Technical Education and Industry

Report of a Commonwealth Regional Seminar/Workshop

Hong Kong, 28 September-7 October, 1976

Commonwealth Secretariat

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INTRODUCTION

Following the wishes of Commonwealth Education Ministers, the Commonwealth Secretariat has given high priority to technical education and industrial training, and in 1966 organized a Commonwealth Conference on the Education and Training of Technicians which was held at the Huddersfield College of Education (Technical). Taking their lead from this Conference, and endorsing its recommendations, the Fourth and Fifth Commonwealth Education Conferences gave a more specific remit to the Secretariat to develop activities in support of technician education. The practical training of technicians in industry and the training of technical teachers are two areas in which the Secretariat has been investigating a generally inadequate provision of facilities.

In 1974 the Secretariat commissioned Mr A. MacLennan, former Principal of the Huddersfield College of Education (Technical) and host to the 1966 Conference, to write a book which would develop and update the thinking of that Conference. This was published under the title "Educating and Training Technicians" in December 1975. The Secretariat also saw the need to provide key personnel in this area with opportunities to exchange views, examine pressing needs and problems, and identify possible solutions. lt was thought that this could best be done in the form of a seminar or workshop conducted on a regional basis.

The Hong Kong Government kindly offered to host such a seminar for the Commonwealth countries in the two great regions of Asia and the Pacific. Throughout 1976, planning of the seminar proceeded in conjunction with the Hong Kong Department of Education. In Hong Kong a working party was set up to carry preparations forward in greater detail. The Commonwealth Secretariat wishes to record its gratitude to the Department, to the Hong Kong Polytechnic and to the members of the working party for their meticulous and comprehensive preparations.

The objectives of the seminar were to consider the various ways in which the partnership between technical education and industry can be developed in order to make education and training more effective; to study information contributed by each participating country about its training legislation, organization and institutions; to exchange ideas about how industry can best provide practical training complementary to institutional courses; to discuss standards and content of technical education, as well as examinations and awards; to consider specifically the technician level of education and training, the level at which the closest partnership between institutions and industry is vitally needed; and finally to recommend follow-up measures and arrangements which will be helpful to developing countries in meeting their needs for technical manpower, whether on their own or in co-operation with other Commonwealth countries. Eleven Commonwealth and

associated countries in Asia and the Pacific, besdies Hong Kong, accepted invitations to send delegates to the seminar: Bangladesh, Brunei, Fiji, India, Malaysia, Papua New Guinea, Singapore, Solomon Islands, Sri Lanka, Tonga, and Western Samoa. An observer from Nigeria also attended by inviation.

It was decided to organize the seminar in the form of three separate projects, and to sub-divide each of these projects into four constituent topics. The forty delegates and observers were divided into four separate groups to consider these topics, and each group was assigned to make an appraisal of present situations, both in national and general terms, and consider possible improvements or innovations in the relevant legislation, organizations, institutions, and arrangements for technician training.

OPENING CEREMONY

The seminar was held in the Lee Gardens Hotel, Hong Kong, between 28 September and 7 October, 1976 and was opened by Dr the Honourable S.Y. Chung, Senior Unofficial Member of the Legislative Council, leading industrialist, and Chairman of the Polytechnic Board of Governors, who was introduced by the Honourable Kenneth W.J. Topley, Director of Education. Dr Chung referred to the development gap between the advanced and the developing countries, which lay particularly in the disparity in levels of science and technology between these two groups. He pointed out that, in order to narrow the gap, the recipient country must have the capacity and capability to accept a transfer of technology. Hong Kong had to follow the footsteps of the industrially advanced countries so that it could be competitive world-wide, in terms of price, quality and technology. For this reason, Dr Chung saw the development of technical education and industrial training as being of vital importance to the future well-being of Hong Kong. He said that, by the end of the 1970s, Hong Kong should be able to provide sufficient technical education facilities for a total enrolment of 50,000 full-time, part-time day and evening students. The Government and industry were making joint efforts to provide facilities to this end.

In thanking Dr Chung for his opening remarks, and the Hong Kong Government for hosting the seminar and placing generous resources at its disposal, Mr B.F.C. Fong, Assistant Director, Education Division, Commonwealth Secretariat, mentioned, inter alia, that the report of the seminar would be placed before the Commonwealth Education Ministers at the Seventh Commonwealth Education Conference in Accra, Ghana, in March 1977; they would be interested especially in the practical actions which delegates recommended as a result of their deliberations. Mr Fong asked the seminar to place the emphasis of discussions and recommendations on the technician level. He recognised that the less developed countries were only now beginning to introduce education and training at this level, but they in particular might be able to benefit from measures of regional co-operation which he hoped would be among the recommendations of the seminar. He made it clear that the Commonwealth Secretariat, when sponsoring education seminars or conferences, aimed to ensure that practical action would result in some form or other, or preferably in several forms, which would help to solve or ease problematical situations faced by member countries.

On the proposal of Mr Fong, Mr Topley, leader of the Hong Kong delegation, was elected Chairman of the seminar by general acclaim.

SUMMARIES OF CONCLUSIONS AND RECOMMENDATIONS

The seminar, after full consideration of the reports of group sessions, puts forward the following conclusions and recommendations for the consideration of Commonwealth governments and institutions, industries, the Commonwealth Secretariat, and other international and regional organizations.

Project One - Partnership: The National Framework

1. Enhanced co-operation between technical education and industry is vitally necessary to the efficient training of technical manpower, and is to be achieved through organizational structures that constitute a genuine partnership, are responsive to training needs and pay due regard to cost-benefit considerations.

2. Closely related to its central planning machinery, each country should have a national council for technical education and industrial training, to oversee such education and training at all levels and to ensure that it is relevant to the needs of industry. Such a council should be a statutory body, and its powers mandatory or advisory according to the policies and conditions obtaining in each country.

Its terms of reference should include:

(a) deciding or recommending general policy for technical education and industrial training;

(b) setting up (where they do not exist) appropriate boards and committees, eg. industrial training boards, apprenticeship boards;

(c) organizing such manpower planning and manpower surveys as are needed for the proper development of the system;

(d) continuous appraisal of the numbers and categories of persons trained, to guard against over- and under-training;

(e) setting, directly or by delegation, national standards to ensure the quality of training and related education;

(f) deciding or recommending the means of financing technical education and training.

Such a national council must be fully representative of government, of education (at official, institutional, and teacher association levels, with the possibility of student representation), of commerce and industry (at the levels of employers, employees, chambers or federations, and major individual enterprises), and of professional bodies. This representation should be reflected on subsidiary and associated bodies.

3. There should be legislation to provide for the implementation and control of co-operative training schemes (between technical education and industry), normally an Apprenticeship Act or Industrial Training Act. This legislation should be regulatory, promotional, and financial, and aimed at securing the right amount and the right standards of training. It should also provide that on-the-job training is the responsibility alike of government, quasi-governmental organizations, and the private sector of industry and commerce.

4. Bonding or a similar contractual arrangement binding on both parties should be introduced to protect the interests of both trainees and training establishments and to ensure that trainees receive appropriate on-the-job training and related technical education.

5. Apprenticeship, where at present confined to craft or trade training, should be extended to provide for the apprenticeship of technicians.

6. Expenditure on training should be shared equitably between government and industry, and the legislation should lay down a clear demarcation of financial responsibilities (which might be carried out through a levy and grant system). The financial resources of government should be directed towards generalized technical education and basic industrial training, including industrial training in transferable skills.

7. The roles of Labour and Education Ministries should be carefully defined so that machinery for co-ordination is built into them and no important education or training function is omitted.

8. Since science and technology have a decisive role to play in the social and economic transformation of society, expenditure on technical education should be regarded not as part of expenditure on the social services but as a separate commitment and an investment in development.

9. Group training schemes should be organized on a national or regional basis where technical and financial resources are limited or where units of industry are too small to provide the necessary training capacity or capability.

10. The principle of partnership should extend to the training of technical teachers, and as a financial incentive for senior staff development, places for Senior Industrial Fellowships should be endowed, in a manner similar to university professorial chairs, in order to place (a) senior practising teachers in industrial positions, (b) experienced specialists from industry in educational institutions.

Project Two - Partnership: Educational Institutions and Industry

1. The partnership between educational institutions and industry must be achieved through joint responsibility at all levels. At the level of the education and training process itself, educational establishments should be responsible for providing the basic skills and related science and technology, and industry for providing on-the-job training.

2. Advisory committees should include representation of industry, commerce, educational establishments, professional bodies, and government, and should advise on all matters relating to education and training, not simply on course content. Such matters should include the programmes and the management of institutions, staff development, public relations, and assistance to students.

In advising on course content, advisory committees should be guided by considerations of relevance, of economy (giving priority to needs common to many situations in industry), and of good articulation between various parts of a programme.

3. It should be a joint responsibility of educational institutions and industry to provide opportunities for the technician in employment to receive further education and training, (a) to up-date his knowledge and skill, (b) to diversify his field and extend it to supervisory or management skills, or (c) to raise the level of his qualification. Adequate provisions should be made to allow personnel to take advantage of such opportunities.

4. Technician education should ideally be provided not through full-time courses which are 100% institution-based, but through sandwich or block-release courses. Courses could range from industry-based courses of which two-thirds are spent in industry and one-third in an educational institution to institution-based courses, one-third in industry and two-thirds in the educational institution. Day release and evening courses are not in general recommended for initial technicians training because of the work situation and the demands on the individual, but are valuable, if well-devised, for upgrading and where there is no practicable alternative.

5. There should be continuous analysis of the functions and duties of technicians as a joint activity of industry and educational establishments, and training programmes should be organized and curricula designed on the basis of the data obtained.

6. Firms in the same industry should be encouraged collectively to sponsor technical institutions or departments of institutions, on the understanding that this does not limit them to providing courses which serve the immediate needs of the particular firms.

7. Full-time industrial training officers should be appointed wherever practicable. Their duties should include laying down training schedules and standards, liaising with educational institutions and with Ministries or Departments of Labour, visiting schools and offering career guidance, and advising on further education and training. Governments should assist in the development of industrial training officers by providing relevant courses in association with the training of technical teachers.

8. The main educational requirement for entry into technician courses should be successful completion of a secondary education course with a technical bias, with passes in the language medium of the country's technician institutions, mathematics, and a relevant science subject. Alternatively, the candidate should have successfully completed a craft apprenticeship and have his employer's recommendation.

9. Technical examinations should be assessed as to their suitability on the criteria of relevance, balance, validity, and reliability, and should match the real needs of the country.

10. The release as part-time teachers of personnel serving in commerce and industry should be widely encouraged to ensure the relevance of teaching to current industrial needs. They should be provided with induction and refresher courses as necessary, to develop their competence as teachers.

11. Staff development programmes for teachers serving full-time in technical institutions should be the primary responsibility of the institutions but should have the assistance of industry. This assistance should include (a) making available the services of industrial representatives to serve on staff development committees, (b) the provision of facilities for attachments, (c) the loan of specialists in a particular field, (d) the supply of information about new skills, machines and techniques.

12. Inter-visiting between technical institutions and industry should be encouraged at all levels, particularly at the level of industrial training staff and of heads of institutional departments and lecturers, but not excluding governors, directors, technicians, and students. The cross-fertilization to be achieved in this way could extend to working visits of, say, three weeks.

13. The evaluation of technician courses in operation should be mainly the responsibility of the educational institution, but industry should play a continuous part in it through visits, the day-to-day work of the industrial training officer, and representation on joint committees.

Project Three - Technical Education in an Industrializing Society

1. In most developing countries, the constraints on resources are such that new facilities for technical education should be provided on the basis of proven manpower needs related to the economic development of the country, and the preferences of individuals, though taken into account, should be subordinate to this consideration.

2. Similarly the improvement of the schools is, in most developing countries, a pre-requisite for the improvement of technician education, and the availability of a required facility in a neighbouring country should be explored before a decision is made to invest in a marginally economic technical institution rather than in the schools system.

3. Each country should have a well-co-ordinated overseas scholarship policy designed to meet its own manpower needs and care should be taken to ensure that the candidates' academic attainments are relevant, that they have the right personal qualities such as enthusiasm and perseverance, and that suitable positions will be available on completion of the scholars' studies. The maximum advantage should be taken of scholarships offered by national

authorities, international, charitable and industrial agencies, and bilateral aid agencies, but co-ordination of effort must be secured.

5. Although concentration must necessarily be on large and medium-scale industries, the needs of small-scale industries and of prospective entrepreneurs who will be self-employed should not be overlooked and special programmes for them should be developed where possible. The entrepreneur who is already self-employed and therefore unable to attend a regular course of education or training could also be assisted through the media of radio, television, and correspondence.

6. Career counselling should be available in schools from the age of 14 or even earlier in appropriate cases, and in technical institutions, to enable the individual to make a choice within the education and training facilities; and provision should be made for (a) training in counselling for at least some secondary teachers (b) careers talks by industrialists and technical educators, (c) "open days" and exhibitions in schools technical institutions, and industry.

7. To encourage young people to embark upon the rigorous discipline of technician education and training, the rewards for its successful completion should include salaries closer to professional salaries than those prevalent in most countries; improved conditions of service; and a more purposeful and positive approach by employers to promotion opportunities. In this way the status of technicians can and should be greatly improved.

8. The education and training problems posed by new developments affecting the Asian and Pacific regions and by new technologies associated with them should be recognized by the establishment at some suitable centre of a clearing house of information and ideas which would enable countries to co-operate by pooling information concerning solutions to problems, innovations, and research.

9. General studies should be included in all technician courses, to provide a broad background to industry and commerce and to assist the individual's development as a person, a citizen and a worker. General studies lecturers should be carefully selected, having regard not only to their educational qualifications but also to their enthusiasm, their personal relationships, and their ability to teach and to exploit all available resources for teaching and learning.

10. So far as the customs of a country permit, determined attempts should be made to remove the barriers and constraints that operate against the employment of women in technician and other middle-level occupations, and therefore against their education and training for such employment. Governments should ensure that there are no such barriers and constraints in educational institutions, including the schools.

