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Fertiliser Plants

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**TECHNICAL MANPOWER DEVELOPMENT \***

by

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## I. Introduction

It is hardly relevant to emphasize the importance of increasing productivity in fertilizer plants or the importance of technical manpower in this task.

Technical personnel required for manning the fertilizer plants fall under four disciplines - chemical, mechanical, electrical, and instrumentation. Further the personnel are grouped under four categories depending upon the responsibilities they hold: 1) Senior managers, 2) Middle and Junior managers, 3) Supervisors, 4) Operators and Technicians.

The complexity inherent in the production of fertilizers calls for large employment of these qualified personnel. The estimates of manpower obviously depend upon capacity, process adopted, number of streams, feedstock, and whether it is a grass root project or expansion of an existing plant. In the standard of manning adopted for 'Optimal Staffing Scheme', the latest manning pattern of a large size ammonia and urea plant was taken into consideration. The efficiency of fertilizer industry lies on the high level of training and skills of its labor force. So serious shortage of personnel in such skills could endanger efficient production of fertilizers. This necessitates proper advanced training of the technicians and skilled workers.

## II. Summary

The development of manpower covering education and vocational training necessitates investment and, therefore, must head the list of budget priorities. The money that has to be invested is small when compared with returns that can be expected by running the fertilizer establishments efficiently with well-trained personnel.

The worst obstacles to fertilizer development programmes and projects are caused by shortage of qualified personnel, lack of regional cooperation, and inadequate social infrastructure. There is no answer except to consider it an obligation of each country to maximize its resources to train at least the stipulated number of trainees and have also a built-in provision to ensure that these training efforts and the persons so trained are fully utilized for better results. Regional training centres as recommended by Joint UNDP /AFCFP/ IDCAS /UNIDO Exploratory Mission on Regional Development of the Fertilizer Industry in Arab States and Fertilizer training and developing centre (FTDC) in Turkey as recommended by UNDP/UNIDO are best examples of UNIDO's efforts in the field of manpower development in the region.

III. MANPOWER DEVELOPMENT AND PRODUCTIVITY OF  
FERTILIZER PLANTS

Of late the human resources had assumed a great importance in determining the economic growth and development of a country. It is now considered the most strategic and critical aspect for determining the economical growth. A country may have abundant physical and financial resources but unless there are people who can channelise and use these resources for more production effectively, the country cannot make progress to meet economic and social objectives. There is much desired to be done. Manpower development is the basic thing when people talk of human resources development.

Manpower development generally means in preparing a man for his immediate and future task to meet the challenge and fulfill the objectives of the organization. It is the responsibility of the organization to provide him the necessary facilities and arrange for his training on the job.

In many developing countries manpower development activities are sporadic and fragmented and suffer from the absence or low quality of planning, co-ordination of training programmes and institutions and of systematic evaluation of results. These activities are rarely viewed as a component of a wider process of human resource development and as a phase in the life long education of the individual.

If persons are to be induced to acquire industrial skills, to work where their skills are needed, and to perform their tasks in a satisfactory manner, they must be reasonably committed to what has been called the "industrial order". This can be achieved only through a strong employment policy. There is evidence that in many developing countries industrial workers do not feel so committed and consequently do not form a stable labour force. One of the main reasons is that traditional societies have not become fully adjusted culturally and sociologically to modern industry. Other important factors are ill-health, malnutrition, inadequate housing in urban areas, low urban wages, the low social prestige of many industrial occupations, long working hours and poor industrial relations in many enterprises. These factors, besides contributing directly to low plant productivity, have the effect of making workers slow to acquire the outlook needed to promote industrial development. There is good scope of increased productivity and better utilisation of resources, human and material by improving the quality of managers in the fertilizer industry. The managers have to be given a proper understanding of organisational system and knowledge about motivation of employees and management. One of the primary requisites of productivity is the removal of element of 'dissent' from the work force about the policies and directives which the managers would like to be implemented.



Manager has to be, therefore, trained to the extent it is feasible in developing the proper personality traits in dealing with his work force.

They need to have knowledge of such functional areas as production, finance, control and marketing and the new skills and techniques which are now having a revolutionary impact on productive operations of chemical fertilizer plants.

The operation of chemical fertilizer plant itself is a broad subject and must be broken down into a number of different activities in relation to manpower. Several of these activities such as training, staffing of plants have vital impact on productivity of fertilizer plant. It will be seen that each of these activities requires planning and scheduling for the activity before it occurs, otherwise much valuable time will be lost and the final operation of the plant may fall far short of success.

Successful operation of a chemical fertilizer plant depends in the first place on the thoroughness with which the operation has been planned during the design phase. Most contractors employ personnel who are experienced in plant operation and the experience of these people should be used from the early stages onward. They should check plant design to see that start up, shutdown and emergency conditions have been taken into account in finalising the plant design. Their experience should enable them to predict any unusual circumstances that may occur during operation and to recommend incorporation of design features to care for these situations.

If the operating company wishes, the engineering contractor will prepare a manpower organization chart for the entire complex of plant or parts thereof.

Recommendations as to the desired level of experience, qualifications of the personnel to be employed and the number of employees to be hired can be obtained from the plant designer.

This plant organization should be reviewed well ahead of plant completion so that the operating company will have the opportunity to survey the local labour market. If qualified personnel cannot be hired locally, the operating company should make arrangements to get help on a temporary basis by outside recruiting, utilizing contractor's experienced personnel, by borrowing manpower from affiliated companies or some combination from available sources. In addition, it is advisable to have vendors service engineers present to advise or assist in the initial operation of their equipment.

A suggested list of such expatriates, their disciplines and their duration of stay is given below. This is only a guide. The list can be adjusted on the basis of more thorough knowledge or particular requirement by the project authorities, Technical Service Consultant, and the Engineering Contractor.

Some of the expatriates will have to take up their responsibilities even before the mechanical completion of the plants - say three months before - to familiarise themselves with the process and plants as well as the local work force. Others can take up their responsibilities at a later date.

**Table 1**  
**Expatriates Requirement**  
**for an Ammonia/Urea Production Plant**

Category	No	Man-Months				
		Pre- Prodn Period	1st Yr.	2nd Yr.	3rd Yr.	Total
1. Works Manager	1	9	12	12	12	45
2. Chief (Production)	1	9	12	12	12	45
3. Chief (Maint.)	1	9	12	12	-	33
4. NH <sub>3</sub> Plant Supdt.	1	9	12	12	-	33
5. Urea Plant Supdt.	1	9	12	12	-	33
6. Centrifugal Compressor Splst.	1	9	9	-	-	18
7. Instrument Splst.	1	9	9	-	-	18
8. Workshop Techn.	1	-	12	-	-	12
<b>Total</b>	<b>8</b>	<b>63</b>	<b>90</b>	<b>60</b>	<b>24</b>	<b>237</b>

As can be seen from the table, initially the expatriate force will start with seven people, reach a peak of 8 in first year and will taper off to two in the third year.

It is all too easy to rely heavily on outside assistance but it may fail to provide the company's personnel an opportunity to gain self confidence and experience. When outside assistance is found necessary, a prime objective is to use their experience in training local personnel.

Prior to plant completion, a training program should be established. This program normally includes the following elements.

- a) Plant visits by a group of supervisory personnel to a similar installation, preferably under the guidance of one of the contractors experienced operators. These supervisors will be expected to play an active part in the subsequent training program.
- b) Classroom training for personnel that will be involved in the operation of the plant preferably by a training specialist or by supervisory personnel.

Orientation is an important element to be included in classroom instruction. Each man must become thoroughly familiar with the organization and his specific function and duties. Position descriptions should be prepared for each assignment, detailing these duties and responsibilities to assure that each individual knows exactly what is expected of him and what he can expect from others.

