is administered by UNDP it does not, in general, involve itself with the execution of technical projects. This is normally allocated to and undertaken by the appropriate UN agency, which in the case of industrial-oriented projects is undertaken by UNIDO. For plastics the substantive operations are undertaken by the Chemical Section, within the Division of Industrial Operations, and is responsible for project execution. In addition to the above there is also an agreed format regarding the responsibility of contributions to be made to a UNDP funded project as between the Government and UNDP.

In general the Government contribution to the project consists of the following:-

1. Provision of site and buildings
2. Furnishing of buildings
3. Provision of national staff
4. Provision of project operational costs (electricity, water, local travel etc.)
5. Provision of locally produced expendable and non-expendible supplies and equipment.

On the other hand UNDP undertake the responsibility to provide to the project, the following:-

1. Provision of international experts/consultants
2. Provision of overseas fellowships for training and study tours.
3. Provision of imported expendible and non-expendible supplies and equipment.

In addition, particularly in the more advanced developing countries, the Government may call on the industry to make some specific contribution to the project either by cash or in kind. In some cases the industry voluntarily offers to make such a contribution. Where industry makes an active participation in the development of the Centre it is only equitable that they should have representation on the Governing Board to ensure that it has an active voice in determining the policy of the Centre.

D Preparatory steps towards the establishment of a PTC

The ad-hoc committee, or the Governing Board if it has been formed at this period of time, will be required to undertake three actions which form the key points in the preparatory stage for establishing a PTC:

- a) the preparation of an organisational framework outline,
- b) identification of the location and building for the PTC
- c) identification of the director of the PTC

Until these items have been completed the remaining items of the preparatory stage cannot be started since they are interdependent on the completion of the above.

a. Preparation of framework outline

Once the needs of the industry have been established it is possible to develop an outline framework for the PTC. Experience shows that in general this will include the need to provide facilities for:

1. Testing of raw materials and finished products.
2. Technology - Processing and Applications
3. Technical Information services.
4. External co-ordination.

At a later stage these facilities may need to be expanded to include

5. Investigational services (chemical and instrumental analysis)
6. Engineering services for mould design and mould making
7. Training

Each facility can be organised as a separate section of the PTC, and placed under the control of a section leader who responds either directly to the Deputy Director of the PTC or the Director. An example of an Organisational Framework is given in the Annex to this paper (page 18).

Once the organisational outline framework has been prepared it is possible to estimate the detailed staff and equipment requirements for a fully operational PTC. However, it is generally unlikely that sufficient funding would be available to cover the whole cost over a 5 year planning period. Since, at 1982 prices, the cost of UNIDO inputs to establish a PTC would lie between 1,500,000 to 3,000,000 US dollars depending on the degree of industrial assistance required. Moreover, even if such funds were to be made available it would be unwise to fully develop the PTC over a wide area in the relatively short period of five years.

Past experience indicates the advantages of establishing the PTC progressively, on a step by step basis, enabling a concentration of effort to be focused on one specific area at a time. By this means the chance of obtaining positive results are significantly higher. Much will depend on the individual needs of each country's plastics industry and the priorities that have to be determined as to the sequence in which the individual sectors of the Centre should be established. An actual timetable for this can only really be set out when the location and availability of a building to contain the Centre have been determined.

b. Identification of Location and building for the PTC

In attempting to decide the optimum location for the PTC several factors need to be taken into account. The needs of the plastics industry would probably be best served by placing the Centre near the largest concentration of plastics processors, but some consideration needs also to be given to the difficulties which might face the minority who are located elsewhere. Since they would need to travel to the Centre, and likewise staff of the Centre would also need to travel to these processors, then the location of the Centre should be conveniently near to suitable air, train or road transportation, as may be appropriate in the country concerned. Since much of the application work will be concerned with other industries, as mentioned earlier, then the accessibility of the Centre to these industries must also be given some consideration.

The Government also has considerations in determining the location of the Centre. If the Government is attempting to develop newer areas for industrialisation it may wish to place the Centre in such a location to act as a kind of magnet to attract the industry. Alternatively it may not wish to place the Centre in an area concentrated with plastics processors if its policy is oriented to slowing down industrial growth in that area. In developing countries which are geographically large, a special problem may arise if industry is being developed in widely separated centres of population. In such cases consideration may need to be given to the development of a satellite PTC, at a later stage, to serve these special needs.