11. In the planning of technician courses consideration should be given to the adoption of an interdisciplinary approach in appropriate circumstances. Teachers should themselves be trained in an interdisciplinary way, and exposed to diversified subject areas.

12. Technician education should aim, in its particular fields, at relevance, quality and standards that genuinely reflect the needs of the community. The desire to meet outside academic standards should not lead to any diversion from this primary aim.

Commonwealth and Regional Co-operation

1. Greater provisions should be made for awards for study visits between Commonwealth developing countries in the two regions with reference to industrial training in general and apprenticeship training in particular.

2. Participants of the seminar/workshop should act as informal points of reference on questions of technician education and training in their respective countries.

3. Support should be given to the adaptation and production of books and other instructional materials for the technician level of education and training.

4. Assistance in the form of specialist services on a regional basis should be made available to help develop specific schemes in technician education and training.

5. Greater efforts be made to compile and disseminate information and case studies of experimentation and innovation in technician courses and programmes.

6. Support should be given to assist staff development and exchange programmes for further training in Commonwealth countries in the regions.

7. Twinning and other forms of association between technical institutions in the regions should be encouraged in order to maximize the utilization of expertise and facilities.

8. Advantage should be taken of existing staff training colleges to organize regional courses to meet specific needs.

9. A Standing Conference of persons involved in technician education and training on a regional basis should be established to enable them to meet on a regular basis for finding solutions to common problems.

10. In organizing comparable seminar/workshops at sub-regional or national levels efforts should be made to ensure that apart from government institutions and departments, industry itself, together with staff of polytechnics with responsibilities for industrial liaison, staff from employers' associations, education secretaries of professional bodies etc., should be strongly represented.

PRESENTATION OF COUNTRY PAPERS

Background papers about technical education and industrial training in their countries had been submitted in advance of the seminar by governments or appropriate officials for India, Bangladesh, Sri Lanka, Singapore, Fiji, Hong Kong, Brunei, Papua New Guinea, Malaysia and New Zealand. A paper "Some Main Features of Country Papers" had been prepared by the Commonwealth Secretariat. Delegates from the Solomon Islands, Western Samoa and Tonga presented some information orally. At the Chairman's invitation, the observers from Nigeria, the ILO and the WCOTP also spoke. The following summaries include remarks made by several delegates only to expand or comment upon background papers and should therefore not be read as complete statements.

Hong Kong

The Chairman himself, as Director of Education, Hong Kong, presented the country paper for Hong Kong. He said that the Hong Kong Training Council, directly and through two industry training boards and other committees, promoted technical education and industrial training. It carried out manpower surveys, set up training authorities as in the clothing and construction industries, and laid down job standards for a wide variety of technological, technician, craft and operative jobs. The Apprenticeship Ordinance of 1976, which made attendance at part-time technical education compulsory for all apprentices in some designated trades, was a big step forward in promoting technical education. In Hong Kong the two universities and the Hong Kong Polytechnic provided education for technologists, the last for technicians as well; while the three technical institutes provided education for technicians and craftsmen. The Hong Kong Technical Teachers' College produced qualified teachers for the technical institutes and for commercial/technical subjects in secondary schools. The establishment of an Industrial Centre at the Hong Kong Polytechnic, in which the students received industrial training in a factory-simulated situation, and the revision of syllabuses to cope with the requirements of local industry, were other important steps being taken to bring about an improvement in quality.

Mr Paul Lim was invited to supplement Mr Topley's statement, and referred to the importance of technology transfer. In his opinion one of the ways this could be brought about was through joint ventures in the business world; it was interesting to observe how developing countries had absorbed technical knowledge from developed countries in this way. His own businesses, for example, had five joint ventures - three with Australians, one with Americans, and one with Japanese; through this means of co-operation, engineers learnt the appropriate specifications, methods of assembly, etc. Mr Lim wondered whether, if Junior Secondary School leavers went on to apprenticeship training and Senior Secondary School leavers to technician training, the general educational system should be more

clo ely geared to their requirements. If so, this would immediately give rise to a big problem of training sufficient teachers of technical subjects.

Bangladesh

Mr Azad summarized the paper presented by Mr Faizul Kabir and himself. He said that education in Bangladesh had been shaped by legislation and successive National Plans, originally of the Government of Pakistan and after 1971 of the new People's Republic of Bangladesh Government culminating in the "First Five-Year Plan of Bangladesh, 1973-1978", and the "Report of the Education Commission 1974". Primary education began at the age of six and went from Grades 1 to 5, secondary education taking pupils as from Grades 6 to 10. At Grade 9 a pupil could opt for either humanities, science, commerce, industrial arts, home economics or agriculture. Primary enrolment in 1972-1973 was 600,000 and secondary enrolment 170,000.

There were 18 Polytechnic Institutes with an intake capacity of about 3,300, admitting students after Grade 10 and training them for three years. Thirty five Vocational Institutes, with a second shift trade programme in 13 Polytechnic Institutes, had a total intake capacity of 2,200; these admitted students after Grade 8 for 2-year trade training or after Grade 10 for 2-year highly skilled trade training. All these were controlled by the Directorate of Technical Education, under the Ministry of Education. The Directorate of Labour also ran a few institutional training centres, viz: five Technical Training Centres and a Marine Diesel Training Centre; an Industrial Relations Institute; and four vocational guidance and youths employment units. This Directorate also supervised apprenticeship training programmes run in different industries.

Mr Azad then explained the system of budgeting and allocating capital and recurrent funds for the technical institutions, and mentioned that external aid was controlled and co-ordinated by the Planning Commission, also that about 60% to 70% of students received scholarships or stipends from the institutions themselves, from Secondary Education Boards, from District Councils, or from charitable bodies.

As regards the national organizational framework, Mr Azad said there was an autonomous board, the Technical Education Board, which formulated policies regarding examinations and standards of education, conducted the examinations, and awarded diplomas and certificates; this Board included representatives of other agencies and of industry. It had been decided that a Council of Technical and Vocational Education as proposed at the Colombo Plan Seminar in 1975 would be set up. The Planning Commission already referred to, under the Ministry of Planning, was entraced with the overall planning of economic and social development in the country. Manpower surveys were done by the National Manpower Council, Central Statistical Bureau, Labour Department and Planning Commission.

Brunei

Mr Benyon presented the Brunei paper. He told delegates that about 95% of government revenue came from the petroleum and related industries and that the government was aiming at diversification in such areas as plywood manufacture and urea production. In 1970 two new technical schools were established to train skilled manpower to take over, gradually, work done by the imported labour force. The system of technical education was closely

geared to the examinations of the City and Guilds of London Institute, but a local examination system was being established. The problems included deciding on a language for instruction, a serious shortage of qualified teachers for technical subjects, and the small number of suitable students for the technician courses. At present almost all the teaching staff members in the technical schools were expatriates (mostly from the United Kingdom, with some from Malaysia and Hong Kong). It was very difficult to find technicians in the electrical engineering and telecommunications fields.

Fiji

Dr Swamy introduced Fiji as a country of islands, having a population of some 600,000 and a mixture of races, which became independent in 1970 with Queen Elizabeth II as Head of State. The school system had recently been changed and included a six-year primary course followed by junior secondary (forms 1 to 4) and higher secondary (forms 5 to 6). The junior secondary course was Fiji-based whereas the forms 5 to 6 course was New Zealand-based, except for the subject of English in which an optional paper was set. Completion of form 6 led to university entrance.

Fiji had one Technical Institute, which had courses at trade, technician and sub-professional levels. Previously courses were geared to the use of City and Guilds examinations, but recently an attempt had been made to rationalize courses and make them more relevant to the needs of Fiji. The University of the South Pacific, a regional institution, had only social studies faculties to date but it was hoped that an expansion of facilities would attract students from other regions.

Dr Swamy identified one of the major problems as being a lack of long-term planning in industry, which at present was mainly financed from overseas. There was a Fiji National Training Council, which imposed a 1% levy on the earnings of industrial concerns, but co-operation from industry in establishing training schemes was far from satisfactory. The responsibility for technical education for a country of 600,000 people rested mainly with the Ministries of Education and Labour, and both were trying to assist industry by identifying training needs through a number of training boards.

The great need in Fiji was for technicians in servicing areas for the major industries, but the geography of the country, with its many small islands, made it difficult to organize courses which could be attended by people living far from the training. Block-release courses of six weeks duration, shorter three-week courses, and day-release training for city areas, were now organized.

Dr Swamy said that some difficulty had been experienced because a number of overseas agencies were keen to donate equipment or to promote projects which were not fully in the interests of the country. In general, Fiji knew what was required, and every attempt would be made to ensure that technical education suited the needs of the country.

India

Mr Reddy, in presenting his country paper, first described the present pattern in India of ten years' general education, consisting of seven years' at the primary level, three years at the lower secondary level, and two years of higher secondary, with diversification, to relieve pressure on universities, into technical education and vocational education. Over 300 technical institutions provided technician courses for some 50,000 students.

One important problem arising from a quantitative expansion was to train sufficient teachers. Several measures had been implemented, including attractive terms of service and salaries, but some problems still remained in the overall task of training some 15,000 teachers. There was a period of over-production of technicians and several programmes had been launched to remedy this situation. There was also a need to improve curricula as a means of improving quality, and to educate industry about the importance of employing better qualified personnel.

Malaysia

Syed Kadir Al-Junid explained that technical education in Malaysia had changed considerably after 1964, when it became clear that it was necessary to look into the educational structure for technicians. The educational system was now such that, following a six-year primary course, students went on to a three-year lower secondary course, which included vocational subjects for those wishing to study such subjects. A two-year upper secondary course was divided into vocational, technical or general education. Students in the upper secondary vocational courses were intended to fill the need for skilled labour while those from the upper secondary technical courses proceeded to one of the two Polytechnics, established in 1969 and 1976 respectively. The Polytechnics trained technicians through a series of two-year courses, while higher-grade technicians for architecture and building industries were trained at the MARA Institute of Technology. Technologists were also trained at the University of Malaysia and the University of Science in Penang.

The main problem was one of staff shortages, a problem shared by many other countries. Malaysia was largely an agriculture-based country (rubber, palm oil), and exports included raw materials which were re-purchased after processing. The government had established Free Trade Zones in order to encourage overseas agencies to establish industrial undertakings, and technical personnel for car and electronic assembly plants and for the petroleum/palm oil/tobacco/steel industries were in short supply.

Little co-operation with other countries had been achieved so far. Practically no private company had an industrial training programme, but the public sector had well-established programmes. The colleges of technology found it very difficult to arrange practical training facilities for students. Various advisory committees had been established, but these also faced difficulties in arranging training with private industry and this remained a problem to be overcome.

Papua New Guinea

Mr Mummery said that Papua New Guinea was very much in its infancy in the development of technical education, following the country's independence from Australia in 1975. Some apprenticeship training had started in 1968, but with a country having some 250,000 children entering primary school and only 31,000 remaining after the six-year primary course, there were inevitably many problems to be solved. One of the main problems was one of language; it had been decided that English was the common language to be used.

At present seven technical colleges plus two vocational training institutions had an enrolment of some 3,500 students; the intake had been from form 2, but this was changing and in future it could be from the post-form 4 group. Of the 3,500 at present enrolled in technical colleges, it was a matter of some concern that only about 20% would follow a technical career. This problem arose because the Apprenticeship Act made obligatory a ratio of one tradesman to one apprentice. This legislation was now being revised. An attempt had been made to make the existing junior high school - type of technical college serve the needs of the community better by establishing for each college boards of studies which included people co-opted from industries connected with the subjects taught. It was hoped to improve the technological content of curricula and develop co-operation with industry in this way, and much had been done as a result of the establishment of these boards. The financial framework provided for all salaries of lecturers and teachers to be paid by Government; of 265 staff only 47 were from Papua New Guinea, not an ideal situation.

An agreement had just been reached with the World Bank for a A$1.5 million loan for the development of technical education, and a building programme had been agreed for the improvement of technician training. It was also planned to devise courses of training of one-year duration, involving 75% practice and 25% theory, for a form 4 intake, from which the student would enter an apprenticeship scheme. Mr Mummery said the intention was that no one would enter technician training without completing an apprenticeship.

Singapore

Mr Toh introduced Singapore as an island country with a population of over 2.2 million crowded into an area of less than 600 sq.km. A Technical Education Department had been established in 1968 with responsibility for promoting technical education in schools and institutes. In 1973 this Department had been dissolved and an Industrial Training Board set up to train skilled workers for industry.

Secondary education, after a 6-year primary education, was of 4 years' duration; two years lower and two years higher. In the first two years, the lower secondary section, 50% of girls and all boys were exposed to some form of technical education, the main subjects being metalwork, woodwork and electricity. At the end of the 2-year lower secondary course the students were given an aptitude test and, owing to inadequate facilities, about one third of the leavers would be admitted to pursue technical education in the upper secondary course. A co-operative workshop scheme was adopted in the upper secondary education system so as to maximize the utilization of workshop facilities, with 22 secondary schools servicing another 71 schools without workshops. Fifteen centralized workshops served 104 schools without workshops in the first two years of secondary education.

The Industrial Training Board aimed to train skilled manpower for industries and the building trades. Nevertheless, parents and students did not favour building trade courses, and skilled manpower in the building trades had to be imported. There were Trade Advisory Committees to plan courses, formulate syllabuses, select equipment for institutions, etc.

Sri Lanka

Mr D. Amarasinghe said that Sri Lanka a country of 25,000 sq. miles with a population of 15 million, had a well-developed education service with 90% of children in school. Even so, the system was undergoing rapid change and since 1972 primary education had been of 5 years' duration followed by a 4-year junior secondary course and a senior secondary course of 2 years. The junior secondary courses were unstreamed and included pre-vocational studies not designed to train craftsmen but merely to make students aware of work. Craft training commenced at the end of this junior secondary course and technician training at the end of the senior secondary course. Sri Lanka had 7 Polytechnics for the training of technicians and 8 Junior Technical Institutes for the training of craftsmen. Three independent bodies, the Ministry of Education, the Labour Department and the National Apprenticeship Board, were involved in the training of craftsmen and technicians, and industrial training was undertaken by the National Apprenticeship Board. Because three independent bodies were concerned, there was some duplication of effort and no one body co-ordinated the work, which sometimes gave rise to problems.