Much assistance in training can be provided by the engineering contractor or his experienced operators. Visual aids, including training simulators, if available, are also of great assistance when carrying out a successful training program.

The operating instructions manual is used as a basic tool for training purposes.

- c. On the job training proceeds even before the plant is complete. As various portions of the plant are readied for operation, a great deal can be learned. The clients operating personnel can witness and assist with such activities as; checking of plant equipment, calibration, of instruments, blowing of lines, charging of catalysts and chemicals, dryout of furnaces and similar tasks.
- d. Safety policies and procedures must be developed, and the staff must be trained to adhere to those precautions which are established to prevent accidents as well as becoming familiar with the steps to be taken in the event of an accident. In most chemical plants, the operating staff are

expected to play an active role in case of fire, and a fire fighting school is often used to provide the men with the knowledge they will need to properly utilize available equipment. Training must include a basic knowledge of all chemicals involved in the plant including those for fire fighting and the measures required to protect personnel as well as equipment. A sound safety program is designed to provide for safe handling of things as well as people.

After the plant has been placed in operation, classroom training should be continued for new personnel and for development of all plant operators. Shift schedules should be arranged in such a way that personnel can be made available to attend those training sessions.

The importance of the training and the preparation of the training program to obtain the maximum benefit of this exercise cannot be over-emphasized, and the success or failure of future operations may depend on the thoroughness with which this training has been conducted.

IV

ORGANISATION OF MANPOWER DEVELOPMENT AT EXISTING PLANTS

The present generation of large single stream ammonia and urea plants are highly capital intensive. They have to be brought into optimum production as early as possible and should be kept at a high level of output consistently to give a good financial return for the company. Hence setting up a well knit organization with a core of highly skilled specialists is necessary. It is advisable to make the service of a well-experienced foreign technical service organisation in the initial period of the commercial operation of the project, to organise such a core force. It is suggested that the project authorities should make a contract with a well reputed technical service consultant firm (preferably either with the engineering contractor or with a consultant firm who is familiar with the processes and plants offered by the engineering contractor) for the first three years of commercial operation of the plant. The duty of the personnel of this consultant organisation will be to organise and train a core of medium level specialists who can later take full charge of the plants. Also they should help in the training of skilled technicians for day to day running of the plants. They should develop an adequate system for operation and maintenance of the plants, develop standards for production planning, production control, maintenance planning and maintenance programme, inventory control and inventory forecast, quality control, cost analysis and cost control etc. Each of these expatriates should have local counterpart who will ultimately take up the responsibilities of the expatriate

when the latter leaves. It is expected that in the initial stages, these expatriates will be in direct charge of their respective sections and gradually they will be replaced by their understudies as the latter gain the experience.

The work force needed for the fertilizer plant is a highly specialised one. Some experienced workers may be available from the existing fertilizer plants. But the major portion is expected to be people with inadequate experience in fertilizer industry. Hence they have to be trained sufficiently in advance and adequately before they are put to oversee and operate the machine.

Training for technicians and operators should be for various trades with a bias towards fertilizer industry. This training should be from six to eight months and should be by lectures as well as by inplant training. Help of existing fertilizer plants may be necessary.

Training of supervisors should be such that they should be familiar with the processes and machines to be operated. This may be for about six months. In addition to lectures and inplant training in existing fertilizer plants, some of them, especially those in higher supervisory level in operation and mechanical maintenance of ammonia and urea plants, should be sent to neighbouring countries to familiarise themselves with actual operation and maintenance of the new generation of ammonia and urea plants.



The training of senior officers has to be by visits to various new fertilizers plants designed and erected by the engineering contractor. This will be rather a study tour than an intensive training programme. During this study tour they should familiarise themselves with the Engineering Contractors' processes and plants, techniques of installation of plants, difficulties faced during erection and operation of the plants. After their study tour abroad, they should become part of the project force during installation and commissioning of the plants. They should also train the lower staff. The study training may be limited to personnel between works manager and plant area operation and maintenance superintendents. These study tours will be of four to six weeks duration.

Because of the vastness of training programme that has to be undertaken, it is suggested that a well-knit training center should be developed as part of the activity of the project and day to day working of the plant management.

V. EMPLOYMENT POLICIES RELATING TO NEW PLANTS

The contribution of the well trained and efficient skilled work-force is as vital for the success or failure of a fertilizer plant as that of the supervisory or management team. Therefore, equal emphasis, care and scrutiny has to be exercised in manning all the levels. The strength or weakness of any one level will determine the effectiveness of the whole organisation.

Another important aspect which needs emphasis is that the fertiliser industry being capital intensive cannot be viewed as a means of solving the fast increasing unemployment problem. It has a very limited employment potential, confined to skilled, experienced and trained personnel and has hardly any avenues of employment for uneducated and unskilled people. This is important because the pressures for employing more people lead to many difficulties. Apart from having surplus people, it results in taking into the organisation men with very limited educational background, whose upgrading of the skills in the operation and maintenance in the complicated plants is a very slow process; while, a marginal extra number of people with requisite background would be helpful in generation of additional requirement of experienced staff, recruitment of larger number at the lower levels is the main cause of perpetual problem of disturbed employer-employee relations leading to inefficiency and lack of discipline and control. It is also leading to considerable delays in completion of the fertiliser projects. It is, therefore, essential that the development of fertiliser industry is diversified and insulated

from the pressures for employment generation. In the erection of the fertiliser projects and its operation, it is necessary that only essential numbers are in position. To ensure the availability of this essential number is by itself a challenging task.

It has to be appreciated that the requirement of manpower in any new unit can only be partially met by the training of fresh engineers, diploma holders and technicians from various educational institutions. A possible maximum of 50 per cent would be the upper limit which can form part of the manning of a new unit by giving the fresh recruits 1 to 3 years practical training in the existing operating plants. Hence, the total required manpower will have to be generated by efforts in the existing operating units. The existing operating units have to plan to train fresh intakes to meet 50 per cent of the additional requirements in the new projects and to spare the balance requirement of 50 per cent from their experienced personnel and to be able to spare this 50 per cent, they have also to train additional people to replace these.

This requires emphasis because many times when the question of generating technical manpower is considered there is a feeling that it requires strengthening educational and professional institutes in a country or modifying the courses therein. But no effect outside the industry in educational institutions can help the immediate problem. Modification of courses may marginally help to reduce the practical training in the existing factories. The only way is to plan and expand the internal training facilities in the existing operating units.

To consider the ways and means to generate this manpower, it is better to take the staff required categorywise and review the sources from which they have to be obtained.

**A.           TECHNICIANS/SKILLED WORKERS/OPERATORS/FITTERS**

All these designations are used without any precision for this category of workers. The sources to get any category of staff are always as follows:

- (a) Open market recruitment,
- (b) Internal promotions and upgradations of the posts at the lowest level, and
- (c) Fresh recruits from technical and educational institutions like Industrial Training Institutes (ITIs) followed by suitable training.

In terms of the number and the physical efforts required, this category is most vital. The skills of the operators and technicians in any plant and their attitude are a key to be efficient running of the plant. While sometimes it is felt that better supervision and management can substitute this, general experience is that it is not so. The contribution of good supervision and basic norms of performance can be achieved for this category.

As the fertiliser industry is technology intensive, general experience shows that it is not practical to expect to meet these requirements in the open market. All that will happen will be migration of people from one factory to the other and in the total context

of the fertiliser sector the problem will remain the same. Even if few people can be available from allied chemical industries, their skills and educational background generally will be of limited nature. These people are likely to belong to older age group with much less resilience to acquire new skills because of their poor development potential and restricted adaptability. These people will feel frustrated when younger and better educated and trained persons will supersede them in due course. This source, therefore, will contribute little towards meeting our needs of manpower at this level.