These are some of the many considerations which have to be taken into account before the location of the PTC is finally settled. Then, when the general area of location has been determined a specific site has to be selected and purchased. It may be of general assistance to mention that a site of 1 to 2 hectares will generally be required to accommodate the PTC and allow for its future expansion.

At this point it is advisable also to review existing institutions, which already may be established in the general area, to ascertain whether any are operating in related fields, and to consider whether the PTC might be more effectively located within such an existing institution. For such an operation to be successful it is absolutely necessary that the Government and the plastics industry are granted full representation on the controlling board of the institution so that they can still exercise control over the policy of the PTC.

If the above is not feasible then consideration ought to be given to examining existing buildings, with adequate land for expansion, to determine if any are suitable for potential conversion to house the PTC. The advantage of such a scheme lies in the fact that it is generally quicker to build a conversion than to build from a "green-field" site. If a suitable building can be located then the next step should be to carry out the necessary survey, arrange its purchase, and prepare the specifications and drawings for the conversion. At this point in time the ad-hoc committee will require the services of its director of the PTC to assist and supervise these details.

c. Identification of the director of the PTC

Past experience has emphasised the great importance that attaches to the selection of the right person for this position since much of the success, or failure, of the PTC is directly attributable to the functioning of the Director. He should be a technically trained person of post-graduate or equivalent level with both research and development experience, as well as some industrial administrative experience. He should be a self-motivated and committed person, a natural leader respected among his professional colleagues.

Such a person is normally difficult to find, and it may take some considerable time to find the right person. Nevertheless it is well worth delaying the start of the project until a suitable Director has been identified. Recruitment of the director should be undertaken as soon as may be convenient since his services in the preparatory stages of the project can be fully utilised by the ad-hoc committee. He will need to be provided with temporary office accommodation and a secretary. The recruitment of the Director may well raise another issue - salaries. This will have to be settled either by the ad-hoc committee, or by the governing board depending on the stage of establishing the PTC which has been reached.

The key personnel of the Centre consisting of the Director, Deputy Director and section leaders are all persons who should be encouraged to remain at the PTC for long periods of their working life in order that a skilled, competent and effective team may be developed. Once these personnel have exhibited their skills, after a few years, to the plastics industry by the results they achieve it is known that they can then become targets for poaching by the plastics industry. To off-set this to some degree, and in order to acknowledge and recompense the personnel in being unable to openly publish all their results as they would be required to do if working in an academic institution, then it is necessary and desirable that their salary scales should be considerably higher than they would attain in either government or in industry.

A plus twenty percent level is the type of margin that is required to try and hold a team together. Without this kind of salary margin then it must be expected that, after the initial starting phase of the PTC, there will be a twenty to twenty five percent turn over in staff.

E. UNIDO assistance - Preparatory assistance mission

The tasks indicated in the foregoing sections and undertaken by the ad-hoc committee represent the initial preparatory step before a PTC can be established. It is possible that the committee may be in need of expert technical assistance to help it determine some of the details concerned, to advise on organisational framework, or to assist in the drafting of a detailed project document. It is open to government to request UNIDO assistance, through UNDP, for this purpose.

F. Establishment of a PTC - project implementation

Once the project document has been approved and signed the way is open to start the processes leading to the establishment of the PTC. The project would normally be scheduled to be developed over an initial five year period with the prospect of a second 5 year period being required. The first year would be scheduled for the preliminary preparations with the following four years for the progressive build up of the sections.

The first task would be to establish a detailed timetable for the first year work-programme and outlines for the remaining years. Much would depend on a completion date for the availability of the building which represents a key-point in the timetable.

Prior to the building being made ready, temporary office accommodation and secretarial services would be required to accommodate the director and other key personnel, as they are recruited, as well as the international consultants scheduled for that period.

G. International Consultants

The general practice is to provide a consultant to act as Chief Technical Adviser (CTA) to the project who would provide advisory assistance to the national project director of the PTC. The services of the CTA are generally arranged on a split mission basis with appropriate provision for continuity of project work when out-station (i.e. from home-base). The missions are generally of about one month duration as it is believed that the director, being an adequately qualified person, only needs to receive guidance periodically.

