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Manpower Planning and the Technician

Manpower planning is an attempt to predict the role of the labour force in the achievement of the objectives of a national development plan. These objectives are matters of government policy, and reflect the kind of society that a country's rulers wish to create, establish and maintain. Though the priorities are a consequence of the political, economic, and social philosophy of the government, the main priorities are likely to be the provision of higher standards of living and an improved quality of life – particularly for the very poor, the undernourished, the badly housed, the socially ill-adjusted, the under-educated and the under-trained.

It is the function of industry to produce the national wealth required for these purposes. But in order to function at all, industry must have a productive work force. In other words, to obtain smooth, orderly progress towards the achievement of integrated economic and social objectives, industries need an adequate supply of the right kind of trained manpower, in the right numbers, at the right time, and in the right place. Technicians are an essential part of that manpower. Industries depend on them for the production of an increasing supply of goods which can be sold at economic prices in the competitive markets of the world, be delivered in first-class condition on target time, and be supported by efficient maintenance and back-up services.

The analysis of the role of the labour force in the achievement of economic objectives is an on-going activity both at government level and within the different sectors of industry. It identifies areas of the economy in which growth could be hindered by manpower deficiencies and imbalances, as for example between pure and applied scientists, professional engineers, technicians, craftsmen, skilled workers and operatives in industry and their equivalents in business, commerce and the government services. It yields essential data for planning the national and regional distribution and location of particular industrial projects. It is fundamental for planning the primary and secondary education on which

the speed and success of the further education, vocational training and supply of technician manpower depends. It provides information required for forecasting the numbers of different kinds of technician that will be required at critical points of time, and the specialist knowledge and skills which they must acquire to be productive workers in specific jobs in particular kinds of industrial organizations.

The effectiveness of manpower forecasting and planning depends on a high degree of expert technical collaboration between government, the national executive, industry and the education system working together to identify the nature of manpower priorities and to maintain the right balance between the overall development of a country's manpower resources and the usually narrower needs of a particular industry. This task is too complex and too vital to the economic strength of a country to be left entirely to local or private initiative and resources. In the case of technicians it involves isolating, identifying and analysing each category of job. When this has been done it is necessary to write each job description and specification, its constraints and its relationship to jobs of greater and lesser responsibility, its own requirement of specialist knowledge, skills, attitudes, and entry qualifications, and its own technical education and vocational training requirement.

Complete accuracy of job description and job specification is difficult. This is due to a universal shortage of specialists trained to analyse manpower requirements industry by industry and company by company. Consequently it is not yet possible to devise reliable job profiles as a basis for vocational guidance, for selection by an employer or a technical training institution, or for structuring the job evaluation criteria that define an individual worker's wages, conditions of service or status in the service of the government or an industrial organization. White collar jobs based on academic education have more status in industry and greater social prestige in society than blue collar jobs, regardless of the nature of the work, the level of responsibility, the skills or the personal qualities that have to be used. Parents and teachers therefore tend to encourage young people to become pure or applied scientists, technologists or professional engineers. Industry can absorb only a limited number of such people, and where there is also cut-throat competition for jobs in government service and education, unemployment can occur among university and other higher education graduates. In these conditions, status is not gained, but lost. Moreover, those who are unemployed lack the independence, the dignity of having a job and the salary they need in order to feel that they are responsible, participating, and significant worker-citizens in their community and society. On a large scale this may even lead to militant dissatisfaction, political confrontation and social conflict. At the same time there is a shortage of technicians who require in many cases to have theoretical knowledge not far below that of the professional graduate together with high-level practical expertise. This twofold problem could be overcome by having more effective education and vocational guidance programmes and more production industry-orientated edu-

cation courses with their own specialist occupational integrity. If these programmes and courses were to be coupled with an objective system of job evaluation and rewards, and reinforced by mass media education programmes to convince all members of society of their individual and collective dependence on the wealth created by industry, young people would more readily accept the career prospects, job satisfaction and material rewards that exist in the middle and higher levels of industry. The imbalance between unemployed and underemployed university graduates and the shortage of well-qualified technicians could then be corrected.