Sri Lanka had an unemployment problem, with many technicians unable to find a job appropriate to their training. As a result, new programmes of technician training, more broadly based, were being introduced, devised to train technicians to fit any job opportunity. The National State Assembly was responsible for financing education and the National Apprenticeship Board received funds from this source.

Western Samoa

Mr Holmes spoke for Western Samoa, and said that this group of small islands situated roughly 2,000 miles north of New Zealand had a total population of about 150,000, the majority of the manpower being employed in agriculture. There was no large private industry. Western Samoa became independent in 1962, and as part of an independence gift the New Zealand Government built, equipped and partly staffed a small "Trades Training Institute". The emphasis was on practical skills and a few local craftsmen were employed as workshop instructors.

About three years ago it had been decided to turn the institute into a Technical College by adding more buildings and offering more subjects, including commerce and domestic science. However, although one more workshop block was added in 1973, technical education in its present form was not started until January 1975. All courses were full-time and two years' duration and in 1976 all students were recruited from form 5 secondary streams.

The first stage of development, the Trades Section, was expected to be completed by the end of 1977 and it was hoped that the commerce and domestic science departments could be started shortly afterwards.

Technician training would be started only if the developing of the proposed Industrial Free Zone materialized.

About three years ago an apprenticeship scheme had been started but this was not working very well for reasons experienced by many developing countries, the main reason being the lack of trained craftsmen to supervise the apprentices. The two years spent at the Technical College was counted as one year of the four-year apprenticeship.

The main problems at present were a lack of trained instructors, a shortage of money, and students starting with absolutely no previous practical training.

Solomon Islands

Mr Alan Hatfield, a delegate from the Solomon Islands, said that compared with the programmes of many countries represented at the seminar, the Solomon Islands technical education programme was relatively small. However, it shared many of the problems mentioned by other delegates. Although trained persons were needed in most of the disciplines the number required in any particular discipline were too small for the Solomons to mount courses to meet its own needs alone. A policy of regional co-operation had therefore been adopted, taking into account the needs of other territories in the region covered by the South Pacific Commission, thus making it possible to offer a range of courses on an economic basis.

This programme relied to a great extent on support from international agencies and other countries. Examples of this were the Marine and Trade Training Programme set up with the help of the ILO in 1969 and the Survey School recently set up with the help of the New Zealand Government on a regional basis.

In common with other developing countries the Solomons were experiencing difficulty in attracting suitably qualified students to enter upon a technical career. There was still a marked tendency for the more able student to select a white-collar career.

The training of technical teacher was also a problem, too few were available or willing to take up a career in the teaching profession, and of those who had qualified, none were now serving as teachers because their training and expertise had enabled them to find better rewards and careers in commerce or industry.

In short, there was a mixture of problems which could only be solved by a combination of self-help, co-operation with other territories in the South Pacific Commission region, and assistance from other countries and international agencies.

Tonga

Mr Tevita Pilimilose'Aho said that no country paper had been prepared for Tonga because there were no technical institutions in the country. Tonga was a very small island in the Pacific, 99 square miles in area, with a population of only 90,000. The problem of training teachers for technical education was all-important because experience had shown that, even with the co-operation of other territories in training personnel, when the trainees returned to

Tonga they invariably found their pay inadequate and tended to go overseas again. Mr Aho emphasized that one of the main problems in Tonga was a lack of finance to establish training institutions and that more co-operation was needed from neighbouring countries.

Nigeria

Dr Ajayi said that he had noticed in the country papers many things that appeared relevant not only to Nigeria but to other African countries as well. He had noted the references to industrial training boards and councils, and was pleased to say that similar schemes had been started in Nigeria some four years ago. He referred to the important role of the consultants at the present seminar, and hoped that the recommendations which they would assist the seminar to formulate would be implemented in as many countries as possible. The importance of co-operation between countries could not be over-emphasized and the sharing of experiences should have the highest priority.

ILO

Mr Robert Campbell reminded the seminar that the ILO, founded in 1919, with its headquarters in Geneva, was tri-partite in structure, representing the interests of employers, governments, and the workers themselves. By having a tri-partite structure, it was in a good position to assist national planning and the development of curricula, and to undertake the various training programmes in which it was involved. Mr Campbell also drew attention to the International Labour Conference's 1975 Recommendation 150 referred to in the last paragraph of the Lead Paper "Recommendation concerning Vocational Guidance and Vocational Training in the Development of Human Resources"; and made a copy of this available to the seminar.

WCOTP

Mr M.C. Fong said over 130 countries were affiliated to the WCOTP, which had close relations with ILO and UNESCO. One of the main objectives of WCOTP was to uphold teachers' rights, including of course those of technical teachers. He said that it was generally agreed that teachers were under-paid the world over, and it was one of the functions of WCOTP to make every attempt to ensure that teachers' pay scales were increased appropriately; this was important to technical education because of the need to encourage teachers to remain in that field.

PROJECT ONE

LEAD PAPER

PARTNERSHIP: THE NATIONAL FRAMEWORK

Sven Grabe
International Labour Office

The title "technician" is one of several undefinable titles in the industrial hierarchy. The reasons are that technicians are trained in many types of institution and do a great variety of jobs. Moreover, the institutions are at several levels in the hierarchies of national systems of technical education and the jobs at many levels in an industrial organization.

The Title

Most attempts at defining the title "technician" end up in negatives. A technician is not an engineer - he is trained at secondary or post-secondary level but below that of a university; he has a job at the "sub-engineering" level but is not a "skilled worker" since he has received a "higher", more theoretical, level of training than the latter.

A few legal definitions of the term "technician" do exist. As a rule they relate the technician title to graduation from a particular institution or group of institutions in the system of technical education. Thus, graduates of technical secondary schools (lycees) in France are referred to as technicians (techniciens) while the graduates of intermediate post-secondary technical institutes are given the title higher technician (technicien superieur). Similar provisions are found in Belgian legislation. These definitions are, of course, only valid nationally and attempts to internationalize them (e.g. within the European Economic Community - EEC) have not been successful. Graduates of technical schools at similar levels in the German-speaking countries, for instance, are normally given the title "engineer" as are their counterparts in the Scandinavian ones.

The Job

As regards the job the confusion tends to be even more pronounced. A repair and maintenance mechanic would in most countries be referred to as a "mechanic". A radio and TV repair man, on the other hand, is often referred to as "TV technician" although he may have about the same level of education as the automechanic. Three people with the same background, and in principle, the same job may have three different titles: the man on the factory floor repairing machines for his employers would be called a "skilled mechanic"; if he does the samejob for a client he might be called a "service technician"

and if he works for the sales department he might be referred to as the sales engineer. Obviously in this case, it is not a question of the level of the job or of the educational background of the man but of the image of the firm.

Technicians are found in a great variety of departments within an industrial organization. Research, development and design departments are great consumers of technicians and so are planning, work study, and control and testing departments. Repair and maintenance and service after sales are also fields in which many technicians are employed. There are normally fewer technicians in direct production, although many production engineers and foremen have a technical education at a technician level.

As shown already by this short enumeration, job types and job requirements vary greatly at the "technical level". Some require highly developed skills in drafting combined with extensive technical knowledge at the level of applied technology. To others reading of industrial drawings, schemata and lay-out patterns is largely enough since the central tasks in their case relate rather to the assembly and disassembly of complex machinery or instruments which require extensive knowledge of practical mechanics and highly developed manual skill in the use of tools. Technicians in planning, work study, etc., like their colleagues in control and testing, are often highly specialised; they apply a limited number of techniques over a broad range of operations with which they should have some familiarity but need not necessarily have first-hand operational knowledge.

The Training

The traditional technician in the United Kingdom and in many other English-speaking countries is a man who has served his apprenticeship for the full period of four to five years (or has served an abbreviated "graduate apprenticeship") and, parallel to this, has followed advanced courses at a technical college. This type of combined training and technical education ("dual" system) remains an important source of technicians in several countries. In German-speaking countries completed apprenticeship (mostly 3 to $3\frac{1}{2}$ years) and the highest marks in the skilled worker examination are often basic qualifications for entry into a technician training institution (a technicum or ingenieurschule).

"Dual" systems of technician training are the exception rather than the rule. In France, the United States and the USSR, the Scandinavian countries and in most Latin American countries, a great majority of technicians working in industry have received their diploma or certificate at a technical secondary school, a post-secondary technical institute or a similar institution of full-time technical education for which a completed 8-10 year basic schooling (starting at age 6 or 7) is a principle entry requirement. Technical education at this level is generally integrated into the secondary school system or grafted on to it as a line of further education. Often two distinct levels exist, one a two-to-three year technical education (starting at age 16 or 17) and the other a three-to-four year higher technician education, starting at about the same age.

Not all technicians come out of the technical secondary schools however. A great number of workers with experience in industry take technician training through correspondence courses or at night schools; although work experience is an important entry requirement in many of these courses, formal training as a skilled worker is not a pre-requisite.

These statements about initial training and technical education should be qualified by stressing that in most developed countries employers usually do not consider the training of a technician as terminated when he enters into employment. It is common practice in most large and middle sized undertakings for technicians to go through a comprehensive "graduate" training, more or less systematically arranged, in which they gain experience in such basic technician tasks as drafting, tool and jig construction, production planning and control, work study and other industrial engineering tasks before settling into a longer-term job in production or elsewhere within the factory. This "graduate" training in many cases takes even longer than the basic technical education the technician has received at school and in most developed countries it is considered as indispensable "second apprenticeship" although it is seldom registered or even formally arranged as such.

The Legislative Framework

In the "dual" systems there are two sets of laws to take into account if one is to get a clear picture of the rules governing the training of technicians: a set relating to the training of skilled workers and one relating to technical education more generally. In the United Kingdom and in other countries which have more or less adopted or adapted to their own needs the British legislative and administrative arrangements relating to vocational and technical training and education, the training legislation governs training in employment while the essential provisions for part-time and full-time technical education are found in the education Acts relating to further education and higher education generally. In the Federal Republic of Germany training for skilled worker qualifications is governed by a federal vocational education Act; technician training comes under State (Land) provisions for technical education.

In Eastern Europpean countries technician training is largely assimilated to secondary or higher education and falls under the legislation governing such education, and is administered by the educational authorities. However, large numbers of technicians are also trained in technical schools belonging to the various technical ministries (the ministries for heavy industry, mining, the chemical industry, etc.).

In Sweden, which previously had a separate board of vocational and technical education and training, independent of the Board of Education, all vocational and technical training and education is now co-ordinated by the Board of Education and the legislation relating to both forms part of the general educational legislative provisions.

Arrangements vary between developing countries just as much as between the industrialized ones. There are some standard patterns which, with certain important modifications, have been constructed on perceptions of what has been evolved in France, the United Kingdom and the United States. Adaptations of the British patterns are thus found in most Commonwealth countries, while French patterns have largely been followed or adapted in the francophone areas. In Latin American countries, where institutions for vocational and technical education have developed rapidly over the past two-to-three decades, a distinction is generally made between the system of training of skilled workers and the system of technical education through which technicians receive their training. Both French and United States models have played a significant role in the evolution of each of the systems in this region.

Training Legislation

Some kind of training legislation exists in practically all countries of the world. Its quality, validity, scope and purpose vary greatly, however. A wide range of countries merely have traditional apprenticeship provisions written into their Labour Code setting out in some detail the differences between an ordinary labour contract and an apprenticeship contract, and adding the usual provisions about the mutual responsibilities of employer and apprentice in a traditional apprenticeship.

Although such provisions continue to be adopted the trend over the past few years is clearly away from writing training legislation of limited scope into the labour codes towards the adoption of special training legislation. The United Kingdom Industrial Training Act of 1964 provided the foundation for new training legislation adopted by many countries not only within the Commonwealth but also outside it. Similarly the training legislation adopted by Brazil in the 1940s (there were separate Acts for industrial and commercial training respectively) have been used as a model by several other Latin American countries. Unlike the UK Industrial Training Act, the early Latin American Acts related primarily to apprenticeship, i.e. training to skilled worker level under an employment contract. Several countries are to-day changing this approach to a training contract rather than an employment contract.

As legislative practices differ greatly between countries it is difficult to make any generalisations on a regional, let alone a world-wide, basis. The enumeration below should therefore be taken as indicative only.

Latin America. Most countries have separate training Acts providing the legislative basis for the activities of national training bodies. These bodies are concerned, in the first instance, with the training of specialized and skilled workers but in many cases are today branching out into such areas of activity as the organization of special courses for underprivileged population groups, including persons living in urban as well as rural areas; advice to undertakings on the organization and programming of training within the firm; upgrading courses for workers to become technicians; courses of further (but not initial) training for executive and management staff in undertakings. The legislation in most cases includes provision for a levy to be paid to the national training body by undertakings over a certain minimum size.

Africa. Several countries in anglophone Africa (e.g. Kenya and Nigeria) have introduced training Acts on the pattern set by the 1964 UK Industrial Training Act. Provisions for levies are included and national training bodies have been set up within the framework of this legislation. Studies with a view to similar arrangements are being undertaken in other countries.

Although legislative practices differ and the models are not the same, the general trend appears to be fairly similar in the francophone countries of Africa. In the Ivory Coast and Tunisia national offices have been set up for employment and vocational training to deal with all matters related to the training of workers. In the Gabon, too, recent legislation provides for the setting up of a national training agency responsible for both initial and further training. In the Malagasy Republic formal apprenticeship legislation has been operative since 1964 and many of the francophone countries have apprentice training levy provisions similar to those applying in France. A number of the francophone countries of Africa, however, do not have more

than traditional provisions for apprenticeship inserted into their labour code. Where training levies exist the sums collected normally go straight into the state budget and do not influence the planning of the training system.

Europe. The picture is similarly varied in Europe. The Scandinavian countries have gradually and increasingly integrated provisions for training into their educational legislation. Separate legislative texts exist for the education and training of young people and adults respectively. Important provisions for the training of adults are also found in the employment policy legislation. With one exception, the recent introduction of a special levy for adult training in Sweden, there are no provisions for training levies, but state grants are provided for many forms of training for both youth and adults.