#### INTERNAL PROMOTIONS AND UPGRADATIONS:

Except in some older plants, the number of people at the lower category of skills and semiskilled workers is very limited. Generally, the skilled category is the base of the manpower of a fertiliser plant and the very nature of their job excludes semi-skilled/unskilled persons from recruitment. However, partially some percentage of the skilled workers can come out of these lower categories by suitable training. Any way, some avenues have to be kept open for the existing people in this semi-skilled category. These have to be fitted in mainly in the existing plants. Because of this factor, there is a limited possibility from this source though all efforts have to be made to upgrade the skills of semi-skilled/unskilled people in the factory, where they are available by intensive internal training efforts.

**FRESH RECRUITS FROM TECHNICAL AND EDUCATIONAL  
INSTITUTES FOLLOWED BY INTERNAL TRAINING IN THE  
OPERATING UNITS:**

The industries and individual plants have to cater both for the basic training as well as the inplant training. Ultimately, therefore, the answer has to be in recruiting people from educational and technical schools and ITIs and given them basic training and inplant training within the industry. As explained, part of this group has to come from the recruits by the new installations which must at least organise for their basic training at the site of the new installations.

It has already been explained that some of the experienced people in this category have to man the new installations as other sources are not available. Only if the mobility of these people is possible, the newly trained people can replace them and new installations can find their proper mixture of newly trained and experienced people in this group.

Therefore each new installation should set up a nucleus of basic training, select the number, which it considers optimum, from the fresh recruits at least 2/3 years before commissioning, impart them the basic training, arrange for their inplant training in the existing plants and bring them to the site during the time when the mechanical erection and commissioning are started. In case the new installation is an expansion of existing unit, or another factory already exist in the same State, the problem is much simpler.

The existing factories have to gear up their internal training facilities for (a) upgrading their semi-skilled or unskilled personnel, (b) providing training for the fresh recruits for the new factories and their own internal requirements to meet wastage and replacement for their experienced people who will have to be spared for new units.

Efforts have to be made to set up institutes which will relieve the operating factories of the load of providing basic training and also help in shortening the period of inplant training. The operating units can then mobilise all their training resources to the extent possible for training in the plants. These institutes should be built in different regions quickly and should admit students on a sponsored basis from industry.. However, even then the impact of this can be felt only after 4-5 years when these institutes are organised and are able to turn over their products for recruitment as trainees/probationers for the industry.

From the above it will be clear that the important problem the industry will face is to generate enough of these people of proper educational background and training

At the same time means have to be found out to get over the problem of lack of mobility or employment of such people in areas where the need exists.

**B. SUPERVISORY CATEGORY**

These will be the category of supervisors like Chargemen, Assistant Foremen, and Foremen.

**OPEN MARKET:**

The considerations which make this source of not much value, are the same as those for the skilled workers. There are few establishments outside the fertiliser sector which can supply suitable persons in this category for modern fertiliser industry. These have, therefore, to come from the existing fertiliser factories. Oil refineries or petrochemical complexes, which could be another source, have their own expansion programmes and can ill afford to spare such people. General experience of recruitment from open market points in the same direction, that it is not easy to recruit people in this category except from fertiliser sector which in the total context of the problem, is not helpful.

**UPGRADATION FROM THE LOWER CATEGORIES:**

Because of the large base of skilled manpower in any operating unit this would be a major source for this group. A good percentage of people who have worked as operators and technicians and have originally come through the educational stream of ITIs followed by organised training will be suitable to meet the requirements in this group. Their age group will be younger and their competitive spirit can be a spur for their self-development backed up by encouragement



and training. At the same time to cope with the present tempo of raising expectations and pressures of advancement from within, it is also right and proper that largest number of supervisory personnel are by upgradation of technicians. Upto 60 per cent of new requirements could be met in this way. The balance will be met by training of fresh Diploma holders and Science Graduates. This, however, will again mean replenishment of the people in the skilled categories who are promoted to supervisory group by new trainees at technician level. Normally if a technician has the necessary educational background and has put in a 5/7 years of service in the operation and maintenance of a plant, his technical ability for supervisory work is not a big hurdle. The main problem is the development of maturity and other supervisory skills specially in the present context of employee relations. One has also to avoid the obvious problem of losing a good technician and having a poor supervisor. To that extent the screening, selection and training in supervisory skills has to receive due importance.

For this area again, the effort is to be really from within by the industry while comparatively more help than in the category of technicians, can be taken from outside institutions in the field of supervisory training. In the present context of rapid social and industrial change, the challenge and pressure of rising expectations, tensions of daily industrial life, resistance to injection of fresh people from outside, the job of supervisors apart from technical requirements is predominantly one of human relations, dealing with people, getting the work done, grievance handling, etc. This becomes their major responsibility.

**FRESH INTAKE FROM POLYTECHNIC AND SCIENCE GRADUATES:**

About two-fifths of the total requirements, of supervisory personnel have to be met by training fresh Science Graduates and Diploma holders. However, for the fresh graduates and diploma holders to be useful, they have to be broken in into the industry and receive their practical training. Because of the resistance to their injection, except in new installations where the problem will not be so acute, these fresh people have added difficulty to adjust themselves. Therefore, a proper training scheme and promotion policy from within which also specifically provides for such injection at this level is an essential responsibility of management in the fertiliser industry. The features of such programme would be to familiarise the new recruits with the culture of the organisation, to provide intensive and extensive knowledge of the plants, machines and processes and supervisory skills.

**OPEN MARKET:**

The availability from the open market cannot be any better than for the other two categories discussed, though at this level, to provide for fresh blood and avoid complete in-breeding, efforts have to be made to inject some people from outside. However, again, the major sources are within the fertiliser sector, petrochemical complexes or oil refineries.

**PROMOTIONS/UPGRADING:**

In this category, particularly for the middle and higher management, most of the requirements have, therefore, to be met by promotion of junior managers and good senior qualified supervisors. If the supervisory category, as discussed earlier has to be progressively built by promotion of the skilled technicians, availability of the junior managerial persons through upgradation from within will be more and more difficult. The requirements of managerial job in the modern complex plant even in the area of technological competence are different from those of supervisors. There certainly will be many ambitious and painstaking persons in the supervisory category who by their self-efforts would acquire higher qualifications. These certainly have to be encouraged. These people, if carefully selected, could be suitable for normal operation and maintenance, though normally for other areas such as design/engineering, industrial engineering, technical services, they will have inherent limitations. Therefore, it is felt that not more than 25 per cent of this requirement can come out of upgrading the existing supervisors. Most of such people more or less will culminate their career at the middle management level in course of time. Such people, will require a good deal of guidance and encouragement to counter their built-in limitations. Exposure to a variety of experience and encouragement and guidance by the seniors is the only way out.

#### FRESH RECRUITS:

Therefore, about 75 % in this group have to be injected as fresh engineers at the junior managerial level after suitable training. Here again the problem relates to the efforts of the industry to train such young engineers for their own requirements as well as for the requirement of the expanding industry. The training programmes for such graduates are generally well established and the experience is that by and large they are meeting the demands adequately. For various reasons, comparatively more attention and efforts have been devoted in the past to the training of such engineers and not so much to the training of skilled workers and supervisors. This imbalance has to be corrected.