Other consultants would be scheduled to assist the various section leaders in the establishment of their sections as may be required. The work would involve short-term, split missions to enable the consultant to supervise and assist in the erection of equipment, training and supervision of its use, interpretation of results, assistance in preparation of manuals etc. The timing of these missions would be dependant on equipment delivery dates. Additional consultants would be scheduled for specific needs if this is found to be required.

H. Equipment and Supplies

Since the dates for the consultants depends on equipment delivery the next task to be tackled is the preparation of detailed specifications for the equipment items set out in the project document. The CTA would normally assist in this operation. The specifications for UNIDO supplied equipment, after finalisation, are then submitted through the substantive section of UNIDO who raise and pass the necessary requisition to the Purchase and Contracts section (PAC) of UNIDO who have the responsibility of obtaining tenders and/or quotations as appropriate. These are then submitted to the Director of the PTC who, in consultation with the CTA, determines if they meet the requirement for the PTC, and PAC section are informed which equipment should be ordered.

UNIDO are bound by their regulations to purchase the lowest offer quotation if it conforms to the specification submitted. However, in special cases, equipment quoted at a higher price may be purchased if appropriate justification can be provided. Once firm orders have been placed copies are despatched to the UNDP office in the country concerned since all deliveries are addressed to UNDP. Delivery dates are detailed on these orders, and copies can be made available to the director, on request.

With the appropriate delivery dates now available it is possible to finalise a work plan in relation to the dates that consultants will be required, and UNIDO can be duly informed so that the recruitment of the consultants may be started. It is necessary, of course, for the PTC to make arrangements to monitor the delivery dates and start a chase process in case of slippage as this will reflect on the projected date of requirement for the consultant, and the Project Personnel Recruitment Section (PPRS) at UNIDO will need to be informed, well in advance, of any such projected date changes.

The equipment purchase process takes time and it is therefore useful to have some indication of this time factor. After the equipment specification has been submitted to UNIDO a purchase requisition is issued to PAC. They then request quotations. This operation can take six to eight weeks before the quotations are received. The quotations have then to be checked by the Director of the PTC with assistance of the CTA and firm orders placed by PAC. This process may take a further four weeks. A total of about three months. Then added to this is the delivery time quoted plus the shipment period to the country concerned. Thus, in practice, it is generally a minimum of six months between finalising an equipment specification to the arrival of the equipment at the PTC, and in the case of pilot-plant processing equipment this period can be extended to 12 months.

With an appreciation of these time scales it will be understood why priority needs to be given to finalising the equipment specifications in this preparatory period.

Equipment and supplies to be purchased through the Government contribution will also need to be clearly specified before purchase requisitions are made, and the time factors involved will depend on the particular systems in use in the country concerned. The Director will need such information to enable him to finalise delivery dates to the PTC.

A specific point worth mentioning is that of furniture and furnishings for the offices, laboratories, library, etc. in the PTC building. These are items that some architects do not normally include in their specifications for the building. It appears to be normal practice to leave the ordering of these items to the PTC management, and for them to arrange the installation after delivery. It would save considerable time and effort if arrangements could be concluded with the architect to undertake the provision of furniture and furnishings as part of his contract.

I. Recruitment of national personnel

In the preparatory first year of the project it will be seen that the sequence of events has been the preparation of the work programme, finalisation of the equipment specifications, and selection of tenders when received. Action is also required to start the recruitment of a deputy-director and of the section leaders and some servicing personnel. The deputy-director should be an experienced administrator with practical experience of handling personnel matters, purchase and stock control, as well as financial and budget preparation. He will be responsible for the general administration of the Centre.

The Director and the Deputy Director should form an inter-related team - one a specialist technologist and the other a skilled administrator. In the preparatory first year of the project they will have an excellent opportunity of working together in planning and in administration.

J. Overseas training

The Section leaders will need to be recruited in their required specialisations. If such personnel are not available then consideration will need to be given to recruitment of alternative personnel who would need to undergo longer periods of fellowship training overseas to raise them to the required standard.

Familiarisation study tours to plastics technology centres in other countries would need to be organised for the director and deputy director, which would also enable personal contacts to be established for future use. These tours could be developed to cover both general and specific areas of interest depending on the needs. Where possible these tours should be undertaken before the completion of the building programme.