The major provisions for training in Belgium, France and the Netherlands are found in the education Acts. Special apprenticeship legislation exists in all countries, combined, in France, with an apprenticeship levy system. New legislation was recently introduced in France relating to adult training (and further education) with provision for a special levy for such purposes.

In Germany (Federal Republic) a new apprenticeship Act is under discussion and is likely to be adopted next year. The debate on the proposed Bill has largely centred on two of the proposed provisions: the introduction of a levy and the transfer of a considerable part of the responsibility for training from employers (and their organizations) to the educational system and to the State. As the matter now stands, it is unlikely that a levy will be introduced and that some of the proposed "scholarisation" of training (i.e. the integration into the school system) will probably not be retained in the final text.

Eastern European countries have comprehensive provisions for training in their national plans, for the most part integrated into the chapters relating to education. The training systems are conceived as part of the total educational programme although some Eastern European countries, e.g. Eastern Germany, and the USSR, have separate administrations for education and vocational training respectively.

Asia. Asian countries provide a highly diversified picture. Some, like India and the Philippines, have national apprenticeship legislation implemented under the auspices of the Ministry of Labour or by independent offices reporting to that ministry. Generally speaking, however, Asian countries do not have central legislation covering the whole field of training. Levy/grant systems have been discussed in most countries but none has been adopted.

Legislation Governing Technical Education

It may be said, as a broad generalization, that technical education at secondary school level (and thus the legislation governing the training of technicians) forms part of the educational legislation in most countries. Technical education is seen as an integral part (and as a set of streams within) secondary education. Efforts are made to achieve equivalence between graduation in general, technical and commercial secondary schools respectively.

Part-time related instruction and further education for skilled workers (Facharbeiter) is the subject of separate legislation in the Federal Republic of Germany and Switzerland.

Organizational and Administrative Structure

Since the systems vary greatly between countries and since responsibility for the various aspects of vocational training and technical education is normally shared between several bodies it is difficult, if not impossible, to suggest any generalizations concerning the administrative set up.

In countries with highly centralized educational systems, as for instance in Scandinavia and in France, the Ministry of Education has the dominant role in the administration of all school and college based activities. Some representation by employers and workers is normally provided at management level and in such functions as the setting of curricula and examinations. Industry also participates in specialized commissions on standards relating to particular branches of industry. In Sweden, for instance, the employers and workers are represented on the Board of Education and so is the Labour Market Board. In France a network of technical committees participate in the setting of curricula which often form the subject of agreements with the representatives of the various industries. Similarly, in the USSR, both the vocational training and the technical education systems have extensive arrangements for consultation with industry on curricula, the approval of textbooks and other teaching material. However, the final decision normally rests with the central educational (or training) authority concerned.

This might be contrasted with the highly decentralized system existing in the United Kingdom where the technical colleges in principle are free to set their own curriculum but are largely guided by recommendations issued by professional bodies and by specialized bodies such as the City and Guilds of London Institute.

Outside the United Kingdom and the Commonwealth area professional bodies of a corporate character generally have little to say in the development of vocational and technician training and education. As entry requirements, syllabi and examinations are determined and controlled by government authorities - chiefly the ministries of labour (for vocational training) and education (for technical education in the school system), the role of professional organizations of this type is mostly limited to making suggestions or to submitting comments along with those of associations and federations representing the industry, trade unions and other organizations, before the decision is taken at the appropriate ministerial level. In the Federal Republic of Germany, and also to some extent in Austria, corporate bodies of another character, namely the chambers of industry and commerce and the chambers of artisan trades, play much the same role as the professional bodies in the United Kingdom. Until recent legislation the chambers of commerce and industry together with the Confederation of German Industries and the German Confederation of Employers had essential control over the vocational training programming and examination systems (although the relevant ministry had the right of final decision). This has, however, now changed and the state authorities have been given a more central role in these matters. The proposed new training legislation is likely to lead to a further increase in the control exercised by the public authorities over the training system and, at the same time, to a closer co-ordination between education and vocational training policies.

The Financial Framework

Generally speaking, the more centralized the system the larger is the par played in it by public financing. Technical education within the general school system is practically everywhere fully financed out of the state budget.

In federally organized countries the general rule is that it is the individual state "Land", province or canton which finances the educational system, often with some contributions from the federal authorities.

The same generally applies to the provision of related instruction for apprentices in countries where this is considered a separate form of secondary education, as for instance in the Federal Republic of Germany, the Netherlands and Switzerland. Similarly, the school element in co-operative education is considered part of the total educational pattern in Canada and the United States. In Eastern European countries all educational expenditure, including expenditure on vocational training, is charged to the state budget but an important share of the cost is also charged to the accounts of the undertakings which have special relations with a particular school.

Levy/grant systems can be said normally to contribute little to the operational budgets of institutions of vocational and technical education. Even in the United Kingdom where the technical colleges are the principal providers of courses paid for under the levy/grant system, income from such sources constitutes only a part and often an insignificant part of total expenditure. In France the revenues under the apprenticeship levy system go straight into the general budget and are not specifically accounted for in the technical education budget.

The situation is somewhat different in some of the Latin American countries where the whole financing of the vocational training system is based on levies in industry. Here, the training centres and the central services are entirely paid for by revenues from the undertakings under the levy systems. Other income received by the national bodies - in most instances an insignificant part of the total - usually is constituted of payment for services rendered or state appropriations for running particular programmes (e.g. for urban and rural poor) and other programmes not directly related to supplying the manpower required by the fee-paying industry.

Concluding Remarks

The foregoing pages merely provide a general and a much simplified sketch of what is a very complex subject. One thing is abundantly clear: technician training is not a single concept. It has many facets and therefore cannot be provided for by a single system. Consequently both the training and the technical education systems are needed in order to supply qualified personnel to perform the many types of function and multiplicity of tasks required of the technician.

To achieve a harmonious blending of the two systems one must first have a clear picture of their respective roles. The training system, with its emphasis on practical skills and employment, should operate within a broad framework of the promotion or upgrading of workers and of recurrent education and training. It is from this system that will emerge, by and large, the personnel with the highest level of skilled-worker qualifications, with industrial engineering skills, the basic qualifications needed in work study, applied methodology, organization and methods. From the technical education system, with its emphasis on theory as opposed to practical skills, will tend to be drawn the technicians who will eventually gravitate to the drafting offices, technical laboratories, design bureaux, testing and control offices, etc. The two streams of technician activity are inter-dependent, therefore the two systems of technician training must be complementary.

For each system to be truly the complement of the other, however, certain prerequisites have to be met.

Firstly, there should be a comprehensive training legislation encompassing the whole training function, and in particular, co-ordinated planning so that there will be a logical and easy flow between sectors or branches of activity and also between levels of training. A piecemeal approach is unlikely to bring about the desired results. There is therefore strong evidence of the need for an overall planning body which will be in a position to establish the necessary equilibrium and see that the system is inserted into a framework of recurrent education and training.

Secondly, the technical education system must also be given a clear-cut definition of roles and responsibilities. This, too, can usually best be provided through a sound legislative basis which should include a separate section relating to technicians.

Thirdly, there should be joint planning of the two systems, and effective co-ordination of them throughout the structure. This will require co-ordinating machinery which will include representation of all the parties concerned: education, vocational training, industry, agriculture, professional bodies, the unions, to name a few. This concept of partnership is particularly important in certain areas, for instance in the setting of training standards, in supervision of the quality of training, in determining the occupations for which formal training is required and in keeping training and school syllabuses up to date on technical developments, and on changing requirements in employment.

In this connection the attention of participants is drawn to the terms of the ILO's Convention and Recommendation concerning Vocational Guidance and Vocational Training in the Development of Human Resources which were adopted by the International Labour Conference in 1975. The Convention will come into force in July 1977. The scope of the Recommendation is much wider than that of the Commonwealth Seminar/Workshop on Technical Education and Industry but the organizational principles enunciated therein should provide the general framework for a harmonious development of technician training in both industrialized and developing countries all round the world.

PROJECT ONE

PRESENTATION OF LEAD PAPER 1 BY MR CAMPBELL AND SUMMARY REPORT OF PLENARY SESSION

In presenting the lead paper provided by the ILO, Mr Campbell asked that this should be taken as read, as he wished to make remarks of his own on topics not already covered by the paper. He first referred to the apparent confusion of terminology relating to various grades, for example, craftsmen, tradesmen, artisans and journeymen, and questioned what their relationship to technicians was. It had become increasingly recognized that there existed between the craftsman/tradesman and the technologist/engineer someone properly called a technician, who might also be a foreman or supervisor. In the case of the mining industry, he could also be a fireman, oversman, shift-boss, mine captain. Under whatever title, these men normally directed the work of the craftsmen/tradesmen, semi-skilled workers, operators and labourers.

The National Coal Board in the UK had, since 1954, a scheme of certification for mechanics and electricians of the mine, advanced mechanics and electricians of the mine, and unit or chief engineers. The mechanic of the mine was of craftsman level, the advanced mechanic of technician level, and the unit engineer invariably of professional or degree level.

The name 'technician' was not used much a few years ago except in laboratories. The mid-level man, or foreman/supervisor, was invariably a very competent tradesman/craftsman who was dedicated to his job, proficient in assembling and disassembling mechanical or electrical apparatus, and good at "trouble-shooting" because of his long practical experience. The NCB's "Codes and Rules" governing the installation, inspection and maintenance of certain mechanical and electrical apparatus such as winding engines, steam boilers, compressors, required that reliable men carried out these inspections, irrespective of whether their qualifications were informal or formal. Mr Campbell thought it a pity that a situation was arising that unless a person held a certificate, however low its academic standard, he was rated inferior even though he might be a very competent craftsman with long work experience and appreciation for his job, which might exceed that of the young, technically educated foreman or supervisor.

Mr Campbell drew the seminar's attention to the tri-partite structure of the ILO which had a bearing on vocational education and training. The ILO represented governments, employers, and workers' organizations, and these three parties should collaborate in establishing national plans, in devising schemes of certification and so on, so as to make training and educating for employment effective.

Technician level training raised questions that required careful thought, e.g., should it be terminal, or open-ended to allow persons to progress to be engineers? In one (non-Commonwealth) country problems had just arisen because students had recently demanded the upgrading of four technical institutes to engineer level. The national department of vocational education had requested the ILO to assist, and to train craft-based or industry-based instead of academic technicians. This was a delicate issue for both UNESCO and ILO.

Mr Campbell said he would be particularly interested in the findings of this seminar as he was working on a project document for a national department of vocational education. The project, which would attract international aid, was based on Modules of Employable Skill (MES), a concept which he fully supported.

Mr Campbell said he would like to add some thoughts on the subject of overall national planning and training in the planning area. He had attended a national seminar on "Needs and Priorities in Development Training and Research in Thailand" organized by the Asian Development Institute, and participants had made comments relevant to the present seminar such as: manpower planning was not an exact science in any country, consequently realism was difficult; economists were too dominant in planning, and there were often no technical specialists to evaluate projects; curricula must suit the real needs of the people; social, cultural, and economic differences between countries affected the transfer of ideas between countries; each country must therefore be selective about experiences of other countries unless properly adapted to its needs; ADI as an international body had resources which could help by comparative studies between countries. Among the conclusions of that seminar were that, at least in the field of planning, the trainers of trainers lacked work experience; training needed more follow-up and evaluation; and the private sector tended to be ignored - at the seminar one Fellow of the ADI was representing the private sector, but no other participant.

Mr Campbell said that, as a mechanical engineer by profession his work experience was mainly in the mining industry, in engineering education, and in technical and vocational training, in many different countries. He was not a national development planner, but had had to study national plans in order to determine training objectives. His experience had convinced him that more careful research was essential to planning; that National Plans should be rolling plans, reviewed annually as conditions changed; and that training effectiveness should not be judged on numbers passing through courses, but on the number who find relevant employment after training. He was also sure that, no matter how well a person was educated or trained, his ability to perform efficiently should be an important criterion for promotion, and that proven ability and work experience were vital when selecting planners in particular.

After thanking Mr Campbell, the Chairman invited preliminary questions and comments, and the following points were made:

Modular Systems

One delegate suggested that "Modules of Employable Skill" (MES) might not be suitable for small countries where the need was for general repairers, another that the system might not be applicable to training at the higher technician level, and another that it could be flexibly used for up-grading

skilled technicians, but not for training the school leaver. Mr Campbell expressed the view that MES could in most cases provide what the employer wanted; UNESCO had proposed borrowing MES for use in secondary education, and the system had been described as a complete package for all training. It was also thought useful for curriculum development, taking this process away from the instructor and placing it in the hands of specialists. Turning from MES to the credit unitary system, which was based on the same principles, Dr Legg pointed out that the latter was now well established in the UK and could certainly be employed for advanced technician training. (He enlarged on the relevance of this system in his Lead Paper 3, section 6, "A Systems Approach to the Technical Education Process").

Definition of a Technician

The view was expressed that the seminar (and the Commonwealth) need not accept the negative attitude adopted in the lead paper towards defining a technician. The important thing was that the roles that engineers and technicians had to play should be indicated by an identification of needs in each country. The view was also expressed that, since the technician level of work seemed to be generally understood by the seminar, not too much time should be spent in attempting to define a technician. It was agreed that, at least for the purpose of the seminar and probably more generally, the term "technician" should include the middle-level man and woman in commerce, agriculture, etc. Dr Legg pointed out that no amount of defining had yet removed certain obscurities; in some disciplines, like design, the relationship between a professional designer, a technician designer and a craftsman designer was by no means clear; and in spite of the establishment and the initial work of the Technician Education Council and the Business Education Council in the UK, there was still doubt about who was a technician.

Status of Technicians

More than one delegate felt that the registration of technicians and the establishment of national registration boards would make an important contribution to technician status and to technician education. It was generally agreed that the aim should be the creation of a socially identifiable group of technicians, with mobility into and out of technician level; provided there was greater consensus about technician standards, geographical mobility (e.g., within EEC or the Commonwealth) could also be enhanced.

Technical teachers

A delegate drew attention to the paramount importance of keeping technical teachers in teaching and not losing them to industry; the national bodies concerned ought to develop collaboration between technician education and industry in this matter.