#### MIDDLE AND SENIOR MANAGERS

Most of these have to come from the junior managerial group by promotions. The problems of lack of mobility in regard to workers and supervisors are not so much present in this area. Obviously the new factories will derive most of their senior managers from the existing plants. There is considerable emphasis these days on management development. There is a somewhat naive view that good managers can be turned out by sending them to training courses in general management. In the present climate of opinion it may appear to be rash courage to doubt the efficacy of management courses organised within a company or by professional institutions in solving the problem of development of good manager. However, this is broadly the feeling of most of the operational and functional managers in the field. In discussing the problem

of management development/training, one has to consider what management is in the highly technological industry like the fertiliser industry. Generally all of the persons who become managers in such an industry, have a basic specialised background and they reflect primarily their own professional expertise. Ultimately management is the sum total of specialised competences required to run an organisation and these form the basis of large number of managerial appointments. The skills of management are hardly confined to common conceptual definition but must include these specialist skills. It is not the intention that the need to have knowledge and skill of general managerial techniques and the experience of the different facets of the job and the objective of training in this regard should be ignored, but rather, to emphasise the fact that it should not be allowed to obscure the need for training continuously to improve and up-date competence in the primary specialisms. Generally if there is difficulty in an industry, apart from the extraneous factors it is essential that any specific lack of competence has to be identified. Because of these factors a general management training can only marginally solve the problem of finding middle and senior managers for the industry and to that extent the people who are upgraded to the managers' position will be persons who have the basic technical competence, have grown in the existing industry and have held responsible positions in their specialities. After proper selection of such people, their development will really depend upon the opportunity and scope and their understanding of inter-disciplinary functions. The object of bringing out the above point is not in any sense to decry the need of training for management development but to emphasise the fact that the complacency that seems to be generated that a few courses on general management will ensure

improvement in the quality of management is to be guarded against. It is a question of the emphasis which has to be put on the role of management training in building our future managers. Ultimately one cannot get away from the fact that the managers have to be developed and are developed by the challenge of their jobs, their opportunity, their built-in instinct for self-development. As we go higher and higher in the management the conceptual and cognitive skills become more and more important and the information and technique-based, problem-solving and decision-making management courses become less relevant to the success of the manager. The conceptual and other skills are not easily developed in the class-room situation. Therefore, once people are selected from the existing junior/middle managers for middle and senior managerial positions what is necessary is a carefully planned inter-disciplinary exposure to different facets of job with responsibility. Here really lies the problem of management training specially with the fast growth of the industry, and a management development programme within an industry has to progressively provide such experience.

VI

EXAMPLE OF AN OPTIMAL STAFFING SCHEME

A typical pattern for the permanent staff of a standard size fertilizer plant is given in Figure I. This staffing pattern developed assuming that the services of an internationally recognized Technical Service consulting firm is taken for the first three years of operation.

It is assumed that the central office of the plant is located at the project site. There will be a Board of Directors with a President/Chairman. Under the Board of Directors there will be two Executive Vice-Presidents who will implement the policy of the Board. One of the Executive Vice-Presidents will be in charge of marketing while the other will be in charge of production.

Under the Executive Vice-President (Production) there will be Vice President (Techn.), Vice President (Administration) and Company Secretary. Vice President (Techn.) will look after technical matters while Vice President (Administration) will look after the administrative matters. The Secretary will look after the legal aspects.

The Vice President (Tech.) will be assisted by a Works Manager. Vice President (Tech.) will have under his control three departments- Technical Service and Planning Department, Production Department and Maintenance Department.

The Technical Service and Planning Department will have the following sections under it. The Department will be headed by a Manager assisted by Superintendents.

The Planning Section will be in charge of review of past performance of various plants as well as forecast of production for future- both short term and long term.

The Process Control Section will be responsible for coordinating the activities of different plants. It will also monitor the raw material, utility, chemical consumptions of various plants. The section will also look after the quality control of raw materials and products.

The Trouble Shooting Section will be in-charge of debugging of problems occurring in the operation of various plants, modification and improvements in the plant, collection of historical performance data of various equipment and machinery, etc. A small design office will be attached to this section. The Section will collaborate with maintenance department on preventive maintenance work.

Environmental Control Section will be the watchdog on the environmental health of the plants. It has to make effluent and emission studies, monitor them and suggest various control measures and improvements for better environmental control.

Fire fighting and safety can belong to one of sections of the Department.

The Production Department headed by a Manager will have four sections under it-Ammonia plant, Urea plant, Bagging & Shipping and Utilities. Each section will be under a Plant Superintendent. Besides its complement



of shift supervisors and shift operators, the Superintendent will be assisted by a few staff engineers. These staff engineers will be responsible for improvement in plant performance, trouble shooting in cooperation with Technical Service and Planning Department and scheduling of preventive maintenance in co-operation with Maintenance Department. The Bagging & Shipping Section is expected to operate only for two shifts of eight hours each.

Maintenance Department has been visulated as a Central Maintenance Department. The Department is divided into Production Maintenance control, Workshops, General Maintenance, Electrical Maintenance and Instrument Maintenance. The Department is headed by a Manager and the sections by Superintendents.

The Production Maintenance Control is the heart of the maintenance activity of the plant. The aim of this section will be to reduce the unexpected failure of machines by careful routine and periodical inspection (especially concentrating on critical machines and machine parts) all round the year during normal run of the plant. It should also plan the annual turn around in such a way that the period of shutdown is low, at the same time all the machines which need maintenance are attended to. It should aim at the reduction of inventory cost by proper planning, anticipation and control. This can only be secured by avoiding unexpected shut down of machines, which in turn can be achieved by proper preventive maintenance and inspection. This section should develop proper inspection procedures, maintenance manuals, analysis procedure of machine failures, collection of historical record of machine operation, etc.

This section should consist of a material control group on optimisation of inventory, production maintenance control group for development of standards for maintenance, repair schedules, data control, etc. Inspection groups in the section will do daily and periodic inspection of machines, analysis of failures of machines, lubrication, etc.

Workshop Section will cover mechanical group consisting of machine shop, welding shop and repair shop.

General Maintenance section will be a backup and operative wing of Production Maintenance Control section.

The Electrical Maintenance section shall consist of inspection group, repair shop, schedule control group and general maintenance group.

The Instrument Maintenance section will have similar groupings.

Vice President (Adm.) will have under him Plant Relations, Finance and Material Management.