There is no less need to persuade most nations to intensify and accelerate primary and secondary education programmes. Such action is needed to increase investment in craftsmen and skilled workers from among the millions of children who remain uneducated or under-educated and whose abilities and talents remain unutilized for the common good. This is another element in manpower planning, and it must be admitted that complete accuracy in making valid judgements for more than one to five years ahead in technician manpower planning is difficult. It depends on many variables such as those that follow. They are not ranked in order of priority.

1. The level of industrial sophistication in a country's economic development.
2. The rate of growth in different sectors of the national economy.
3. The trend effect of industrial and economic growth in regional development projects.
4. The level of technological sophistication in a country, in different industries, in different companies.
5. The stage of scientific discovery, the rate of its exploitation by technological change and innovation in different industries and companies.
6. The lack of scientific techniques, reliable data, specialist expertise and experience to analyse the occupational, employment, and age structure of the national labour force.
7. The capital intensive or labour intensive organizations in industrial development.
8. Rate at which mechanization will reduce the number of semi-skilled and unskilled workers and increase the number of technicians and skilled workers required.
9. Frequent changes in traditional classifications of jobs and skills to meet future needs in different industries.
10. Modern technological developments that tend to create jobs which overlap traditional demarcations.
11. New skills that are required in modern design to make mechanical production and maintenance simpler.
12. A breakdown of clear-cut distinctions between occupations.

13. Availability of managers, technologists, technicians, craftsmen, skilled workers and operatives.

14. Introduction of organization and management techniques.

15. Attitudes of technicians to geographical, occupational, and social mobility.

16. Emigration; brain drain.

17. Immigration of technicians and skilled workers with technician potential for re-training.

18. The virtual impossibility of identifying in advance every industrial project and the kind of manpower that will be required to staff every projected factory, hospital, university, polytechnic, and school.

19. The movement of industrially qualified manpower to government jobs.

20. Changes in the armed forces and security forces due to increase in or relaxation of national or international tensions.

21. Unforeseen national catastrophes.

22. Premature retirements and deaths.

23. The fact that many well-qualified people leave an industry or a company because their knowledge and skills are under-used.

Despite the unreliability of the data available and the difficulties of guaranteeing complete accuracy it is still essential to have the best possible forecasts made by manpower specialists who understand the role of labour in industry. Such forecasts encourage a rational approach to matching manpower requirements, as predicted scientifically, with national economic and social planning requirements.

The Employment Structure of Industry

The work force in industry can be divided into six broad occupational categories:

1. Managers.
2. Industrial scientists, technologists, and professional engineers.
3. Technicians.
4. Craftsmen and skilled workers.
5. Semi-skilled operatives.
6. Unskilled labourers.

Manpower in business, commerce, and central and local government services could, in large measure, be fitted into the same categories, though the ratios between the categories will naturally vary.

Throughout industry there is no fixed ratio between the number of workers and the number of managers. Even in the sophisticated technology-based companies with massive investment in highly-trained manpower and equipment, the percentage of top-level managers involved in making and implementing policy is very small in relation to the total work force and to the number of middle-level departmental and line managers. The ratio between the numbers of

lower-level managers – including supervisors and foremen – is not specifically related to the numbers of technicians, skilled, semi-skilled and unskilled workers. Instead, it varies widely with the size, technological sophistication and consequent mix of the labour force. Even so, there does tend to be a relationship between the number of technologists, technicians, and craftsmen in industries or companies of the same type *and their efficient operation*. Thus in production engineering the ratio is about one technologist to five technicians and 25 craftsmen: in the chemical industry there may be as many as three highly skilled technicians to two technologists; a frequently quoted generalization is ten craftsmen to one technician.