Planning

Referring to the needs for overall planning and for the joint planning of the technical education and industrial training systems emphasized in the lead paper, delegates reported that some of the existing boards and councils did not have the necessary overall responsibility for thinking about numbers of technically trained people required in the various categories, or for guarding against their over-provision or under-provision. There was complete agreement that only a close partnership between industry, educational institutions and government could bring about the correct balance. The point was made that it was vital to determine levels of responsibility and to

forecast skill requirements so as to ensure that these were provided for by the training establishments; also that the lead time between planning for the training of technicians and their qualification needed to be taken into account. Finally it was emphasized that technicians had an important role in helping to evolve the development plans not only of industries but also of countries.

SUMMARY OF DISCUSSIONS

Discussions were held in group and plenary sessions and led to the Project One conclusions and recommendations set out on page 3.

The seminar noted the characteristic national frameworks discussed in the ILO paper, and noted in particular the conclusions of this paper that technician training was not a single concept but had many facets which called for a harmonious and complementary blending of the education system and the training system. Different countries had assigned different roles in the education and training process to their Ministries or Departments of Education and Labour. The division of jurisdiction between these two was seen as to some extent a British legacy but to some extent functionally inevitable, and the division between UNESCO and the ILO was evidence that it was generally accepted internationally. Mr Campbell had made the point that the ILO had a tripartite structure, being representative of governments, of employers and of employees, and the groups recognized in their discussions that these three interests should be taken into account at the national level.

Particular interest was shown in the national framework described in the Hong Kong country paper, and a Hong Kong delegate saw "the national framework" as simply a way of describing the sum total of responsibilities and expenditure on education and training shared between government on the one hand and industry on the other. If viewed in this light he suggested that "elements such as departmental responsibility, industrial training boards, levy and levy/grant systems are no more than expressions of the means of administering such responsibilities". There was general agreement that there could be no standard specification for industrial training boards or levy systems and there was not necessarily any reason, in some national circumstances, why they should exist at all; but their successes and failures, and the arguments for and against these elements of shared responsibility, were thought on the basis of evidence submitted in the country papers of Hong Kong, India and others, and the interesting paper submitted by New Zealand, to deserve separate study. It was felt that it might be possible, in time, to collect comparative studies of this kind into a worthwhile publication.

The groups concerned, and the seminar in plenary session, considered that legislation controlling industrial training was often inadequate and were agreed, from the different points of view from which they considered the question, that legislation was needed that had financial as well as regulatory and promotional purposes. They also took the view that apprenticeship as such was by no means out of date and that legislation should be enacted or extended to cover apprenticeship at the technician as well as the craft level. Differences between apprenticeship at the two levels would need to be recognised administratively; for example time spent on full-time education,

needed to a much greater extent at the technician level, should be counted; and the sponsoring of technician students, involving the payment of an allowance or stipend by the employer, probably constituted in most countries something of a problem for employers. Where this problem existed there must in the national interest be some means of offering incentives by governments. Several recommendations were formed and agreed on the basis of the discussion of these questions.

The role of Labour ministries or departments was generally recognized by groups as including the setting of "on-the-job" training standards and the supervision of on-the-job training in all sectors, as well as responsibility for legislation relating to industrial training. Nevertheless "standards" could not be conjured out of thin air, and here in particular the group concerned saw the need for the fullest consultation between Labour, Education, and employers' interests, as regards both standards and the content of the curriculum; and the group concerned felt that the development of new or existing professional bodies to promote the interests of technicians, as had happened in the UK, could play an important part in the setting of standards. These points were embodied in agreed conclusions.

All groups were agreed that every country should have a national body to co-ordinate technical education and industrial training, particularly at the technician level; though there were suggestions that this national body might cover training functions alone and leave formal technical education to the Ministry or Department of Education the general conclusion was that the national body should ideally be in function and in name a "Technical Education and Industrial Training Council". The group concerned recognized that the extent to which its edicts were mandatory and not merely advisory must inevitably depend on national circumstances and preferences, but felt that in some countries the existing national bodies did not have enough "teeth". Also in some countries they were not thought to be sufficiently broadly representative, and emphasis was placed on the representation of all legitimate interests - for governments, not only Education and Labour but major users such as Public Works; for industry, chambers of mines, industry and commerce, employers' federations or consultative associations, trade union councils and large single industrial enterprises; teaching staff, or their associations.

Reference was made to the recently established Technical Education Council and Business Education Council in the UK, because of their important place in the new British national framework for technical education and training and their contributions to training methods, particularly through the system of modules. Literature concerning these opportunities was made available; and the seminar would have an occasion to revert to the question of modular training under Project Three.

Manpower planning machinery came in for criticism and a number of different organizations were noted from some country papers; and from others, the lack of organization at all. It was felt that rigid positions taken up for or against manpower planning were often unrealistic; there must be at least some identification of manpower requirements and planning of ways and means of meeting them, but not over-planning. It was agreed that a greater responsibility lay on all employers in all sectors to make realistic projections of their future requirements; and that whether responsibility was vested in a Ministry of Labour, a Statistical Office, or the Central Government Planning Authority, there was a paramount need for manpower requirements to be ascertained and interpreted in terms of the educational provision

required. Only thus, the seminar agreed, was it possible to determine what courses should be run within a country and its educational institutions, and what courses run in other countries should be utilized to supplement them.

Finally the provision of a sufficient cadre of technical teachers was seen as an essential and all too often defective part of the national framework. The lack of interest in technical teaching in some countries was noted, and it was agreed that well-qualified technical teachers were sometimes quickly attracted away by better salaries and conditions of service in commerce or industry. No easy solutions were offered; the status of technician teachers was clearly bound up with the status of technicians and the seminar would return to this under Project Three.

PROJECT TWO

LEAD PAPER

TECHNICIAN EDUCATION AND TRAINING: A SHARED RESPONSIBILITY OF INDUSTRY AND TECHNICAL INSTITUTIONS

Dr L.S. Chandrakant
Director, Colombo Plan Staff College for Technician Education, Singapore

Many scholarly reports have been written on Technical Education and Industry Co-operation. Many national, regional and international conferences have been held on this subject; and all of them have produced extensive recommendations on why and how to promote such co-operation. The education archives of all countries are replete with the reports. I would therefore not like to add to the available literature merely to repeat what has been said before.

After all is said and done, so much has been said, but so little done! Why is this problem still dogging us? What crucial factors have been overlooked and are therefore acting as a barrier between technical institutions and industry- What must be done to remove the barrier and how? Who should take the lead?

It is to these issues that I will address myself in this paper and develop the thesis that the concept of "co-operation" is a weak one and should be replaced by the strong concept of "shared responsibility" to demand of both technical institutions and industry a joint effort towards human resource development. I go further and argue for a state policy in all countries, which spells out the complementary roles of institutions and industry and how they should play their respective roles.

In all of this and more, I will confine myself to the education and training of technicians, although much of what I have to say will apply equally to technologists and skilled workers.

The reason for addressing myself specifically to technicians is that of all areas of technical education, the education and training of technicians is the most crucial, but most misunderstood. It is also the most mismanaged because of the conflicting attitudes and approaches between technical institutions and industry. My concept of shared responsibility is best applicable to this area.

At the outset, the term co-operation used as a label or slogan appears to reveal and explain. Actually, like other catchall phrases, it conceals and confuses. The term implies existence of conflicts, cross purposes and rivalry which can only be resolved by the parties concerned agreeing to work together in their common interest. It has also overtones of equality among the parties. None of these is true where technical institutions and industry are involved, particularly in developing countries. Each has grown into a separate system

propelled by its own internal dynamics and with no interaction with the other. Although the concern of one is to train and supply usable manpower and that of the other to get trained manpower, develop it and profitably utilise it, the gap is lack of acceptance of this common objective by both systems and joint responsibility to achieve the objective.

Historical Background

This is the crux of my argument. Historically, in developed countries industry started first with the application of technology to the production of goods and services needed by society. Industry recruited young persons with some general education, trained them on the job as apprentices, and employed them. As technology advanced, industry needed not merely workers with operative manual skills which they could apply on machines and other equipment; it needed the workers to be equipped with a wide range of scientific and technical knowledge with which they could cope with complex problems of design, production and construction. It is in response to this need that technical institutions came into being and started offering part-time, day release, block release courses to persons working in industry. Thus a whole system of apprenticeship and technical education developed with a close matching up of the roles of industry and technical institutions. As technology advanced on a broad front, a new stimulus was given to research and development which in turn added new dimensions to technical education over the years. In this process, the interdependence of technical institutions and industry was established.

In the so-called developing countries, industry and technical education took totally different courses in their development. Technical education came first as an integral part of the educational systems of the countries. Industry came next as a result of totally different forces. Most of those countries were for many long years colonies and the colonial rulers introduced what is known now as public education to provide the people with an access to western civilisation and culture on the one hand, and on the other, to induct the colonial people into administration. In course of time, education came to be identified with access to government employment, but since government employment was limited to clerical and other white-collar jobs, the colonial powers introduced vocational and technical courses into the educational systems so that boys and girls might acquire useful skills for gainful employment outside government sectors. Industrial activity was limited to the processing of raw materials for overseas markets, mainly with the help of expatriate capital, know-how and technical personnel. Entrepreneurs used local labour for unskilled or semi-skilled work.

All this may be history, but the point is that from the beginning there was hardly any connection between technical education and industry in developing countries, and each took its own course for manpower development. Although much has since changed in all those countries and both industry and technical education have made significant progress, the historical gap still persists. In essence, the gap is that industry does not have any stake in the educative processes of the manpower that it needs. It has been merely a consumer of the products of the educational system, has stood outside the system, at times as a critic and at other times as a disinterested spectator. The educational system has identified itself exclusively with social services and become more responsive to social demands than to industry's manpower needs. Hence the criticism of industry that technical institutions are not producing the correct types of engineers and technicians useful in design, construction, production and similar activities; and the counter-argument of institutions that industry expects too much of them to the exclusion of its own

responsibility. The vicious circle must be broken by bringing them together to understand each other and work together towards a common goal.

The process must start with determination of the common goals in precise terms and identification of the methods and means of reaching them. To examine these problems with reference to technicians and develop the thesis of shared responsibility:

Planning of Technician Education

Who is a Technician?

Definitions are difficult, because we do not know for certain whether to relate a technician to his educational qualification or to his functions in specific occupations. There is no unique relationship between education and occupation. The First Commonwealth Education Conference in 1959 gave the following definitions:

Technologist	:	a person holding a degree or equivalent professional qualification in science or engineering, who is responsible for the application of scientific knowledge and method to industry
Technician	:	a person qualified by specialist technical education and practical training to work under the general direction of a technologist
Craftsman	:	normally a person who has served a recognised apprenticeship and who applies his skills on the shop floor.

The Commonwealth Conference definitions of a technologist and technician are mainly in terms of their educational qualifications. But educational qualifications are vague indicators, because there are no universally accepted standards of education at any level. Also, in these definitions there is no indication of the level and content of the educational preparation of technologists and technicians and how they are related to their respective professional functions.

Another Commonwealth Conference on the Education and Training of Technicians held at Huddersfield in October 1966 came to the following conclusion:

> "The Conference quite deliberately rejected the temptation to attach a specific clear-cut meaning to the term 'technician' and accepted the impossibility of finding an acceptable definition which would cover the whole range of industry and commerce. It was recognised that, throughout the whole range of industry 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 when planning educational and training programmes, but the whole band does represent a unique and distinguishable group of people who, whatever their specific functions, can be broadly classified as technicians."

Many other agencies, committees and commissions have also attempted definitions of a technician. Typical of such definitions is the one adopted by the Haslegrave Committee (1969) of the United Kingdom:

> "Technicians and other technical supporting staff occupy a position between that of the qualified scientist, engineer or technologist on the one hand, and the skilled foreman or craftsman or operative on the other. Their education and specialised skills enable them to exercise technical judgement. By this is meant an understanding, by reference to general principles, of the reasons for and the purposes of their work, rather than a reliance solely on established practices or accumulated skills."

Unfortunately, these and other definitions do not help us much to understand who a technician is and what his functions are. The definitions are too general, give merely an educational identity and locate a place for him in the manpower spectrum between a technologist and a skilled worker.

How does industry view a technician? Totally differently, because industry rarely uses this expression and identifies him with reference to a wide range of functions associated with an equally wide range of job titles. For instance, in industry's view, a technician is one who carries out one or more of the following functions:

> applying known technology to field operations in production and construction; testing and development; installing and running engineering plant; drafting and designing products; estimating cost; selling and advising customers on the use of engineering and scientific equipment; liaison between engineer and skilled worker to interpret plans and designs, determination of production and construction techniques; choosing tools and machines best suited to each job; supervising skilled workers; and assisting engineers in design offices, laboratories, etc.

It is evident that educationists' definition of technician and that of industry are not congruent. The former equates a technician with a mere academic course in an institution and the latter categorizes him according to his functions, but there is no matching up of the course with the expected functions. Hence, the oft repeated complaint of industry about the unsuitability of the products of technician institutions.

Therefore, the first area of shared responsibility of technician institutions and industry is to identify the technician, delineate his precise functions in industry, determine the knowledge, skills and competencies needed to perform the functions, and design courses of education and training which will best serve the purpose. This demands an activity analysis of technician occupations in industry:

> (a) To know where technicians work: the different departments of an industrial organization where technicians are employed, as for example:
>
> > Commerce: departments whose work is directed outwards to the supplier and customer.
> >
> > Research, Design and Development: departments engaged in technical work which leads up to the decision to produce on a commercial scale.

Production: departments whose work ranges from the point of decision to produce up to the stage of the finished product.

Services: departments whose work supports two or more of the above.

This survey gives us distribution of technicians by their functional classification and by their job titles. From this we will also know the main areas of work of technicians and the type of jobs done by them.

