INTRODUCTION

The basic purpose of this enquiry, which arose from recommendations made at the Fifth Commonwealth Education Conference held in Canberra in 1971, was to consider the problem of providing practical training in industry and commerce for technicians and their equivalent, so as to determine its shape and characteristics and make suggestions as to how it might be alleviated. In carrying out that assignment I therefore focused my attention on three major topics, namely, training needs, training opportunities, and the suitability of the available training. For the first of these topics I concentrated on courses of education which require complementary practical training, and tried to build up pictures of the needs, in terms of subject and level, over the next two or three years, and to estimate the trends. For the second topic - training opportunities - I obtained as much information as I could about the facilities that were already available or could be created in the countries concerned, the factors influencing the provision of such facilities and, wherever it seemed appropriate, the opportunities for training students from other countries. For the third topic, I considered the value and relevance of the training provided.

I concentrated, as I was asked, on the education and training of technicians. This represents a new and encouraging activity for the developing countries of the Commonwealth, but not for the developed countries. It seemed necessary for me to adopt some sort of definition of the word "technician", but not to go to any great length to achieve precision. The Commonwealth Conference on the Education and Training of Technicians, held in Huddersfield in 1966, "deliberately rejected the temptation to attach a specific clear-cut meaning to the term 'technician' and accepted the impossibility of finding an acceptable definition." Nevertheless the Conference rightly "recognized that, through the whole range of industries and commerce, there is a broad spectrum of occupations lying between the craftsman, on the one hand, and the professional (or technologist) on the other; within this spectrum there are wide differences, both in subject interests and in degrees of expertise, which must be taken into account while planning educational and training programmes, but this whole band does represent a unique and distinguishable group of people who, whatever their specific functions, can be broadly classified as technicians." Equally to the point, Mr. (now Lord) Goronwy Roberts, then Minister of State, Department of Education and Science, U.K., in his closing speech to the Huddersfield conference, said: "It is essential that the technician be accorded a status of his own, that he feels himself to be a member of a body with an ethos of its own, a body of men - and women - who have wanted to become technicians rather than anything else, who have been selected as having the right qualities for a technician, who have had the education and training appropriate to a technician, and who are proud to bear the title 'technician'. One certain way of helping to achieve this status is to ensure that the relevant programmes of education and training are 'custom-built' for technicians, deriving neither from craft courses 'plus' nor from technologist courses 'minus'."

These, then, are the people who were the main subject of my survey. But I was asked to widen its scope to include some reference to the education and training of graduate engineers, if only because, for industry, this is part of the same picture in that some of the same resources and some of the same problems are involved. As a

result of my wide terms of reference, this report incorporates information on such matters as types of course (e.g. general, specialized, sandwich and post-qualification courses), on manpower assessment and planning, on measures taken to co-ordinate the activities of training organizations, on examinations and awards, and on gaps in resources, information, know-how, and experience. It also identifies shortcomings in the provision of technical education which tend to be common to all the countries of the region.

As Dr Cookey pointed out in his letter inviting me to carry out this project, one of the main drawbacks to technical education in developing countries is the theoretical nature of the curriculum so that graduates of technical schools are not always suitable for employment in industry. This is true. The end-products often lack any of the self-confidence needed to accomplish a job. They are not entrusted, even once throughout their entire course of study, with any technical problem. This leaves them high and dry. They are wanting acumen, and their approach to research and problem-solving is negative, therefore they are not readily accepted by industry and other major employers. What is, therefore, most desired is that technical education should be essentially linked with industry, production, design and construction work. This will enable them to learn about actual work situations and the manner in which various tasks are accomplished. The students will then have developed a degree of self-confidence and an insight into the intricacies of the employment market.

While conducting the survey I kept in mind the fact that some of the countries under review are industrially backward and a lot of work remains to be done towards proper exploitation of their natural resources. There is no lack of willingness on their part to link education with practical training in industry as an integral part of the courses of study, but there is a lack of industrial and economic development. At the end of my survey the belief that lack of practical training in the total process of education is circumstantial rather than intentional has only re-affirmed itself.