Managers

The success of any company depends on the quality of its management. It must be efficient if the company is to contribute to the steady growth of the national economy on which full employment and social development depends. The top manager's function is to exploit all of a company's resources to maximize production in order to achieve the goals of the company and, more specifically, its profit targets. He is involved in policies of manpower planning, recruitment, selection, induction, placement, technical education, vocational training, and development. Though he is normally supported in his work by specialists, in the final analysis he is responsible for co-ordinating product design, development, field tests, manufacture, quality control, inspection, distribution and servicing; for planning and manipulating the use of space, equipment layouts and materials; and for devising systems, methods of work programmes, flow charts, and production time-tables. He has to implement the company's financial investment and resource development plans. This involves budgeting, cost control, value analysis, and diagnosis of deviations outside the financial parameters. He has to understand computer techniques for analysing data concerning ratios of profit to product turnover, turnover to assets, efficiency of purchasing, economic use of storage space, losses due to bottle-necks in work flow, cost of skilled labour turnover, speed of production-line problem-solving, efficiency of man management, and the quality and success of industrial and human relations in avoiding conflict and confrontation in the labour force. It is the efficient use of expensively trained manpower and maintenance of profitable, productive industrial and human relations which is the main and most difficult responsibility of a majority of managers.

Technologists

Progressive growth in national economy depends on industry having an adequate supply of industrial scientists, technologists and professional engineers whose education and training fit them to carry new industrial designs and processes from the research and development stage to the innovation of efficient and productive processes. They are required at the point of production for it is here that application of scientific knowledge and technological know-how can be most effective, and it is here that industry needs highly intelligent, person-

ally able, appropriately educated and trained men and women technologists and engineers. The capital investment at the point of production in trained, skilled manpower, in equipment, in materials, and in servicing is far greater than the investment in pure research and development. As time goes on, more and more technologists and professional engineers will be employed at the later stages of the production process. They will be employed in departmental and line management, as works and maintenance supervisors, and in co-ordinating technical processes, quality control, inspection, value, and cost effectiveness.

The technologist in a modern industrial organization needs to have the trained ability to deal with people as much as with things, to use data from computers and from operational research, to apply techniques of critical path analysis and work study, to innovate, organize, plan, direct and manage, to solve problems of product development, and to avoid shop floor production and industrial relations problems. Technologists and professional technical manpower whose education and training have been production oriented are required for economic and social development by every country needing a stake in world markets for the application of the technologies of life science, bio-engineering, medical sciences, nuclear power, petro-chemicals, data processing, ocean technologies, and the transformation of older industries such as ship-building, civil engineering, building construction, textiles, mining, steel manufacture, and transport.

Craftsmen

The craftsman is almost totally concerned with things and only marginally with data and people. He needs to have the right level and kind of manipulative skills together with enough knowledge of mathematics, science, drawing, technology, and communication skills to know how to use the tools, instruments, machines, materials and the special techniques required to practise his craft effectively. In some companies, if he is employed near the lower end of the technician function, he may need basic mathematics in order to use fine measuring instruments and gauges for setting machine speeds and feeds, and to calculate limits, fits, tolerances, clearances, quantities, capacities, task times and costs. He may have to learn to use simple formulae involving substitution and transposition. In a modern organization he is likely to have to learn how to use mathematical tables and calculating machines and materials suppliers' instruction handbooks. He is unlikely to need more than this, and training programmes should be structured accordingly. *At present there is evidence that craft apprentices and trainees are taught more mathematics than they are ever required to use on the job.* Many of them fail in the mathematics part of their technical education course. It is an unnecessary barrier to the recruitment and career prospects of many people who have the practical knowledge and skill to get and to give satisfaction in craft jobs.

The craftsman may do a better job if he has learned to appreciate the science and technology applicable to the basic design, use, care and maintenance of

tools and equipment, to the operations in a particular craft process, procedure or technique of production, construction or servicing, and to the properties and treatment of the materials he uses.

The craftsman is concerned with learning to produce a working drawing only to the extent that the knowledge will give him the practical skill to interpret a blue-print on the job in order to make a simple, step by step analysis of the sequence in which the individual tasks in a job have to be done, to mark out a job, to prepare a simple schedule of the materials required, to make a simple costing of the job, and to devise a tool layout and machine use programme on a simple time and motion, work study analysis so that he can complete the work within the prescribed framework of speed, accuracy, cost, and quality of workmanship.