(b) To study what technicians do in their jobs i.e. the work content of their jobs in each functional area, which can be rationally grouped. As for instance:

- **Communications**
  - (1) Written Communications - reports, correspondence, etc.
  - (2) Written Communications - quotations, specifications, schedules, etc.
  - (3) Verbal Communications - liaison with customers, answering queries, etc.
  - (4) Drawing
- **Design**
  - (5) Design of components, circuits, tests, etc.
- **Organizing Work**
  - (6) Planning, Control, Programming
  - (7) Appraisal, Evaluation of Company Practices, etc.
  - (8) Purchasing, Stock Control, Materials Ordering
- **Diagnosis**
  - (9) Measuring, Testing, Inspecting, Work Study
  - (10) Fault Finding, Diagnosis
- **Practical Work**
  - (11) Servicing, Maintenance, Installation
  - (12) Assembling, Manufacturing Operations
- **Supervision of Other Staff**
  - (13) Supervision
  - (14) General Administration

(c) To prepare on the basis of (a) and (b) above on activity profile of technicians which will give a three-dimensional matrix of technicians by their functional classification activity composition and relative proportions of their activity categories.

Technician functions constitute a broad spectrum. At one end of the spectrum are near-professional functions which demand of the technician a sound broad-based knowledge of the chosen engineering field and the ability to apply that knowledge to the day-to-day practical problems of design, construction or production in industry. At the other end are technicians who are required to have a mastery of manual or manipulative skills of the craftsman type with the relevant knowledge of engineering to control and supervise production operations on the shop floor. In between are technicians who are required to have different proportions of professional engineering knowledge and practical skills, depending upon their precise functions in industry. Their education and training must therefore aim at equipping them for those functions. In the last analysis each technician course must have its own integrity.

Therefore, it is only when technical institutions and industry jointly carry out an activity analysis of technicians on the above lines, form clusters of technician occupations according to well-defined common characteristics, and determine for each cluster the type of technical professional knowledge, skills and competencies needed that a coherent system of technician education may be evolved. Only then will it also be possible for technical institutions to define correctly the objectives of their technician courses to guide all the other components of the system, especially the curriculum and its design. The technician curriculum thus designed should equip a technician to the following:

(a) Apply basic principles, concepts, and laws of science relevant to his field of speciality.

(b) Apply mathematics as a tool in the development, definition or quantification of scientific development according to the requirements of his speciality.

(c) Perform specialized services required in relation to materials, processes, equipment, procedures, methods and techniques.

(d) Investigate technical problems using scientific method of inquiry and observation.

(e) Establish an effective rapport with other professional and non-professional workers within his field of speciality.

(f) Transmit and receive facts, ideas and data objectively through oral, graphic and written communication.

Technician courses thus planned must, however, have a broad educational character and not merely be to serve the immediate or here-and-now purpose of technician functions. We must remember that we are educating a technician for a minimum of thirty-year professional life. During that period, technology will advance, the nature of technician functions may change, and a technician may be required to adjust and adapt himself to wholly new circumstances. The technician whom we train today must therefore be equipped intellectually to cope with a future that we can only dimly visualize. He must be capable of transferring his knowledge from known to unknown situations with confidence. All this and more implies that technician curriculum must have a futuristic approach too.

Technician Curriculum Implementation

The next phase of shared responsibility of technical institutions and industry is in the implementation of the technician curriculum. This is a logical sequel to activity analysis and curriculum design processes discussed earlier.

A coherent system of technician education is a process which must take place partly in a technical institution and partly in industry. The business of a technical institution is to give the prospective technician a sound broad-based knowledge in the theory of his chosen field. With this he should be able to understand the basic principles of design, construction and production. He should be able to communicate his ideas to the expert and to the skilled worker. The curriculum must develop knowledge and mould attitudes to the highest level of proficiency. This education has to be cross-fertilized with practical experience in industry so that the technician-trainee is familar with working methods and skills relevant to his own field. He has to be made to observe and understand how engineering principles are translated into processes. He has to be as expert on the job in industry as he is expert in the underlying scientific knowledge that has to be applied in the job.

To co-ordinate theory with practice, to relate technical knowledge with work in industry, and to elaborate the complementary functions of technical institutions and industry - all this is the heart of the problem of technician education.

It is therefore no longer a question of just any kind of training or practical experience in industry, but of a joint effort by industry and technical institutions to design and provide that kind of practical experience which is relevant to a technician curriculum and promotes the initial growth of a prospective technician in real life situations. The basis for designing practical training should therefore be the technician activity analysis which has been carried out in consultation with industry.

The technician curricula designed on the basis of activity analysis will reflect the types of technicians needed by a country, depending upon the nature of industrial activity in that country, pattern of employment of technicians and technology level. Therefore, the nature and scope of practical training will vary according to each technician curriculum, but the following principles must guide each programme:

Induction: to acquaint a student with industrial environment and give him an understanding of the structure of industry, including the role of a technician. He must be made aware of the importance of industrial training to his professional development.

Training in Basic Skills: following preparatory training in the workshops of technical institutions or in industry, the student must be equipped with the knowledge and skills in various production operations and processes employed on the shop floor or construction techniques in the field. He should also get adequate experience of the techniques employed in the shaping of materials towards the final product. This involves an understanding of materials and their properties, production functions, time, cost, and method.

Engineering Practice: this part of the training should be in the field of speciality of the student, with particular reference to the main functions of a technician in that field. It should cover design-drafting, estimating and costing,

production/construction techniques including choice of tools and machines for a job, testing, installing and running of engineering plant, and supervision.

During this phase of training, the student should get acquainted with the working of the organization as a whole, including sources of capital and raw materials, production, sales, installation and servicing of the finished product etc. Finally, depending upon the time available and towards the end of the training, it would be a good thing to assign to each student or a group of students a project centred round the functions of a technician. The problem for the project must be suggested by industry from live situations and must demand of students' application of their knowledge and experience concerning design, drafting or production or construction or installation of plant, and testing.

The relevance of the training programme to technician curriculum must be further established by laying down:

(a) Training Specifications in behavioural terms: i.e. what types of knowledge, skills and competencies are aimed to be acquired by a trainee.

(b) Training Methods: i.e. with whom or under whose guidance a trainee will work, what procedures he will follow, what records of work he will keep etc.

(c) Training Examples: which will explain the actual jobs or work which a trainee will carry out.

All this and more implies that for each group of industry a training board consisting of representatives of industry, technical institutions and training officers should be set up to design the training programmes and oversee their implementation. The programme should have a built-in system of evaluation of training on the basis of which both technical institutions and industry may evaluate the total curriculum in actual operation and make the necessary improvements on a continuing basis.

Apprenticeship and Sandwich Courses

A variety of methods is practicable for the education and training of technicians in an integrated manner between technical institutions and industry. The most effective of the methods are:

(a) Apprenticeship in industry along with block or day release courses in technical institutions.

(b) Sandwich courses or co-operative courses.

Apprenticeship is one of the oldest social institution and although over the centuries it has undergone many fundamental changes, it has remained the main source of skilled manpower for industry. In almost all industrially advanced countries, a national framework has been evolved for the organization and administration of apprenticeship. Within the national framework, legislative provisions or administrative instructions regulate training in apprenticeship by laying down detailed job descriptions, training programmes and examination standards for each trade. These regulations too are being revised and elaborated on a continuing basis to ensure improvement in skill competency in the light of changing technological needs. In addition, in most countries, the central training authorities concerned also provide to industry

detailed training manuals, audio-visual aids and other training materials which are developed through extensive pedagogical research.

Apprenticeship is not confined to the training of skilled workers either in concept or in practice. The system is extended to the training of all other manpower formations in industry. Thus, the system includes, in addition to craftsmen, apprentices, student apprentices, technician apprentices, graduate apprentices and management apprentices. In Britain, under the Industrial Training Act, 1964, the Engineering Industry Training Board has on the basis of technician job analysis prepared model training programmes for technician apprentices. The training programmes consist of:

> Basic Training: Off-the-job training to prepare potential technician apprentices, particularly for the planning and diagnostic skills.
>
> General Training: to develop the abilities required by technicians and to impart the background knowledge and understanding of industrial practice essential to their first posts of responsibility and to their subsequent career development. The training includes Design Appreciation, Manufacturing Practice and Communication.
>
> Objective Training: to develop expertise in a particular technician function on the basis of identification of skill and knowledge requirements either of a specific job or of a family of related jobs.

All technician apprentices also start off on a complementary further education course on block release or day release basis, first to a Technician Certificate and later to Higher Technician Certificate or Diploma, depending upon their areas of specialisation.

Unfortunately, in most developing countries there is no organized system of apprenticeship to secure an adequate quantity and quality of training within industry. This is the cardinal weakness responsible for inadequate development of technical education and training in those countries. It is evident therefore that unless as a matter of state policy apprenticeship is made an integral part of manpower planning and development and industry enjoined to discharge this responsibility for its own survival, no worthwhile progress is possible. Appropriate legislation along with the setting up of industrial training boards, one for each group of industry, which must function in close co-ordination with technical institutions, is urgently needed.

The alternative route to technician education and training is Sandwich Courses which designedly integrate classroom learning with actual work experience in industry or in the professional field into a single educational process. The integrated process establishes for a student the meaningfulness of what he studies in his institution through appropriate experiences while on the job. It goes further: it develops a student's ability to increase his range of ideas in response to a much wider variety of questions and settings.

As a Joint Working Party of the Committee of Vice-Chancellors and Principals, the Committee of Directors of Polytechnics, the Association of Colleges of Further and Higher Education and the Confederation of British Industry has noted on the basis of actual experience of sandwich courses in Britain:

"The main virtue of the sandwich course is that it not only trains students at an early stage in professional skills and responsibilitieis by giving them the opportunity of relating their academic work to practical situations, but it also enables them to work in a mixed age group, in a multi-disciplinary environment and under different pressures from those encountered in educational institutions. It provides the opportunity to develop an understanding of human relationships at work, together with the appreciation of the social, economic and administrative considerations which influence industrial and commercial activities .... One of the most important indirect benefits of the sandwich course system is that it creates a bridge between education and the working environment. The links established for this purpose between educational institutions and industry and commerce often benefit each partner in the exercise by helping to achieve a better understanding of each other's objectives and role in society."

It must be emphasized that sandwich courses do not mean just working in industry. Nor is it intended to train an engineer or technician for a specific job in a particular organization. Sandwich courses are integrated education, with the college and industry providing the means in an industrial situation.

It is axiomatic that the success of sandwich courses depends upon close and meaningful partnership between technical institutions and industry. Both must share the same objectives of sandwich courses and agree to implement the programme as partners in the same enterprise, each complementing the role of the other. This demands interaction between the faculty of technical institutions and experts in industry on a continuing basis.

In structuring sandwich courses, co-ordination between theory and practice is of supreme importance, but it can be achieved only step by step through the joint efforts of academic and industrial experts. The former must agree that good education is not mere learning, but that it is knowledge applied to work. Practical experience in live situations leads a student to the same educational goals as classroom instruction. The faculty of institutions conducting sandwich courses must therefore accept practical work in industry as an important part of the learning process. It must be substituted partly for classroom work in which theory and practice need to be taught as an integrated whole, to demonstrate engineering analysis and synthesis. Likewise, experts in industry must agree to the essentially educational goals of sandwich courses which are reached only when a student is equipped with the knowledge and skills needed not merely for the here-and-now productive work in an organization, but to meet the challenges of new and unfamiliar situations yet to come.

Many patterns of sandwich courses are possible. "Thick sandwiches" require a student to spend a long period in industry between periods of college work. A typical example in Britain is the 2-1-1 system, in which industrial experience occupies a third year between two academic segments. In other patterns called the "Thin sandwich" shorter periods of industrial work alternative with periods of college study. For example, in a four-year course a student alternatively spends six months in college and six months in industry. There is also to be found the system of alternative weeks for college study and for industrial work. There is therefore no ideal pattern for sandwich courses. Each institution must devise its own way of integrating academic studies with practical training in consultation with its counterpart industry.

The importance of industrial training must be reflected in the efforts made to assess the performance of students during industrial periods. Written reports by tutors and industrial firms are one method of assessment. Other methods like oral examinations and continuous assessment must be tried, on the one hand to ensure fulfilment of the educational objectives of sandwich courses and, on the other, to have some measure of a student's attainment in his industrial work. All this assessment must also provide a means of feedback to improve the training programme and to define course objectives in operational terms.

Sandwich courses can be either institution-based or industry-based, depending upon who selects students. In the former, technical institutions select students and place them in industry for training; in the latter, industry selects and sends them to institutions for studies, in addition to providing the necessary training. In both cases, the whole programme of training and studies is jointly developed by industry and technical institutions.

Because of their integrated nature sandwich courses are longer in duration than conventional courses, but the advantages far outweight any objections to duration. It is, however, important that sandwich course students should be paid stipends at least for periods when they work in industry. For instance, in India, when sandwich courses were introduced some years ago, an incentive was built into the system in the form of stipends during industrial training and the entire expenditure on the stipends was borne by the Government. Later, the Indian Apprentice Act 1962 was designedly amended to legitimize industry's responsibility for sandwich courses. Industry is now required to bear fifty per cent of the cost of stipends, in addition to bearing the entire cost of training.

As an example of how conventional technician courses could be reorganized into more useful sandwich courses, a sandwich course jointly developed and implemented by an Indian polytechnic and industry is given at the end of the paper. In this example, the conventional course is three years long and wholly institution-based for the diploma in mechanical engineering. The reorganized sandwich course is three and a half years long and includes one full year of practical work in industry which is provided in three instalments: the first of three months sandwiched between two academic sessions of the second year; the second of another three months during the long summer vacation; and the last phase of six months sandwiched between the last two academic sessions of the course. The nature and scope of practical training in industry is also given in the example.

Conclusion

In this paper I have taken the stand that technician education and training as a means of human resource development of a country is a shared responsibility of technical institutions and industry. Both technical institutions and industry must discharge the responsibility in unison, first by identifying who a technician is, where he works and what he does; next, by determining from activity analysis what types of knowledge-skills mixes are needed for different clusters of technician occupations and developing appropriate curricular offerings; and finally, by implementing the curricula in close co-ordination either in the form of apprenticeship with complementary block release or day release courses or in the form of sandwich courses. To co-ordinate theory with practice, to relate technical knowledge with work in industry and to elaborate the complementary functions of technical institutions and industry - all this is the heart of the problem of technician education.