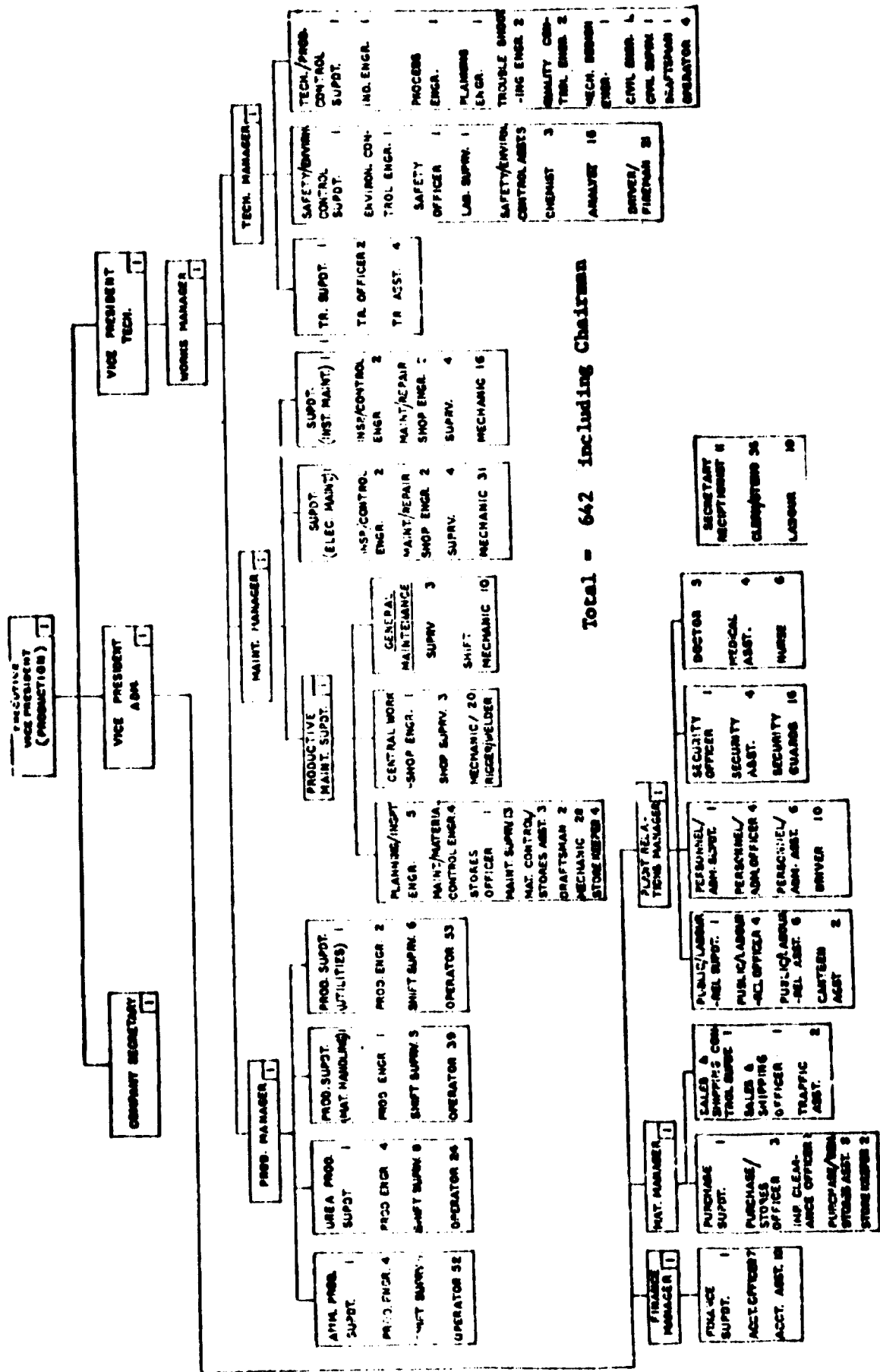
The Plant Relation Department will look after General administration, Public Relation, Employee' Welfare and Relations, Security, Township, hospital, etc. The Material Management Section will look after allocation of fertilizer products to different indentors, coordination of transport and shipping, dispatch of fertilizers accounting of sale of fertilizers, etc. This section is concerned with ex-gate-sale of fertilizers

from the factory. It does not concern itself with actual sale to wholesalers and retailers, extension, marketing research sales promotion, etc. This will be the responsibility of the marketing wing of the Organisation.

Work in non-technical departments of a factory can be easily computerized and mechanized. However, use of computer and highly mechanized office service are not considered in this case as adoption of the same will considerably reduce employment potential of a developing country.

The permanent staff requirement for the factory will be 642, including chairman.

FIGURE I  
KAYPOKER CHART



Total = 642 including Chairman

VII. Social Environment for Manpower Development  
and Raising Productivity

Motivation has been defined as the force that drives an employee to a higher level of morale. The force, of course, comes from financial and non-financial incentives, job satisfaction, and proper working conditions. Financial incentives would undoubtedly play a leading rôle towards higher motivation and consequently higher productivity. But the managements should not show rigid attitudes towards any incentive scheme with the argument that it is an avoidable expenditure. It is, therefore, necessary to adopt an industrial relation policy to maintain industrial peace and harmony. Initially the industrial relations policy meant welfare of staff such as provision of canteens, sport activities, redressal of individual grievances, etc. With the rapid growth of fertilizer industry, there is manifold increase of organized labor which requires an expertise in handling of human problem. Therefore, it is necessary to frame industrial relations policy on a scientific basis to meet the overgrowing aspirations and demands of the workers. Inventory of human resources, identification of future trends and aspirations of the employees, anticipation of turnover, phasing of recruitment over age groups in order to avoid a large number of employees of the same grade expecting avenues of promotion at the same time, planning for succession, making technical and managerial skills co-exist and complement each other, the overall manpower planning, organisation of executive development programmes, etc. are very important functions in creating good working environment from which fertilizer industry cannot afford to abdicate.

VIII. TRAINING PROGRAMS      CASE STUDY ON COUNTRIES

(1) Arab Republic of Egypt (ARE)

Training in Egyptian Chemical Industries (KIMA)

The Ministry of Industry took the lead in the creation of special Industrial Training Centers for the preparation and training of qualified personnel for the various industries. At the same time, however, the various industries were directed to and charged with the responsibility of preparing the necessary required specialized "Technological Cadres" to cover their requirements for the efficient operation and maintenance of the factories.

As an example of this work and efforts in the field of the Chemical Industries in ARE by one of the Industrial Centers, the work carried out by Egyptian Chemical Industries "KIMA" may be cited as an example. "KIMA" created its own Institute of Technology called "KIMA Institute of Technology (KIT)", centered at its factories in ASWAN for the preparation of the Technological Cardes of all levels in the four fields of specialization (electrical, mechanical, chemical, metalurgical) in the general field of Electrochemical and Electrothermal Industries.

Intermediate Course

Candidates are recruited by selection from students who completed their Secondary School Education whether General or Technical according to special criteria of merit in Mathematics, Physics, Chemistry and Foreign Languages (either English or French), etc...

Successful candidates are then admitted to a special dual "Intermediate Course" which comprises:

- a. A theoretical course of study over 25 weeks comprising 24 hours per week, i.e. 600 hours in total.
- b. A practical training course in one of the departments of the factories extending over 26 weeks at the rate of 42 hours per week and thus totalling 1092 hours.

At the end of this course candidates must pass an examination and successful candidates are qualified and formally appointed as "Technicians" either in the operation or in the maintenance departments according to the candidates secondary school education and courses of training in the factories. Normally, candidates with General Secondary School Education are generally directed to work in "Production Operations" while candidates with Technical Secondary School Education are directed to work in Engineering and Maintenance Departments.

"The Technicians" with education and trainings as outlined previously therefore stand at the FIRST step on the scale of the Technological Cadres.

#### Upgrading by Higher Education and Training

Technicians working at "KIMA" have the privilege to apply for admission to higher courses of education and training:

#### Higher Course Part I

Comprising a course of theoretical studies over a total of 6 terms each term of 20 weeks, i.e. a total of 120 weeks, with 27 hours theoretical studies in class per week.

Therefore the total hours of theoretical studies in this course are  $120 \times 27 = \underline{3240}$  hours.

At the same time the candidates are given advanced practical experience and training in the plant over a period of 130 weeks at the rate of 42 hours per week totalling 5460 hours.

Candidates who complete this course and successfully pass its special examination are therefore qualified as "Skilled Technicians" and are eligible for appointment as "Technical Supervisors" who take full charge of a shift either in production operations or in Engineering and maintenance operations according to the educational and technological background of the candidates.

#### Higher Course Part II

"Skilled Technicians" and "Technical Supervisors" working at KIMA have the opportunity to complete their high education and inservice training by proceeding with the High Course Part II.

This course comprises higher theoretical studies over a period of FOUR terms each term of 20 weeks i.e. a total of 80 weeks with 30 hours theoretical studies in class per week, making a total of  $30 \times 80 = \underline{2400}$  hours.

Candidates who complete this course and pass the examinations are then given a "Project Task" which they are required to work out. "Project Tasks" are usually selected in connection with related Technological activities of KIMA.

On the completion of the Four Steps of higher education and training in-service namely:

1. The Intermediate Course
2. The Higher Course Part I
3. The Higher Course Part II
4. The Project Task.



The Candidates graduate and receive the Bachelor's Degree of the KIMA Institute of Technology since the Institute has been formally recognized by the Ministry of Higher Education and its Courses are approved as equivalent to those given at the Universities qualifying for the Bachelor's Degree in Engineering Science.