The craftsman needs communication skills to understand and carry out the handbook and work schedule instructions for using the tools, machines and expensive equipment which have to be operated with maximum efficiency in order to obtain the full economic output to justify the company's investment in them. This involves understanding, interpreting and translating printed instructions into work procedures. It means understanding words which are within the range of his vocabulary, and being able to read them without difficulty. Any misinterpretation or confusion of the text can result in costly errors on the job. Modern instruction handbooks reduce the printed word to a minimum. The medium of communication may consist of the one-step-at-a-time, gradually built-up diagram of a technique or an exploded picture of a component assembly. It may contain graphs, charts, and tables giving data, for example on machine shop operations, heat treatment processes, engine service data, fitting electrical installations, and the scientifically correct mixes of materials to be used by craftsmen in different trades and on different jobs.

Technicians

It is difficult to establish acceptable criteria as a starting point for investigating the nature of occupations. There is no classification that covers every job. This is particularly true of the technician category where a wide variation in job functions exists even within a single technician group. The criteria used in arriving at the classification include the kind of work involved in the occupation (whether it is intellectual or manual, whether it deals with people or with things, and whether it is concerned with administration or with production); the educational qualifications required for admission to training; the profile of general intelligence, special aptitudes, and personality traits required for admission to training; the recruitment incentives and career prospects offered by employers; the wages paid; the factors which the individual workers in an occupation consider to be important; and the general interests of the workers employed at different levels of the occupation.

A great deal of research is being concentrated on investigating the possible psychological basis for occupational classifications. It could be many years

before such a classification becomes available.

The search for better ways of exploiting scientific discovery and technological innovation in order to obtain more rapid industrialization, higher productivity and more efficiently managed organizations has resulted in a changing of job functions in every manufacturing industry and business. A new occupational category of 'technician' has emerged. Technicians function between the technologist or professional engineer on the one hand and the craftsman or skilled worker on the other.

As the professional engineer and technologist become increasingly employed on research and development, design and industrial engineering, technicians have to take over some of the duties they formerly held. As a result, more and more technicians are required with the higher-level technical knowledge, the practical know-how and the necessary skills to build, install, and service sophisticated equipment and operate complex processes. They constitute the middle ranks of a country's highly trained skilled manpower. Unfortunately, the pace of industrial change has created a world shortage of technicians in every sector of industry and government service, which, in turn, has created a serious bottleneck in the implementation of the industrialization projects on which national economies depend.

There is a general consensus that the causes of the shortage, and its solution, lie in education. There is a shortage of secondary school teachers who are scientists, mathematicians or technologists with experience and interest in industry. This limits the scientific education of many pupils, and consequently their career choices and opportunities. In other words, the problem is not that pupils consciously reject technician occupations, but that the shortage of science and technical teachers, and the academic content and traditional interpretation of much science teaching, deny pupils an understanding of modern science and a technological job orientation. As a result they miss the opportunity to choose a satisfactory career in industry.

Clearly, if things are to improve, technological, industrial, and occupational changes should be reflected in the secondary curriculum. These changes will be far reaching. They will extend beyond the classroom to affect the kind of jobs pupils will do, the standard and quality of life their families will have, the kind of society in which they will live, and the level of job satisfaction they will have. Curriculum builders need to be more directly and personally involved in industry to understand the changes that are taking place in the employment and manpower structure in industry. The values and the general cultural climate predominating among the teaching staff in schools and colleges towards careers in industry can have a strong positive or negative influence on the attitudes of students when making job choices. It is socially sensible and educationally responsible that pupils in secondary schools should learn from their teachers that profitable industrial production is essential to sustain the healthy economic life and culture of their community with its commitments to the poor, the homeless, the sick, the aged, the oppressed and the under-privileged in all lands. They

should learn through social studies programmes and by direct participation in production work experience in their final years of secondary education that real wealth must be produced before it can be used. At the Conference on the Education and Training of Technicians held at Huddersfield in 1966, the view was expressed that to satisfy manpower needs, technician courses require roughly four times the financial provision of corresponding university courses, and that in hardly any developing countries is this ratio achieved. One difficulty is that in a developing secondary school system, the relatively few students who reach sixth form (or equivalent) level hope to go on to the university which, on its part, often encourages their entry because it has more places than it can fill. Many students at this level are on the Arts side. In few countries does the proportion of secondary school students oriented towards science, technology, business, or agriculture meet the needs of the economy.