The problem of educating the engineer is similar and I would argue for the same concept of shared responsibility between engineering colleges and industry and methodological approaches to designing and implementing engineering curricula. Here, cross-fertilization between engineering colleges and industry must extend to research and design-development areas too to equip prospective engineers with higher-level ability and creativity on the one hand, and on the other, to push up the technology level of the economy of a country.

My point is that the education and training of engineers and technicians is a total effort in which the responsibility of technical institutions and industry must be clearly identified, delineated and directed within a national system.

Sandwich Course: Content of Practical Work in Industry

MCM Polytechnic, Avadi, Madra, is conducting diploma courses in mechanical and electrical engineering on the sandwich pattern. The courses are three and a half years long and include twelve months of practical training in industry. The programme of training is divided into three phases: three months, three months and six months. The first phase is sandwiched between two academic sessions of the second year course and the next phase is again sandwiched between the last two academic sessions. The broad outlines of the training programme are as shown below:

Mechanical Engineering

(Elective: Automobile Engineering)

First Phase:	Introduction: Nature of work done in different shops. Job Specifications for the trainees - what the trainees are expected to do. Understanding shop drawings. Study of different machining processes in different sections of the factory as specified, preferably on lathes, drilling, milling and shaping machines and also on turret and capstan lathes.
Second Phase:	Tool room work. Machine tool maintenance. Working on automatic lathes and general purpose machines. Drawing office work. Production-planning work.
Third Phase:	Planning work. Production processes. Plant layout. Materials control. Costing techniques; work study. Analysis of existing designs of components manufactured. Preparation of standard drawings for components supplied. Testing components using various gauges and instruments. Servicing of materials handling equipment. Servicing and maintenance of industrial engines.

Electrical Engineering

(Elective: Electrical Machines)

First Phase:	Introduction to the nature of electrical work in different sections of the factory. Work specification for the trainees: What work is expected of the trainees. Practice in fitting, welding, drilling, grinding, turning and other lathe work.
Second Phase:	Studying drawings of electrical layout and distribution systems in the factory. Maintenance and overhauling of electrical equipment in various shops, e.g. motors used for rolling mills, furnaces, cranes etc. Maintenance of batteries.
Third Phase:	Work planning. Layout of electrical plants. Materials control. Costing techniques: work study. Overhauling and servicing of electrical equipment. Materials handling equipment and control systems. Electrical plants in the factory including equipment in sub-stations.

PROJECT TWO

PRESENTATION OF LEAD PAPER 2 BY DR CHANDRAKANT AND SUMMARY REPORT OF PLENARY SESSION

In presenting his lead paper, Dr Chandrakant thanked the Commonwealth Secretariat for inviting him to the seminar and for providing him with an opportunity to share his experiences in the area of technician education and industrial co-operation. Through conferences, the Commonwealth Secretariat had brought together distinguished educationists to cross-fertilize ideas and experiences, to present newly-acquired perspectives and to point new directions. The Huddersfield Conference of 1966 was in his view an important landmark in technician education and training, because it was the first to be concerned in depth with planning and developing technician education systems in relation to other socio-economic needs. An important sequel to the Conference was the book (circulated to delegates) under the authorship of Mr MacLennan. Dr Chandrakant considered that, in the entire Commonwealth literature on technical education and training, this was the most comprehensive book, and gave the best appreciation of the complexity and magnitude of the problem of technician education development. The Huddersfield Conference also underscored the importance of co-operation between education and industry. It was appropriate that this Regional Seminar was specifically devoted to the subject.

Dr Chandrakant emphasized that a technician's education and training and the development of his professional competence was a process which must take place partly in an institution and partly in industry. The institution must equip him with basic knowledge in the fundamental sciences, mathematics, and technology appropriate to his specialization. This education must be cross-fertilized with experience of industry, because only then would he understand how theory was translated into practice, how the practical aspects of design, construction, production, etc. were applied to industrial situations. Therefore education and training must be integrated, and it was no more possible to make clear-cut distinction between education and training than to say how cold was hot water or how hot was cold water. To co-ordinate theory with practice and to elaborate the complementary functions of educational institutions and industry was the heart of the problem of technician education; therefore technical manpower development, whether one thought of engineers, of technicians or of skilled workers, was a shared responsibility of technical institutions and industry.

In his lead paper Dr Chandrakant had preferred "shared responsibility" to the weak word "co-operation". Unless national policy reflected this shared responsibility, many of the problems of providing education and training in the right quantity and quality would persist.

He therefore put forward six axioms:

(a) Technician education and training must be relevant to employment in industry, commerce and other sectors of the economic life of a country. It must fulfil the employer's aspirations for trained manpower.

(b) As technology advances, the technician must be capable of adapting himself to new situations and his education must equip him with the knowledge and skills needed to help him meet new challenges.

(c) Technician education systems must provide for the further education of working technicians to enable them to advance in their profession, and continuously determine what additional knowledge and skills are needed for their purpose.

(d) Technician education is part of both the social and economic systems and as such is influenced by a complex of social and economic factors. It must be responsive to the attitudes, values and work styles of future technicians so that they become useful and productive members of the community.

(e) The interaction of technician education with the economic system implies partnership responsibility within industry and institutions so that curricula, teaching/learning processes and methodological approaches are vitalized continuously.

(f) All forms of technical education and training are expensive because of the heavy investments involved in buildings, equipment and running expenditure. The resources of a country must be optimized.

In the context of these six axioms, Dr Chandrakant found much of relevance in the education systems of all the 21 Colombo Plan countries. All were aware of the importance of mid-level manpower groups and all were establishing and developing their own systems of technician education and training. Their general characteristics were that all technician education was at the tertiary level after 10, 11, 12 or even 13 years of school education, depending upon the elementary and secondary structure; and that, by and large, the courses were full-time, of two to four years' duration. Curricula embraced the whole range of engineering and technological subjects such as civil engineering, mechanical, electrical, electronic, textiles, chemical, there were also some curricula offerings in the narrower fields of e.g. building construction technology, automotive mechanics, electrical communications. Differing levels of curricula were recognized in some systems, with engineering technician, higher and lower level technician courses, etc. The curricula were a mix of knowledge and skills; in the so-called industrial technician courses, there was a larger proportion of the manual, manipulative, or operational skills. In the higher technician or engineering technician courses, the theoretical part of technology and the sciences predominated. Most systems were wholly institution-based, but Singapore and Hong Kong for example made some provision for part-time and block-release courses; and by and large they were for persons with a secondary education. A last important characteristic was that very few systems provided for the further education of working technicians.

The present systems in Dr Chandrakant's opinion had grown more in response to social forces than as a direct response to industry's needs for technical manpower. The systems therefore did not clearly identify the technician occupations to which the curricular offerings were addressed or the education and training these technicians required to meet the needs of industry. As a result, the precise objectives of the curricula in terms of subjects and topics were not clearly defined. A syllabus only indicated the topic headings to be covered, the subjects to be taught, the number of hours to be spent on each subject, both theory and practical. A syllabus did not answer the questions "Why do I teach this subject; at what level should I teach; what is the eventual outcome of this teaching in terms of employment?" Consequent concern was about the employability of the products of the system. He was aware of the very serious criticism by industry in many countries he had visited, including his own, that the products were not employable. Unfortunately, industry had remained merely as a critic and consumer of the products of the system, with no valid stake in their education and training. This was where shared responsibility between educational institutions and industry started. Three questions should be asked:

Who is a technician?

Where does he work?

What does he do?

There were enough definitions of a technician to be confusing, including those of the Huddersfield Conference, which he had had the honour to attend. These definitions placed the technician somewhere between a technologist and a skilled worker but went no further. The more important thing was to know how industry used a technician. Industrialists said that the word technician was rarely used in industry, as did Mr MacLennan's book. Industry looked upon a technician in terms of his functions; the job he did, where he worked, and what he did. Only a re-examination of education's definition of a technician and industry's understanding could bridge this gap between industry and education. In his lead paper he made a strong plea for a scientific, methodological approach to identifying technicians and determining what they did, and he had labelled this "Activity Analysis". This was the first joint responsibility of industry and technical institutions.

Dr Chandrakant explained Activity Analysis by reference to examples from the electrical and mechanical engineering industries. In these examples, technicians could be identified at work in four major functional areas:

One functional area where technicians were employed was those departments of an organization whose work was directed outwards to the suppliers and customers; departments concerned with commerce.

The second functional area was research, design and development - departments engaged in technical work leading up to decisions to produce on a commercial scale.

The third functional area was production, in departments whose work ranged from the point of the decision to produce to the stage of the finished product.

The fourth functional area was departments which provided services or supported the activities of one or more of the above departments.

Dr Chandrakant next illustrated, by chart, how to understand what technicians did in their jobs in these functional areas. His paper broke down the jobs into six groups and gave examples of sub-groups. The broad groups were communications, design, organizing work, diagnosis, practical work, and supervision of other staff. Further analysis should make possible a three-dimensional matrix or profile of technicians in industry by their functional classification, and by their work content in different functional areas. Dr Chandrakant could not see how a technician education and training programme could be developed. At one end of a broad spectrum the technician's functions were nearer the professional engineer's; more concerned with design, design drafting analysis and other types of what might be called higher technician duties and responsibilities. At the other end, there were technicians doing work like a craftsman's, but at a slightly higher level and with a better understanding of the skills involved. In between there were technicians with different mixes of knowledge and skill.

This picture could be elaborated by an activity analysis, which only industry and institutions together could carry out, to provide much-needed information for curriculum design. From the analysis, curriculum designers should be able to develop an understanding of the problems and to decide the broad content of the curriculum; what kind of mathematics and science needed to be taught and at what level; the precise objectives of teaching the subject; what type of educational theory, what type of technology and at what level; what technology practice, and what other general education subjects to develop communication, supervisory and management skills. The intention of this kind of analysis was to get the basic information needed to structure the curriculum by aggregating a large number of closely related technician occupations. Whether the technician went to work in a department of commerce, production, or design, Dr Chandrakant knew from experience that it was possible to aggregate the technician occupations on the basis of activity analysis; there was no implication that technicians were to be produced in this manner for a particular job in a particular organization.

The next stage of shared responsibility or partnership between industry and institutions was in the implementation of curricula. Because a going system of technician education and training was a process which would take place partly in an institution and partly in industry, curricula must be designed jointly. The practical work to be integrated with education in institutions was not just any kind of practical work, not any kind of training; it must have definite objectives, be part of a well-designed programme, and be supervised. His lead paper outlined some of the general principles to guide the designing of practical training programmes in industry. There must start with a period of induction when the aspiring technician was exposed to the industrial scene to understand how industry operated, its climate, community, and other conditions. A second component was training in the basic skills relating to production operation and use of tools, machines, and related aspects. To his mind, it made no difference whether these basic skills were given in separate training centres of industry or in workshops attached to institutions. This depended on the conditions of training in each country; but there must always be a well-designed programme of basic training before a technician trainee was sent for on-the-job training.

Dr Chandrakant thought the most significant improvement in apprenticeship schemes was the realization that basic training must be given away from the production shop; against the old concept of apprenticeship, of "sitting next to Nellie", when Nellie knew nothing, or you learned the bad things that Nellie knew. Basic skills development must take place under supervision as an education process in separate shops. The engineering practice, that is

the actual application of these skills on the job, on the shop floor, in departments, was the last stage of any apprenticeship programme. The country papers had shown that almost all countries had one form or other of apprenticeship, but few had extended apprenticeship to technicians. He realised that in some of the systems, students in institution-based education were required to put in six months to one year of practical work in industry; but unfortunately such training was not supervised, nor part of a well-designed programme, nor intimately related to the education element. Boys coming into industry became mere shop-walkers, gaining no really worthwhile experience. All this implied further aspects of partnership between institutions and industry. Industry and institutions together must lay down the training specifications in behavioural terms. Most training programmes did not do this; the trainer in industry, like the teacher in an institution, did not know the precise objectives. The specification should be accompanied by information about with whom or under whose guidance a trainee would work; what procedures he would follow; and by some training examples. Unless this kind of apprenticeship material complemented the institutions' curricular documents, the integration of theory and practice would not be realised.

Dr Chandrakant referred to the interesting Haslegrave Report on the education and training of technicians in Britain, where under the diversified systems of technician examinations run by various authorities, there was lack of coherence between courses. This Report called for some rationalization of the technician education programmes in Britain in line with the programmes of the Industrial Training Boards. This was again bringing industry and education together not merely on a conceptual plane, but over practical methods of working together.

Sandwich courses were not the domain of industry; they were as much education as the education given in institutions. To him, the question was exploiting the resources of industry so that industry and institutions combined to provide the type of education and training that a prospective technician required. There were different forms of sandwich course, thick ones, thin ones, medium ones. In his own experiences in India, there were 320 polytechnics and the constant complaint of industry was that the products of these polytechnics completing full-time three-year courses were not employable. Those arguments went back and forth, and a basis of understanding could not be formed, except through sandwich courses. According to his own survey of the results of the sandwich courses, they were not acceptable to industry in terms of the kind of technicians they needed.

Dr Chandrakant then returned to his last axiom, relating to the economics of education. Since education, including technical education, was regarded as a part of the social system, there was a limit to which a government could provide the means for the education and training of technicians. Educational costs were going up, including teachers' salaries and the costs of equipment. Unless ways and means could be found to minimize costs, countries would be unable to afford better-developed systems because of their additional financial burden.

Dr Chandrakant's paper, having dealt with activity analysis, work content, the knowledge/skill mix, and the types and levels of technicians required, had moved on to the stage of clustering technicians' occupations, which he thought very important. He had then identified the main technician specialities. Then came the planning of the technician education system itself; specifying its objectives; determining the course duration; specifying the entry requirements. Then the curriculum design part of the system, curriculum objectives, subject objectives, behavioural aspects, specifying

the training objectives, training specification, schedules of training, sequence matrix. Dr Chandrakant added that there must be a continuous feedback both from the institutions and industry to indicate where the total system needed to be modified or improved; and the role of industry was as important as any other in evaluating both the student's performance and the interaction between the many elements involved.