In this way KIMA was able to create a special and new educational system which has the following features and advantages:

- a. It opens a new way for the youth to proceed after their secondary school education with their higher education while at the same time working in active production earning a good living and building a career at an early age.
- b. It ensures proper evaluation of skills and capacities and fair and equal chance to workers in Industry for promotion on sound basis.
- c. It ensures the best and most efficient Technological training and education for Industry through the development and growth of the Technological Cadres within the disciplines of the Industry.
- d. It saves time since the graduates at every stage are fully qualified to take responsibility in the field immediately.
- e. It gives high economic returns through higher efficiency in operation and maintenance of the Plant.

(2) INDIA

A. TRAINING AND DEVELOPMENT IN FERTILIZER CORPORATION OF INDIA (FCI)

FUNCTIONS AND ORGANIZATIONAL SETUP OF TRAINING CENTRES:

The functions of the training courses are actually two folds:

1. To train fresh graduates and diploma holders to tackle the complexities of fertilizer manufacture.
2. To provide a well knit program for the development of already employed, technical and managerial personnel at different levels.

FCI's 13 units/divisions all over the country have their own training centres and have a total capacity to train at a time 400 graduate engineers, 600 diploma holders and 1,000 craftsman trainees.

Training begins in the earliest phase of the project activities where the immediate task is to train people largely local, into skilled workmen suitable for a fertilizer plant employing highly sophisticated technology.

The Chief Training and Manpower Adviser having his seat at Central Office, New Delhi is in overall functional charge of the FCI Training Organization. He takes the general policy decisions and draws the guidelines that determine the shape of future training activities. The heads of each unit training centres are under the administrative jurisdiction of their unit General Manager and are free to organize any particular course to suit the needs of their local unit.

In order to avoid duplication of training courses at the various local units, each training centre specializes in a chosen field. Thus, Sindri Training Institute offers special courses in process control instrumentation, Trombay in advanced training facilities

for welding and plant operation with sophisticated equipment for process simulation, Nangal in electrical and Gorakhpur in fitting trades. Employees and trainees are sent to any of these institutes depending upon their inclination and technical aptitude. Some of them are also sent to two or more institutes to familiarize them with different processes and equipment.

#### OVERALL PERSONALITY DEVELOPMENT OF TRAINEES

The effectiveness of a supervisor or manager does not only depend upon his technical competence but also on his overall personality. The personality of a trainee takes shape depending upon what he does, not only during the working hours but also when he is away from the shop-floor.

FCI places great emphasis on this aspect. Excellent hostel facilities are provided at each of the training institutes.

The trainees are normally accommodated in double seated rooms. They organize their social and cultural activities through various committees manned by their representatives and under the guidance of the training staff. These include debates, variety programs, get-togethers, picnics, dramas, cultural meets and social service.

The trainees manage their messes on a cooperative basis entirely by themselves.

Extensive facilities for reading room, library, indoor and outdoor games are provided in each Hostel. Every year competitions, tournaments and athletic meets are organized and the successful competitors are awarded prizes and certificates of merit. The trainees are encouraged to develop their personality through the organization of hobby centres at each institute. Photography and Electronics are very popular hobbies and all facilities are provided for instructions and practical experience in these fields.

The training activities can broadly be grouped as follows:

- A. For new entrants
- B. For existing employees
- C. For others

A. TRAINING SCHEME FOR NEW ENTRANTS

- 1. Junior Executive Trainees
  - a Technical Cadre
  - b Commercial and Administrative Cadre
- 2. Chageman Trainees/Sr. Operative and Technicians
- 3. Craftsman Trainees

JUNIOR EXECUTIVE TRAINEES

Engineering graduates in Mechanical, Chemical, Electrical Engineering, Instrumentation, and post-graduate Degree of Diploma holders in Business Administration, Law, Arts, Commerce, etc., are eligible for this cadre of trainees.

The training program aims at molding these fresh hands into junior executives with sufficient potentialities for advancement to middle and higher levels of management. After imparting necessary practical skill in technical matters during the first year of training, the second year program mainly aims at imparting various supervisory and managerial skills.

During the two year training period trainees receive a monthly stipend. Trainees are bound by terms of agreement to complete the training and to serve the Corporation for a period of five years after appointment to regular posts on completion of their training.

Immediately after training, they are absorbed as Junior Engineers/Officers in various departments like Production, Design, Maintenance, Industrial Engineering, Sales and Purchase, Personnel Administration, etc.

**CHARGEMAN TRAINEES/SENIOR OPERATORS & TECHNICIANS**

Diploma holders (3 years course) in Electrical, Mechanical, Chemical Engineering or B.Sc. with Physics, Chemistry & Mathematics are recruited as Chageman Trainees for two years training. Their training program consists mostly of imparting technical and supervisory skills. After successful completion of training they are bound by terms of agreement to serve the Corporation for a period of five years and are absorbed as first line supervisors on the shop-floor of various depths.

Craftsman training scheme has now been replaced by Act Trainees described later. However, in case of new projects, bulk of operators and technicians are recruited through craftsman training scheme, whose training is 3 years and minimum qualifications is Matriculation with Science and Mathematics. After the successful completion of training, they are absorbed as Grade II Operators/Technicians. The Bond and other service conditions are the same as in the case of other trainees. Specialized trade skills have been developed in each trade like Welder, Instrumentation, Mechanist Operator, Electrician, etc., at one of the Institutes of the Corporation.

**B. TRAINING SCHEMES FOR EXISTING EMPLOYEES:**

(Broadly they can be grouped under two heads)

1. Part-time classes
2. Employees Development Courses

**1. PART-TIME CLASSES**

As the Personnel gain experience in the factory, the urge for higher responsibility and better opportunities grows in them. In order to bring their abilities at par with their enthusiasm,

facilities have been provided so that they improve upon their knowledge and get over their initial handicaps. For this purpose part time classes are conducted by each of the training institutes to help them in studies without interference with their normal duties. All the courses are generally run for a year. Usually, the following Part-Time Classes are being conducted in our various Training Institutes.

1. Guidance Classes for AMIE and AMII Chem.E.
2. Advances Courses
3. Basic Courses
4. Pre-Basic Courses
5. Foreign Language Courses

#### 1. GUIDANCE CLASSES FOR AMIE AND AMII CHEM.E.

Guidance for these institutional courses is provided by the Training Institutes in the evening hours. Persons who are desirous of appearing in such professional examinations and have the requisite qualifications can avail this opportunity.

#### 2. ADVANCED COURSES

Advance courses in different branches like Production, Mechanical, Electrical and Instrumentation are also arranged by the Training Institutes. Candidates, who pass in the final examination are given one increment as an incentive and a certificate is also awarded which is considered equivalent to Diploma in Engineering or B.Sc. for the sake of internal promotion only. The Institute of Engineers (India) has recognized this course as an exempting qualification from their student-ship examination.

#### 3. BASIC COURSES

This course is run on two streams, Technical for Plant personnel and non-technical for secretarial staff. Candidates qualifying in this examination are also given advance increments in their respective scales. Passing of this course is considered as equivalent to Intermediate in Science or Arts within the Corporation.

#### 4. PRE-BASIC COURSES

Candidates with some knowledge of English and Mathematics are admitted to this course. Duration of this course is one year. The syllabus consists of teaching in English, physics, Chemistry, Mathematics and Social Sciences. The successful candidates get an advance increment as an incentive. Passing of this course is considered to be equivalent to Matriculation or Higher Secondary for internal promotion.

#### 5. FOREIGN LANGUAGES CLASSES

Italian, German, French and Russian language classes are conducted for Engineers to enable them to read and translate the technical literature drawings, etc., in the above languages.

#### 2. EMPLOYEES DEVELOPMENT COURSES

New ideas, techniques and developments take place every day. In the technological field, the rate of this development is phenomenal. Unless special efforts are made either by the individual or the organization, it is not possible for the employees to keep themselves up-to-date with these developments.