At one end of the spectrum of technician occupations there may be little difference between the education, training, and responsibilities of a higher technician and those of a junior technologist or engineer. The higher technician uses his knowledge, ingenuity and technical judgement in solving the problems generated by the engineer's design. He has an understanding of the scientific principles of his work rather than an uninformed reliance on established practices or accumulated skills. He uses the same kind of knowledge, practices and skills as the junior technologist or engineer. Both function within a similar frame of decision-making and a similar pattern of relationships with people, and both work with data and people more than with things.

At the other end of the technician spectrum are the junior technicians who work more with people and things than with data. They are the nuts-and-bolts men. Their work is similar to that of higher-level craftsmen in that they use practical skills more than technical knowledge. They plan, control, and supervise processes and workers, and they service and maintain equipment at the point of production. In some companies they are responsible for the training of skilled workers and production line operatives. By applying their technical and operational knowledge and practical skills to the proper use of equipment and materials, junior technicians probably contribute most in a direct way to the quality, quantity, operational efficiency and profitability of the production process.

In between the higher and the junior technicians are the middle-level technicians whose technological education and training equip them to understand whatever innovations have to be implemented in design, building, manufacturing, production, and servicing processes as a result of the work of scientists and technologists. They are the technicians who play a strategic role in translating and activating ideas for new projects into plans and work schedules which they then interpret to shop floor supervisors, craftsmen and skilled workers. Depending on the organization or the company for which a middle-level technician works, he may be employed as an assistant designer, senior draughtsman, specialist tester, inspector, or supervisor in a factory, laboratory, hospital,

planning office, production line, or engineering construction site. He may be working under the direct guidance of a technologist or senior technician, or he may be working alone with sole responsibility for his particular operation. In short, technician functions differ. They therefore have to be identified industry by industry for individual organizations and companies.

The balance between theory and practice in the technician's training depends on the level at which he is to function in a particular working environment. This may change as technology develops and as a man moves from one level of employment to another. Upward movement usually requires upgrading of technical knowledge and special skills, and involves further vocational education and training.

At the present stage of industrialization the nature of the work a person does determines whether he is a technician or a technologist or a craftsman. There are many people in industry doing technician jobs without being labelled technicians and without having any recognized technical qualifications. They function adequately in their jobs. However, their number is likely to diminish rapidly as industrial processes become more scientific, more mechanized and more complex. To prepare the way for this development, more clearly identified job functions are needed. They could provide the data for writing more objective job descriptions and for compiling more scientific specifications from which to structure profiles of the general education, technical education, vocational training, and work experience suitable for admission to the technician grade of an occupation in a particular industry and organization.

The role of the Technician in Industry

A number of definitions have been accepted as a starting point for exploring the role of the technician in industry. The Institution of Electrical and Electronics Technician Engineers in its publication *The Education and Training of Electrical Technician Engineers* gives the following definition of an 'engineering technician' which has been accepted by the Conference of Engineering Societies of Western Europe and the United States and by the Commonwealth Engineering Conference:

> An engineering technician is one who can apply in a responsible manner proven techniques which are commonly understood by those who are expert in a branch of engineering, or those techniques specially prescribed by professional engineers.
>
> Under general professional engineering direction, or following established engineering techniques, he is capable of carrying out duties which may be found among the list of examples set out below.
>
> In carrying out many of his duties, competent supervision of the work of skilled craftsmen will be necessary. The techniques employed demand acquired experience and knowledge of a particular branch of engineering, combined with the ability to work out the details of a task in the light of well-established practice.
>
> An engineering technician requires an education and training sufficient to enable him to understand the reasons for and purposes of the operations for which he is responsible.
>
> The following duties are typical of those carried out by engineering technicians:

> Working on design and development of engineering plant and structures; erecting, and commissioning of engineering equipment and structures; engineering drawing; estimating, inspecting and testing engineering construction and equipment; use of surveying instruments; operating, maintaining and repairing engineering machinery, plant and engineering services and locating defects therein; activities connected with research and development, testing of materials and components, and sales engineering, servicing equipment, and advising consumers.*

The 1961 H.M.S.O. White Paper *Better Opportunities in Technical Education* states: 'The term "technician" is applied to a wide range of responsible jobs involving a higher level of scientific and technical knowledge than that needed by a craftsman but below that needed by a technologist.'