Overseas fellowship training required could be detailed and preliminary timetables arranged. This type of training would be of periods of not less than three months and not more than twelve months. For example, in the case of plastics technology and testing it is advisable to take such training on a split operation. For example six months on technology followed by four or six months back at the PTC carrying out practical work followed by a further three or four month overseas training session. The experience of training institutions indicates that more effective knowledge is transferred by this techniques compared to a single nine or ten month course.

These particular training programmes should be related to the type of sections to be developed in the PTC, and where possible, in the same priority sequence. However, experience indicates that the availability of suitable personnel for recruitment does not always make this possible.

Consideration of the type of specialist courses that will be required needs to be given at the beginning of the preparatory period. The details need to be passed on to Training Section in UNIDO who hold responsibility for making the necessary arrangements. In this matter the assistance of the CTA may be utilised.

Once the personnel have been recruited and are then ready for undertaking their training programme there are certain administrative matters that have to be completed both with Government and with UNDP before the fellowship can be granted. Depending on government procedures this may take one or two months before a candidate is cleared for departure. This is a factor that needs to be taken into account in determining the training timetable.

The general aim should be to try and complete the overseas training of section leaders before the equipment of their relative sections is scheduled for arrival. Training of other staff members would be scheduled to be undertaken during the second and third years of the project as may be appropriate to the requirements of the project.

K. Step by step development of activities

The first sections of the PTC to be implemented are normally the Technical Services Section and the Testing Section. The Technical Services Section contains the Library which can be relatively easily started with a limited quantity of journals and books while the technical information service would be engaged in obtaining catalogues of equipment and of raw materials from various manufacturers and in establishing an information recording system. The Testing Section would be restricted in activities until equipment became available. In the interim period contact with processors could be established and their specific testing requirements ascertained. Appropriate samples of products could be collected for subsequent testing, and which could be used during the training period. In addition, contact could be established with the National Standards organisation to arrange for the PTC to be represented on appropriate Plastics Industry standards committees.

The administration section would effectively start its function when the Deputy-Director is recruited. During the first year most of the work would be involved in the preparation of appropriate manuals dealing with personnel management and physical resource control, followed by manuals for financial management of the Centre. This task can be greatly simplified if standard manuals, used by Government service, or other Government funded institutions could be authorised for use by the PTC. If amendments were deemed necessary these would have to be authorised by the Governing Board.

The Engineering Section at the initial stage would consist of perhaps one electrician and one fitter who would perhaps be better controlled by the section Leader of the Processing Technology Section which is the area where they would be most utilised in the early stages of the project implementation. The establishment of the Engineering Section can thus be left to a later stage in the project implementation, perhaps during the third year. Much will depend on particular work programmes.

The Technology Section would be able to start practical work on processing only after its equipment has been installed and made operational. The Applications part of the Section could undertake both desk work and consultations with processors to determine the area and nature of specific industrial applications required to be developed, and the nature of problems experienced by processors in developing new products.

By these various steps the work within the Sections is progressively developed and advanced. In particular contact with the plastics industry is established at an early stage so that first hand knowledge of its activities and its problems are discussed. By this means a more useful work programme can be detailed for the second and subsequent years of the project. The primary objective of the PTC is to serve the needs of the industry and provide practical solutions to its problems. These early contacts with the industry need to be followed up and made a regular feature of one of the activities of the PTC.

With the build-up of information gathered from the industry it will be possible to determine problems of common interest, and problems specific to certain processors. Suitable work programmes can then be developed to tackle the common-interest problems, while a suitable contract might be discussed and organised with the processors to tackle more specific problems.

If there is insufficient work to keep pilot-plant busy it may be possible, with the agreement of the Governing Board, to undertake sub-contract work for the industry. This provides opportunities for ensuring that machine operators maintain and improve their skills whilst providing a supplementary source of income for the PTC.

It is by these means that the establishment of the PTC is progressively developed and tailored to fit the specific needs of the industry that it serves. If the planned development of the Centre as specified in the project document fails to meet these needs because of subsequent changes that may have taken place since the document was first approved, or for other reasons, then it should be pointed out that the Governing Board has the power to change the policy of the Centre if that is deemed to be necessary. By having representation on the Governing Board the plastics industry is thus able to exert a control on both the development and services which the PTC offers to the industry.

ORGANISATIONAL FRAMEWORKPlastics Technology Centre