FCI's employees Development Courses are developed with this idea in the background. The courses cater to the needs of all categories of employees like technicians, supervisors, junior and middle & senior managers. Help of senior managers and outside professional experts and institutions is taken wherever necessary in organizing these courses. Usually the following development courses are being organized by the Training Institutes:

- a. Managerial Development Courses
- b. Supervisory Development Courses
- c. Operators/Technician Development Courses
- d. Refresher Courses.

**a. MANAGERIAL DEVELOPMENT COURSES**

Techniques adopted for such course include lectures by inside and outside experts combined with syndicate discussions, simulation exercises, role play, etc. FCI runs a full fledged Institute of Management Development for the training of Senior Executives. Courses are need based and the contents of the courses are framed by the Institute.

**b. SUPERVISORY DEVELOPMENT COURSES**

For imparting knowledge of different supervisory techniques to the supervisors, FCI has developed these courses. They normally are of one week duration. The participating supervisors have to devote full time to the courses. Lecture-cum-discussion technique is adopted for conducting these courses.

**c. OPERATORS/TECHNICIANS DEVELOPMENT COURSES**

FCI's main work force consists of personnel who have thorough practical skill of the job but lack in theoretical knowledge. To overcome this, a course has been devised and is conducted for the 'Process Operators/Technicians'. They are relieved for one week from their respective plants for undergoing the courses. The syllabus of this consists of pure science and allied information of the processes and equipment common to the plants.

**d. REFRESHERS COURSES**

These courses are designed for the employees so that they are kept abreast of the latest information and skills in their lines. They include instructions on subjects like measuring instruments, special welding techniques, Boiler Operation, Machining process, Safety, etc.



**C. TRAINING SCHEMES FOR OTHERS**

(These schemes are mainly catering for the following:)

- a. ACT Apprentices
- b. Vocational Trainees
- c. Foreign Trainees.

**a. APPRENTICES UNDER THE ACT (1961 AMENDMENT 1973)**

As a statutory obligation under the Apprenticeship Act, 1961, we have to train number of apprentices in various designated trades like electrician, fitters, machinist, welder, turner, Graduate engineers and Diplomaholders, etc. The period, stipend and minimum qualification are fixed under the Act. They are provided with rent-free accommodation and other amenities just like other trainees. For this category of trainees, the Corporation has no obligation to provide employment after the completion of the training.

**b. VOCATIONAL TRAINEES**

Since many of the technical institutions and managerial institutions have factory training as a part of their curricular, facilities are made available to the trainees for preparing the same.

**c. FOREIGN TRAINEES**

The FCI Training Organization also undertakes the training of foreign nationals sponsored under various international coordination plans like Colombo Plan, etc., to help the sister nations in the development process, to develop their specialists in the field of fertilizer technology and production. A number of nominees have been trained for various terms from France, Australia, West Germany, Sri Lanka, Indonesia and several far eastern and southeast Asian Countries.

IX. UNIDO'S EXPERIENCE IN MANPOWER DEVELOPMENT

The generation of the manpower required for rapid industrialization, in addition to any measures taken by the developing countries themselves, will call for a concerted approach on the part of all the international organizations concerned. Furthermore, it is impossible to make provision for industrial manpower without reference to that required for other sectors of the economy.

United Nations bodies have therefore adopted an integrated approach by tackling the problem of the development and utilization of human resources as a whole.

The UNIDO manpower training program for the development of industry is financed under various United Nations operational programs in which UNIDO participates.

In accordance with resolutions of the United Nations General Assembly and the Industrial Development Board, UNIDO is to assist developing countries in increasing the size and improving the quality of managerial, technical and economic personnel in those countries in order to sustain and accelerate their industrial development. The present role of UNIDO in this connection is threefold:

To coordinate the work of international and regional organizations of the United Nations family in the field of industrial training, within the framework of the responsibilities assigned to UNIDO under General assembly resolution 2152 (XXI);

To assist developing countries, in cooperation with the ILO, UNESCO and other international organizations, in analyzing the training requirements of industry with a view to organizing suitable training programs and organizations based on such estimates;

To implement a limited but integrated program of national and international training for certain types and levels of industrial personnel.

In addition, UNIDO carries out a number of coordinating activities. Agreements on areas of responsibility have been concluded between the ILO and UNIDO, and between UNESCO and UNIDO. These agreements provide the basis for the establishment of joint programs in fields of common interest, including industrial training, and for harmonizing activities in fields where there appear to be conflicts of competence.

While earlier UNIDO programs were directed primarily to technical training in specific branches of industry, present and future efforts are being extended to include other subjects, such as management of repair and maintenance services, export industries, investment promotion, project formulation and implementation, industrial administration and standardization.

UNIDO is executing a long-term integrated in-plant training program for engineers from the developing countries on three levels:

Basic-level in-plant training programs aimed at providing pre-employment training for newly graduated engineers. These programs are arranged in a particular developing country or in a neighbouring country at a somewhat higher stage of development in the specific industry in which the training will be conducted;

Middle-level programs, lasting from three to six months, intended for engineers who have from five to eight years experience in specific industries. Such training programs are designed to upgrade their professional capacity in specific functions;

Top-level training programs providing further training for engineers with substantial practical experience and for managers of industrial enterprises.

In addition to fellowships to attend the in-plant training programs, UNIDO operates an individual fellowship program.

In the light of the recommendations of the Athens Symposium, UNIDO is exploring ways of encouraging the establishment of national industrial training organizations in developing countries.

Examples of other industrial training activities operated or planned by UNIDO are given below:

Special training programs in modern management methods for managers of state-owned enterprises in a specific industrial sector;

Special training programs for industrial administrators, based on the recommendations of the Interregional Working Party on Training of Economic Administrators of the Developing Countries in Industrial Development, organized jointly with OECD.

Regional group-training programs on the planning, establishing and management of industrial estates;

Regional training workshops for government officials on the organization and administration of patent offices;

Regional training seminars on various aspects of industrial information services;

Special regional training programs on investment promotion techniques.

**1. AREAS RELATING TO THE DEVELOPMENT OF INDUSTRIAL MANPOWER IN  
WHICH UNIDO IS IN A POSITION TO PROVIDE TECHNICAL ASSISTANCE**

Establishment of National Industrial Training Organizations in the developing countries.

Implementation of the activities of existing National Industrial Training Organizations.

Promotion of bilateral and multilateral financial assistance for implementing industrial training programs in the developing countries.

Organization of in-plant training programs in specific industrial branches in the industrialized countries for engineers from developing countries.

In plant training of higher technical personnel within the developing countries.

Provision of individual fellowships in the field of industrial development.

Organization of training programs for industrial administrators from developing countries.

Adaptation of techniques and methods of industrial education and training used in industrialized countries to the particular conditions in the developing countries, including the adaptation of modern industrial management techniques.

Estimation of industrial skill requirements at the national and industry level.

Translation of required numbers and types of industrial skills into practical training programs and institutions designed to meet the needs.

**2. SOME EXAMPLES OF TRAINING PROGRAMS IMPLEMENTED, UNDER IMPLEMENTATION IN PREPARATION OR UNDER DISCUSSIONS WITH GOVERNMENTS OR OTHER ORGANIZATIONS IN THE FIELD OF FERTILIZERS**

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a. Workshop training course in fertilizer plant operation and maintenance for 3 months in cooperation with United States agency for industrial development (USAID) executive agency: UNIDO in coordination with the executive agency of the Tennessee Valley authority, national fertilizer center.

b. During the last five years, courses were held on fertilizer production, both theoretically and practically for fellowship holders in USSR with the assistance of government of USSR. In 1976 the in-plant group training seminar on the production of fertilizers organized by UNIDO was held at the state institute of nitrogen industry (GIAP) in Moscow and at the fertilizer plants in the cities of Gomel, Cherkassy, Sumy and Nevinnomissk.