Another definition is given in *A Report on the Recruitment and Training of Technicians* (British Iron and Steel Federation.) This states: 'A technician is charged with the application and control of technical practices that have been defined by technologists. He should have practical knowledge and experience of the skills involved, combined with adequate technical and process knowledge and experience to enable him to diagnose problems, work out details of a task or operation, carry out the work himself, and in some cases to exercise supervisory or advisory duties.'

The report continues: 'Thus the technician does not require the more advanced knowledge of the technologist and only rarely will he have any responsibility for initiating new work. He is, however, distinguished from the craftsman by his ability to bring a greater theoretical knowledge to the solution of his problem than a craftsman normally requires.'

The technician functions between the technologist and the craftsman. The technologist is normally a university graduate who has the scientific and general educational background qualifications and the range of responsible experience to be given professional level authority in an industrial undertaking. He has been referred to as the commissioned officer in the industrial army. He functions at the higher levels of management and administration, applied research and development, design, production, planning and organization. The craftsman has normally completed an apprenticeship or equivalent training. He needs to have the theoretical knowledge to appreciate why he is using tools, instruments, machines, and materials in particular ways for specific jobs. This knowledge and a wider range of manipulative skills are the characteristics that distinguish the craftsman from the skilled workers and operatives who carry out specific operations on equipment (such as lathes and machine tools) or who control special equipment (such as the tower crane) or who carry out skilled operations in a foundry, a textile mill, or a factory making steel or chemicals. Although operatives do not normally serve an apprenticeship, they usually have special training varying from a few days or weeks to one or two years. Craftsmen represent over one third of industry's manpower. The estimated demand

*As reproduced in Booklet No. 9: *The Training of Technician Engineers.* Engineering Industry Training Board.

is for ten craftsmen to every technician. Although there is no fixed ratio of technicians to other categories of manpower, it is estimated that about five technicians are required for every technologist in industry.

Technicians constitute a wide range of personnel in a modern organization. Their use is increasing rapidly to accompany the accelerating pace of industrialization and technological change. They are employed by every major industry. Because of the variety of the jobs and the lack of precision of nomenclature in industry, the specialist technician is not always recognized and designated as a particular kind or grade of technician. The specific functions and skills vary widely in their nature and breadth of application, and have to be identified within individual industries and companies. The identification of the specialism in the functions of a technician activity determines the technician job title. It depends on the nature of the work he does in a particular company. Industries and companies vary in their recognition of the duties that are suited to a technician. In some cases a job is done by technologists who would be more profitably occupied on more intellectual tasks, and in others it is done inefficiently by craftsmen or skilled workers whose education and training is below the level needed to do the job. Identification and analysis of job functions and responsibilities is necessary in order to minimize waste of capital investment in education and training by the misemployment of specialist and skilled manpower. Analysis can provide the data for structuring job-oriented training and associated vocational educational courses. It can provide the facts on which to base selection, recruitment, and job placement procedures. It is required for vocational guidance, staff career development and counselling.

It is the ability to apply specialist knowledge and proven techniques to a specific job that makes the technician a valuable asset to a modern industrial organization. He uses greater theoretical knowledge than a craftsman normally requires in solving his problems. His level of craft skill varies according to the nature of his work. In production, construction, catering, or servicing it may be high. It will be minimal in research and development, performance analysis, jig and tool design, model testing, estimating, process and production planning, quality control, industrial engineering plant layout, work study, materials handling, electric power generation and transmission, or technical or sales representation. Even when he is concerned with the details of workshop or construction practice it is usually more important for him to have a fundamentally sound understanding of underlying principles than to be expert in their execution.