From my own experience in the administration of technical education and from my discussions with educational authorities in India and other countries, I know that the minds of educational planners, teachers and administrators are preoccupied with the immense difficulty of improving the pattern of technician training in the circumstances I have described. The immediate problems are: how to make the training more meaningful, constructive and practical; how to link education with gainful employment; and where to look for the resources which must ultimately throw open facilities for practical training as an integral part of technical education at any level. Because industry finds graduate engineers and technicians unsuitable or unable to put theory into practice and apply it gainfully, industrialists feel obliged to run their own training schools and programmes, thus diverting money, effort and resources which could have been invested in development and modernization. It is wrong for them to enter into educational territory and thereby overlap with and duplicate responsibilities which should rest with public technical institutions raised at great expense. This is a waste of national resources. I am not of course suggesting that industry should not train and re-train its staff to prepare them for sophisticated operations and modern machines.

I have been thinking over the problem, and although I was not asked to make formal recommendations, I have, in addition to comment made in the text and views already expressed, formulated the following suggestions which may be found useful in all the developing countries:

1. Sandwich programmes should be introduced for as high a proportion as possible of the admission capacity of technical and technological institutions. Industry in the vicinity should be encouraged to sponsor this proportion and so become automatically involved as an equal partner in the processes of course planning and theoretical as well as practical instruction. This is by far the most important method of linking technical education with practice. It also has the merit of inculcating the discipline

of the sponsoring organization. Long vacations should be used for practical training in industry at the end of each year, and short vacations can be used for project work.

2. Curriculum should be reviewed and renewed as a continuing activity by the authorities concerned, which should include Boards of Technical Education where they exist, degree and diploma awarding bodies, and the technical teacher training institution in the region. Courses should as far as possible be planned to provide for two or three connected specializations, these being carefully selected with due regard to the manpower requirements of the country. This can provide students with alternative openings to jobs without prejudicing the essential content of broad-based courses.

3. Industry should not be expected to provide more than its share of facilities and resources, but should be able to look to technical institutions and their teaching staffs for an important contribution. Teachers should visit industrial establishments regularly and apply their expertise and knowledge to live problems of product development, quality improvement, or design, and they should undertake consultancy work. Industry should in turn make available the services of their technical personnel to supervise the training and guide the project work of the students.

4. Amid the explosion of modern knowledge, the training of teachers in polytechnics and engineering colleges should be mounted as a continuing programme. These teachers should be encouraged to undertake postgraduate courses and/or research leading to doctoral degrees; the idea that higher theoretical studies for such teachers are useless must be discarded as obsolete, as it impedes both educational and economic development. Refresher and other short courses on special methods and other pedagogical topics should be arranged during long vacations, and 30-40% of the teaching staff, at a time, should be required to attend them, with compensatory leave or monetary benefits. Teachers should also be sent for short-term industrial training at intervals of two or three years, each time to a different industry, so as to learn actual work situations over a range of products and services.

5. No country can on its own keep pace with advances in science and technology. There should therefore be an exchange programme between the countries of the Commonwealth for technical teachers and industrial experts. The Commonwealth Secretariat could very well operate such a programme, in view of its central funding and co-ordinating role. Some of the exchanges should involve quite long stays in the host countries.

6. Each member country should have a "manpower cell" directed by a responsible senior person with a strong statistical background. In addition to conducting manpower surveys to establish requirements in terms of demand and supply, the cells should have the wider function of reviewing the scale and quality of training facilities, assessing needs for additional facilities, and determining whether the country has the capability for developing its own arrangements or needs external assistance. The cells in different countries should exchange information for their mutual benefit. Here again, Commonwealth Secretariat assistance would be appropriate.

7. The professional engineering bodies in the different countries should play an important part in the development of proper training facilities. They should communicate in a more meaningful way with technical institutions and with industry, and not confine themselves to conducting professional examinations but give real help with training. In this connection the role played by the Indian Society of Technical Education is commendable. A conference of the presidents of the main professional bodies in the various countries might well prove very useful in this connection.

Introduction

In conclusion, I should like to express my gratitude to the Commonwealth Secretariat for inviting me to undertake this assignment, and to all those individuals in government departments, educational and training institutions and related organizations, and in industry itself, who kindly assisted me with my enquiries. Without their assistance and co-operation, this report could never have been prepared.