X. CONCLUSIONS AND RECOMMENDATIONS

At the supervisory and management level, apart from the knowledge and expertise and the concept of control, more emphasis has to be given to conceptual, analytical and co-operative skills. Much better understanding of inter-disciplinary problems and consciousness of the social situation will be necessary on the part of the management. There has to be a major concern to avoid walls between different specialists which inevitably grow in an organisation over a period of time.

The practice of creating inter-disciplinary expertise groups as task force or special cells will have to be adopted more often. This is essential to enable different disciplines to look at the problems from overall point of view and to cut short the normal channels of communication which generally can choke up or get distorted due to the individual specialists department interest.

The growth of the industry will also mean direct possibility of more mobility of employees from one organisation to another. This mobility has to be encouraged. To do so organisations will have to deliberately attempt to develop second-in-command, to have a continuous internal training effort. With the increased job opportunities for experienced people, they cannot be held in one organisation indefinitely. Different needs and aspirations will make persons migrate to other organisations where there is a promise to meet their individual satisfaction. Organisations, therefore, have to be more conscious and prepared to avoid this disturbance because of losing their key persons unexpectedly.

The present and future large capacity single stream fertilizer plants will mean much greater effort to train good technicians and engineers.

The new plants have bigger machines, more sophisticated instruments and effects of even the least mal operation or delay in rectifying defects will mean huge production losses. In these plants down time have to be minimum. This will mean much more attention will be required in developing of specialized expertise in the erection and maintenance of critical equipment. Specialized welders for high pressure vessels and piping are another group which has to be developed for quick maintenance repair and erection.

Trained staff for rigorous inspection after routine/ break down scheduled maintenance have to be developed. Each operator, supervisor or manager will be responsible for equipment and machineries of a value many times more than what it was a ten years before. In new plants the investment per employee is 6 - 10 times higher than the older plants. This means that better skilled and higher qualified men will be required to man each position.

The average skilled worker or operator has to have a much more content of technical understanding and the emphasis will shift from general long experience or skill to technical knowledge and understanding. The general demands of the workers for advancement will also mean that at the lower levels persons will have to be recruited who have a built-in potential for absorbing this knowledge and experience.



The processes are more complex and interrelated and the work of co-ordination/planning will increase and this will mean higher ratio of supervisors and managers to work-force. The need for unskilled and semi-skilled workers will be almost nil.

Injection of this category of workers due to the various constraints and pressures, will mean continuous labour-management problems as it is difficult to find advancement opportunities for this category and upgrade their skills to those required with the further complication of very restricted mobility of such persons.

Proper determination of training needs of an employee is of vital importance, but it is often ignored. To increase the productivity of an employee, he should be developed in his deficient areas with great individual care. Merely assigning him to undergo a package course, more often than not, fails in its primary objective.

Training needs must be determined for a particular group of participants on the basis of an evaluation of their job responsibilities and the course contents are to be made accordingly. In consultation with the heads and sectional heads of the various departments and a personal discussion with the assessee a program is to be made suiting to the requirements of individuals wherever necessary.

The managers should be encouraged to participate in conferences, symposiums, seminars and professional activities where they can read papers on managerial

subjects and allied group discussions both in the country and abroad.

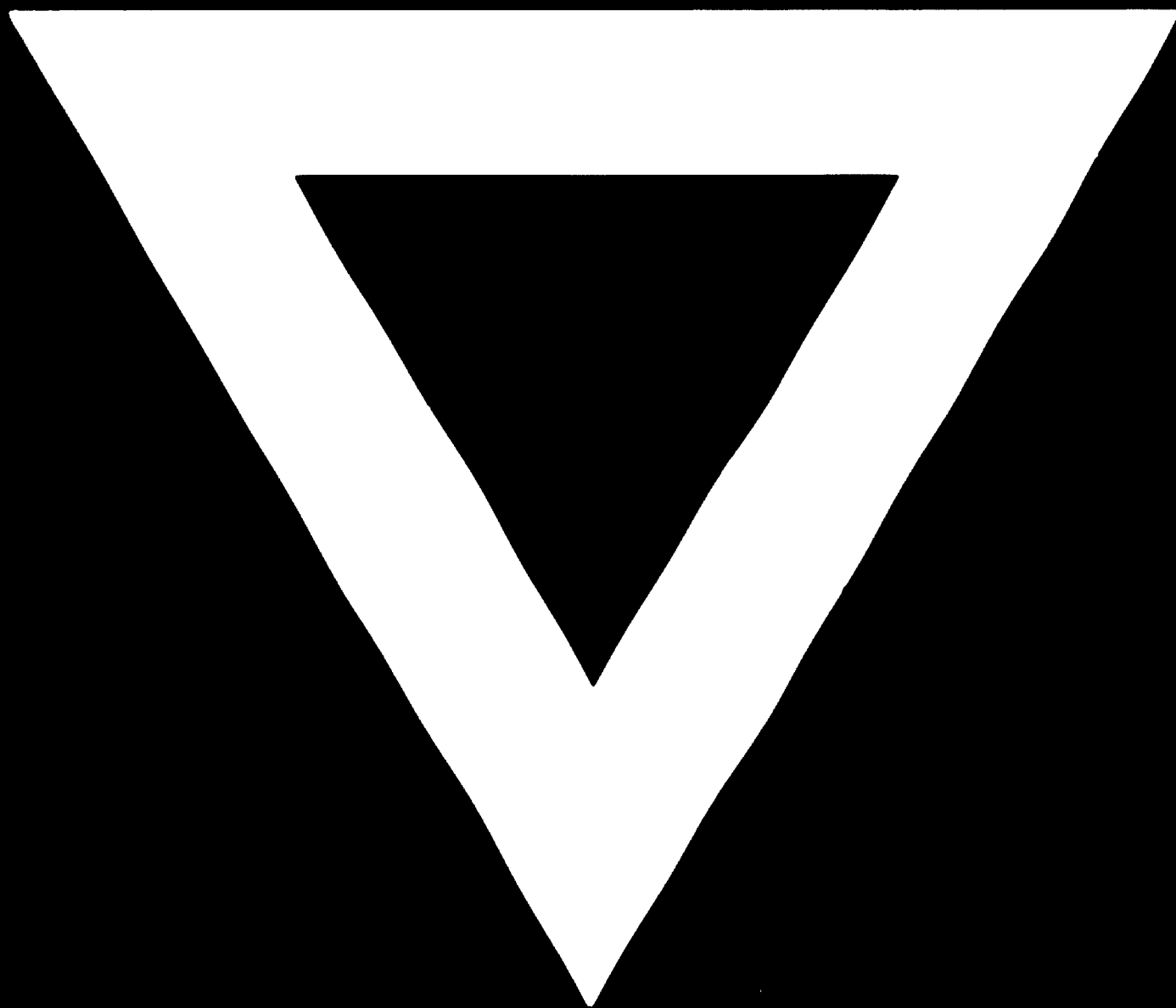
Also, it is recommended to adopt varied training techniques to suit the requirements of the group of managers participating in the programs since no single method is universally applicable to all areas and types of learning.

The "Conference Method" or "Syndicate Discussions" are the most practiced methods adopted for "Management Development Programs" with the sole task of building broad attitudes, understanding as well as for developing the habit of collective thinking on subjects at issue. Besides, casual staff meetings, conventional lectures and other modern methods such as "Role-Playing", "Case-Study", "Job Rotation", "Vestibule Training" and "Counseling" are also to be adopted in running these programs at Training Centers.

The programs must be conducted for all levels of executives, managers and supervisors right from General Manager, Chiefs of Technical and Non-Technical Departments, Deputy Chiefs, Plant Managers / Engineers and Foremen, Chargemen, etc., to purchase and store assistants and course contents be varied according to the needs of the group in session.



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