The education and training of the technician must be designed to equip him to adapt and develop his expertise to the changes in products, equipment, materials, and techniques that are characteristic of modern industry. The fundamental ability of the technician is of basic importance, but as processes, methods and techniques become obsolete he must accommodate himself to changing circumstances and be adaptable to re-training, up-dating and re-grading. As products and plants become more and more complex, the number and

variety of middle-level technician jobs increases, and the role of the technician becomes more clearly recognizable as being complementary to the professional engineer or technologist. He is a member of the research and development team. He analyses and interprets information from project and prototype experiments and makes evaluations upon which technical judgements can be based. Under the supervision of engineers he designs, develops or plans modifications of new products and processes. He may be a technical writer covering field tests for product performance or environment tests of mechanical, hydraulic, pneumatic or electrical systems. As the expert in the application of skilled techniques in a specific field he activates design or production policy decisions at drawing office or shop floor level. He prepares or interprets engineering drawings and sketches. He selects, compiles and uses technical information. He chooses tools and machines suited to a particular job. As a member of the production management team responsible for planning the efficient use of manpower, materials and machines he may be concerned with method and work study, inspection and quality control, rate fixing, and value analysis. He may be developing and supervising schedules which enable junior technicians, craftsmen or skilled workers to do first-line maintenance. Many are employed as supervisors or foremen. Many others work independently without direct supervision in the field as managers of small businesses, agents, contract managers, surveyors, senior estimators or buyers. Growing numbers are engaged in town planning, hospital administration and finance, mental health and social work, data processing, and transport.

The Status of Technicians

Most countries are facing the problem of establishing an understanding and appreciation of the work and status of the technician in industry and society. There is a consensus of opinion that part, but only part, of the reason for the universal shortage of technicians is this lack of a recognized status. The thesis is that the technician derives status from the nature and level of his responsibilities, from his indispensability, and from his contribution to the wealth-creating processes of the nation. It takes time for a comparatively new middle-level category to establish a status relationship with other occupations, particularly those which require the same standards of general education and vocational training and have similar financial rewards and conditions of service. Thus although the Industrial Revolution produced middle-level professional managers, accountants, and administrators over a century ago, they have only recently gained recognition and status in the community. More recently the technological revolution has produced the professional engineer and the technologist who have a recognized place and status in the top echelons of companies and an accepted status in society. At the other end of the scale the craftsman has a traditional status because of his apprenticeship and recognized skills, and his obvious contribution to production. But the work of new, emergent middle-level specialists who bridge the gap between the work of the professional

engineer and the craftsman has, in many cases, still to be identified, analysed, described, and evaluated in relation to the work of other more easily identified work groups. As we have seen, this lack of status affects recruitment, posing a serious problem to developing countries which need an adequate supply of technicians if their national development plans are to be achieved.

In the present state of industrial development, technicians are most commonly recruited from craftsmen or skilled workers. They undergo re-training to extend, up-date and up-grade their knowledge and skills to equip them for new tasks and work practices. This route should always be kept open for those workers who have the know-how, the abilities and personal qualities, the experience and on-the-job achievement to make a new kind of contribution in a changing industrial climate of scientific organization, logical planning, systematized functions and production management. The fact is that at every level of policy implementation people are needed who can adapt to change and innovation and who have sufficient mental flexibility to modify those traditional attitudes which lead to strict job demarcation and restrictive practices. But this form of recruitment is not the most effective way to obtain the specialist technician manpower needed to modernize industrial productivity and accelerate the achievement of national economic development plans. It identifies the occupational status of the technician with the craftsman or skilled worker. It perpetuates the shortage of recruits to technician education and training programmes. It discourages senior secondary school students of above average ability, with a good general education record and with technician potential, from choosing mathematics, science and the subjects on which to build the vocational education and training suited to a technician. It inhibits vocational guidance staff and teachers in secondary schools from advising students to look towards careers at the technician level in industry. It discourages parents who understand the occupational value and career opportunities of secondary education from recommending to their children technician jobs that project an image of manual labour with its dark shadows of insecurity of employment and lack of status in society.

Also to be deprecated is the method of recruiting technicians from among those who have failed to obtain a university or equivalent degree or a professional qualification. It lowers the prestige and adversely affects the status which teachers, parents and the community attach to the job of technician.

How could the attitudes of teachers and parents of children be changed? One way would be to devise special mass media communication programmes which stressed that the main purpose of universal primary and secondary education is to help each child, regardless of social, religious, racial and cultural factors, to build his personality and character and develop his intellectual and vocational potential as an individual human being in a society in which everyone is economically dependent on the combined work effort and shared civic responsibility of the whole. Another would be for the government to spell out the damage which the serious shortage of technicians is doing to its national economy, and make

whatever educational development plans and provide whatever capital investment resources are needed to remedy the situation. This programme would need the support of captains of industry who could explain how the lack of skilled manpower, and specifically of technicians, is retarding productivity. As things stand at present, most parents remain unconvinced by assertions that the technological revolution is changing the pattern of national employment structure and bringing about a breakdown of social divisions and barriers. Their experience of life has not encouraged them to believe in the blue collar revolution. They are very much aware that job and social status is highest in academic, white collar, government, non-manual and non-industrial occupations, and believe that it will remain so. They do not realize that status cannot remain static in a society which is changing its economic and social priorities, and its modernization and industrialization plans.

In the schools themselves, special information programmes are required. At present few students are motivated to learn about industry or about the jobs of technicians in industry. Like most of their parents and teachers and the politicians they do not have the foggiest notion of what a technician does for a living. However, if students are to learn more about these things and the realities of the industrial and economic world in which they live, the teacher training programmes must also be revised. Only in a few countries do primary and secondary teacher training deal with the national economic development plan, and the kinds of education and training that are needed to produce the skilled professional, technical and operational manpower to achieve its targets. Profound, penetrative, academic studies are not required. The need is for programmes to communicate basic knowledge to teachers about the government's philosophy of industrial development to match the national economic development plan, about the purposes, aims, objectives, social obligations, manpower policies, and employment structure of industry, about selection for employment, and about working conditions of employment. Such a programme would familiarize teachers with the meaning of industry and its importance to every individual in society. But is this sufficient? Should teachers not also have sufficient work experience to enable them to understand the work of technicians, and to learn what contribution it makes to raising the standards and the quality of living for everyone?

Lack of knowledge of the technician's work is more widespread than people realize. It is an unfortunate fact that few employers are much better informed than parents or teachers about the kind of work done by the technician. Yet it is the employer who determines the occupational status of an individual in an industry or company, and the employer who has the obligation to give the technician a career structure which adequately reflects the importance of his specialist knowledge and skill. Moreover, it is the responsibility of employers and governments to keep the general public informed about the value of particular categories and grades of technicians to industrial development and national economic growth. They need to ensure that educators in secondary schools are

equipped to advise students on the technician career opportunities available to them in a particular industry or company at a particular place and time. Careers advisers need to convince students and their parents of the job satisfactions which technician jobs offer to socially conscious young people, and employers and government departments need to give more than a label to a technician job when they seek recruits from among the good students in secondary schools. A label does not give status or convey the meaning of a job. It does not say what kind of work is involved, or what a technician is called upon to do. Young people need to know these things as much as they need to have details of the kinds of qualification required for admission to technician training, the duration and content of the technician's special education and training, and the standard and standing of the qualification awarded on successful completion of the training. They also need to know what they will be capable of doing on entering employment, and what their wages, career development opportunities and prospects will be. Students are aware that occupational and social status come from possessing a nationally recognized specialist qualification on top of appropriate general education qualifications. They are aware, too, that jobs that require the same general education and the same length of further vocational education and training and have the same salary structure and conditions of service are of roughly equal status. The education and training of technicians must therefore reflect their status in industry. The curriculum must clearly be quite separate from professional courses. It must have a distinct integrity of its own. Whether the terminal qualification be a degree, a diploma, or a certificate, it must have national standing in industry, in education and in society. Possession of the qualification should become a requirement for employment, and salary structures should reflect its worth. If the technician is to be accorded the recognition, status and rewards which it is claimed he deserves, the public and employers must understand how his activities fit into the overall technological pattern of industry. They must be convinced of the particular importance of his work and its contribution to the community.

Nevertheless, for the individual in an occupation, true status goes beyond the salary structure commensurate with the responsibilities of a job and the status symbols attaching to it. For him status comes from having his abilities absorbed to capacity and his ambitions satisfied at his level of employment and a feeling of having chosen to belong to an occupational group which has an ethos of its own.