After thanking Dr Chandrakant, the Chairman invited preliminary questions and comments, and the following points were made:

Partnership

More than one delegate reported a lack of response in his own country to approaches made by education to industry, and one delegate said that the willingness of industry to make its contribution to a partnership was minimal. Dr Chandrakant said that he had encountered this problem, but thought that sufficient goodwill could sometimes be generated among a few small industries for a break-through to be achieved. Direct contact on practical matters was important. Asked to define the term "common goal", he said that educational objectives were usually expressed in terms of educational standards, but it was important to have a clearer definition of what a technician was to do; industry needed technicians with a well-defined technical content, and this definition of industry's requirements was the common goal.

The partnership as it existed in Hong Kong was described by a Hong Kong representative. He said there were many committees under the Hong Kong Training Council, and its industrialist members spent much time in attending meetings during normal office hours. Industry did not on the whole favour the imposition of a general levy but there was a levy system operating in two industries. The generally accepted view in Hong Kong was that technical education was the responsibility of the Government and in-plant training the responsibility of industry. Some industrialists wanted government to subsidize apprenticeship training, but this was unacceptable to government. In certain industries some units were too small to have their own training programmes; the garment industry (the largest in Hong Kong) had established its own vocational training centre for the training of garment workers, and a levy was imposed on the industry. The construction industry was the other industry with its own levy system. Partnership was, in short, reasonably well-developed in Hong Kong.

Representation of Industry at the Seminar

The same delegate asked why industry was not more widely represented at the seminar. He and others regretted that the delegates were nearly all drawn from technical education, and the voice of industry was therefore not heard on many issues that closely affected it.

Mr B.F.C. Fong said that the Commonwealth Secretariat would very much like to have seen more industrialists participating, but governments had nominated a great preponderance of delegates from education (though it should be remembered that quite a few of these had previous experience in industry). The point would be borne in mind for any similar occasions in the future.

Correspondence Education

In reply to a question about the use of correspondence education for technicians, Dr Chandrakant said that he had no experience of correspondence courses but could see definite advantages in their use. The experience of the Open University in Britain led him to believe that new media like television, radio and programmed learning had tremendous potential at technician education level. In New Zealand and Australia a substantial part of technician education was through the medium of correspondence, sometimes allied with other media. Correspondence courses were certainly as not as narrow as they used to be and there was no doubt that they had a part to play.

Apprenticeship for Technicians

The plenary session was told that one of the seminar's groups had already reached the point of recommending that apprenticeship should be extended to technicians and not confined to craftsmen.

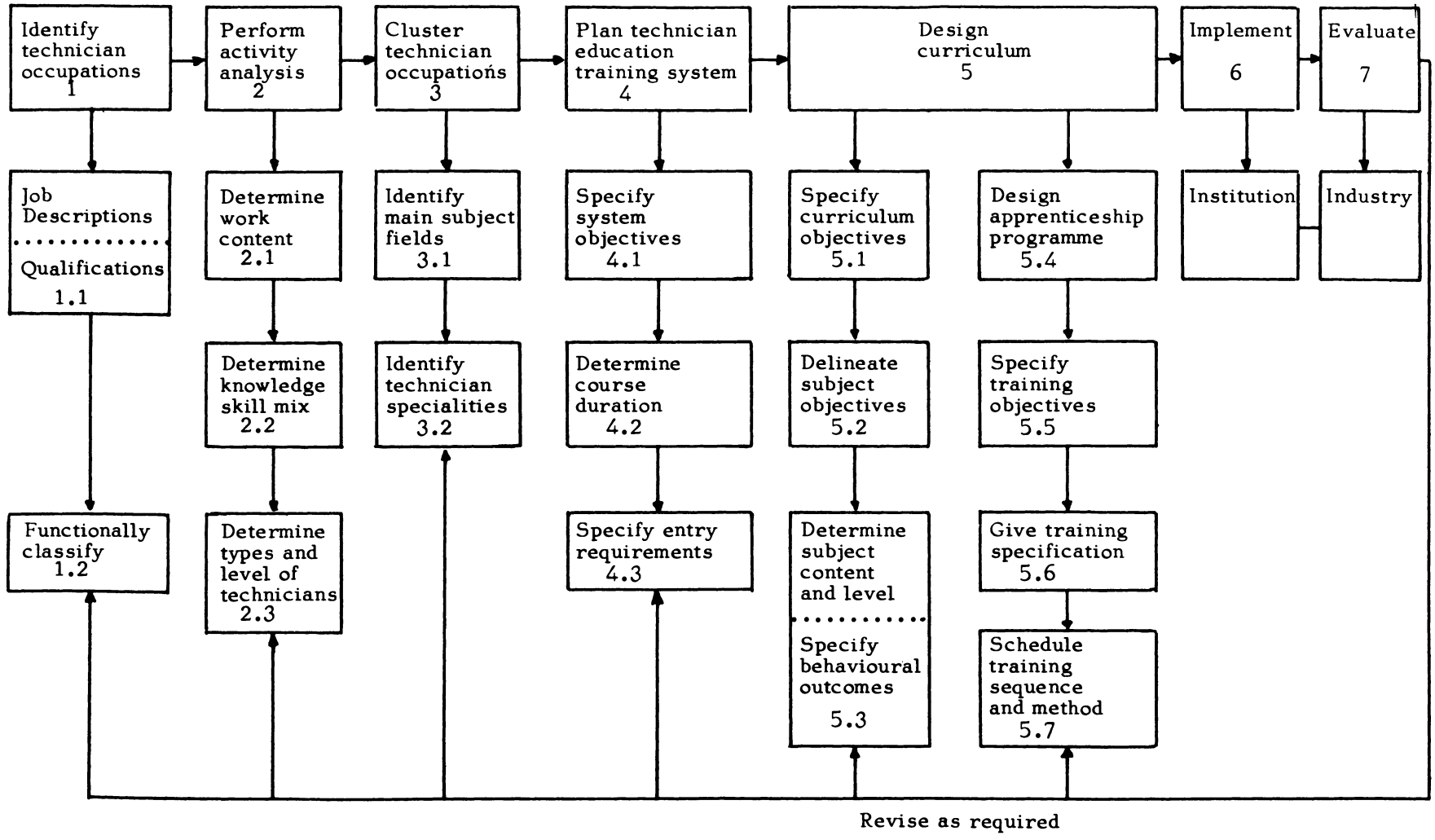
Further Education and Training

In reply to a question, Dr Chandrakant said that providing further courses for trained technicians who could not return for more education posed certain problems, but these could be overcome. The feeling that current education and training programmes were a dead-end sometimes created pressure from students to upgrade courses to degree level; but this upgrading should only arise from actual development needs of a country's system. It was important that the national system should provide further education both for student technicians and for qualified technicians, to help them to higher qualifications.

Sandwich Courses

Asked about constraints that operated against organizing courses on a sandwich basis, Dr Chandrakant said that in India sandwich courses had been introduced to combat criticism from industry, and the system as implemented there involved the employment of additional teachers because some had to accompany the student in industry. Another problem was that sandwich courses were of longer duration than full-time courses, and sandwich course students did not have long summer holidays. A delegate added that the location of educational institutions vis-à-vis industries was also an important consideration. Dr Legg said that his 13 years' experience at Loughborough, a pioneer of sandwich training, caused him to sound a word of caution. The lack of sufficient places for trainees was a constraint, and there came a stage when the institutions could not go on approaching industry. If industry could not accept all trainees, and if sandwich-type course became considered as an integral part of an education system, institutions would have to introduce some quasi-industrial practical training within the institutions themselves.

FLOW CHART FOR TECHNICIAN EDUCATION PLANNING & IMPLEMENTATION



SUMMARY OF DISCUSSIONS

Discussions were held in group and plenary sessions and led to the Project Two conclusions and recommendations set out on page 5.

The groups discussed the topics set out in the "seminar contents", and also selected points from the comprehensive exposition given by Dr Chandrakant in his lead paper and in his address presenting it to the seminar. They concentrated on practical methods of effecting a direct partnership between technical education and industry, in the first place in devising and providing integrated programmes of education and training for technicians. The general view was that the educational element should not normally be provided through full-time courses, but it was appreciated that geographical and industrial conditions sometimes made this necessary. A learning process which was 100% institution-based was not considered the best preparation, practically or psychologically, for technician employment in industry. Instead, delegates favoured sandwich and block release courses in which there was a real parallelism between the academic content and the content of practical training in industry. Day release and evening courses were not thought to be suitable for technician education; the latter in particular made too much demand on the young person after a day's work. Nevertheless, it was accepted that such courses if well devised were suitable for up-grading and up-dating purposes, and often the only practicable way of meeting them.

Much attention was paid to the emphasis placed by Dr Chandrakant on the need to ensure that the period in industry was carefully structured and closely supervised by a training officer who should himself be trained, qualified, and experienced. This implied a responsibility on management to provide the necessary facilities, with its financial implications; and a responsibility on government, in partnership with industry, to make public provision for the training of training officers. This could often be carried out in a technical teacher training college or department; although the roles and training needs of the technical teacher and the industrial training officer were different, they had a common concern with the teaching and learning processes and with other pedagogical aspects, and in some countries training colleges and departments were successfully training both categories. The seminar agreed upon recommendations on these lines.

The role of the training officer was considered in detail by the group concerned, which felt strongly that this role should not be confined to devising and operating training schedules and maintaining standards, but should include a more generalized function of liaison with technical institutions, with ministries or department of labour, and with secondary schools. In this last role the training officer should visit the schools and offer career guidance and advice on further education and training opportunities. This was endorsed by the seminar in plenary session.

Groups were often critical of the inadequacies of advisory committees and governing bodies whose composition did not include representatives of all the interests which ought to have a say in what is taught, and how, to whom, for what purposes, and at whose expense it is taught, in the technical institutions and their departments. One group went into the question of the role of advisory committeees in some depth, and its suggestions were also endorsed in plenary session. This role included a responsibility for ensuring that courses were relevant and well put together, and that priority was given to categories for which there was the greatest general need.

There were no agreed conclusions about the best methods of testing the standards reached by technician students. One group had looked at the level of entry into typical courses and considered that the three main educational requirements were successful completion of a course of secondary education with a technical bias, including the attainment of good standards in the language - medium of instruction in the country's technician institutions, in mathematics, and in a relevant science subject. Continuous assessment was called for, both of theoretical knowledge and of practical training; a modular construction for courses was favoured by some, though a few thought that modules, while suitable at the craft level and for technician up-grading purposes, were not suitable for technician courses generally; but recognised that the credit unitary system was finding favour in UK polytechnics and in the Hong Kong Polytechnic. There was general agreement that final examinations for technicians were needed, in the interests of all concerned. Most delegates reported that their countries were moving away from overseas examinations to locally-set examinations which had a more detailed relevance to their requirements. But the point was made that in many branches of technology requirements were of universal validity, and little modification to the content of syllabuses and examinations that had been found right in developed countries was needed. There were merits on other grounds in having national and/or institutional examinations and awards, and it was often appropriate to adopt or adapt the syllabuses and examination of the overseas examining bodies. It was noted that some of these bodies gave their active co-operation to the transfer of examining responsibilities into local hands and provided training in the theory and techniques of examining. The main objective was agreed to be the relevance of examinations to the real needs of a country, and the seminar recommended accordingly.

No-one thought there was enough coming and going between technical education and industry, and it was agreed that visits in both directions could stimulate partnership at all levels. Company directors for example could both provide and derive support through visits to technical institutions, and the principals or directors of those institutions through visits to industry; there were many things for both sides to observe, to give and take, and to decide. Similarly teachers at all levels must visit industry to keep in touch and up to date with its policies and practices and technologies, and technicians working in industry can provide background and detailed information to students and teachers alike.

Such visiting could extend to longer periods, of say three weeks, during which a teacher might do a job in industry, and vice versa. It was agreed that the cross-fertilization that could be achieved in this way should be strongly encouraged. But the seminar was also emphatic that the process of providing the technical teacher, and particularly the technician teacher, with industrial background and experience should start much earlier; that no initial course of technical teacher education was complete without periods

of both practical training and practical experience in industry; and that this experience should be renewed from time to time throughout a teacher's working career. Indeed, his career prospects should be advanced in this way. Groups were convinced that technical education and industry had a joint role in staff development that was not sufficiently widely appreciated. Industry also had an additional role that it could play with advantage to both sides, and that was the provision of part-time teachers. This would help to ensure that teaching was relevant to what was going on in industry at the particular time, and to bring students closer to the world of work. Part-time courses for part-time teachers should be provided where possible.

Emphasis was placed on the responsibility of industry for providing opportunities for the further education of a technician. Purposes served would include the up-dating of his knowledge and skill; the diversification of his field of training, and its extension into supervisory and managerial functions; and occasionally the up-grading of his qualification. Delegates also considered that industry should co-operate in the provision of opportunities for continuing education, whether to provide a broader understanding of the industrial background or of a more general nature.

PROJECT THREE

LEAD PAPER

TECHNICAL EDUCATION IN AN INDUSTRIALIZING SOCIETY

Dr Keith Legg
Director, Hong Kong Polytechnic

The previous two projects have dealt with partnership between technical educational institutions and industry, commerce and other bodies. They have been concerned with national framework, division of responsibility, and co-operation and co-ordination in the education and training process for industry, especially at the technician level.

This paper is concerned with Project Three and considers technical education in an industrializing society. It is tempting to commence with a series of definitions; however, suffice to state that technical, which derives from the Greek work "techne" meaning arts, crafts and skills, is intended here to cover a very broad subject spectrum from science and engineering to commerce, design and economics. Secondly, "industrializing society" implies a developing situation from a base which can vary from the primitive to the relatively sophisticated. Thus it is an essentially synamic process and is usually accompanied by inadequate resources.

The paper covers the various significant elements of the topic theme in four groups although in many instances they are interdependent. It also inevitably touches on aspects dealt with in the other two projects. Finally, the subject matter is effectively brought together through a concentration on a systems approach to technical education and the importance of the planning function.

The objective is to promote free-ranging discussion in the hope that it will lead to new approaches, and appropriate action, to what are, by now, rather "old" problems.

INDUSTRY AND THE INDIVIDUAL

The needs of industry and individual choice

The needs of industry and individual choice in technical education usually provide a dichotomy for most countries and must depend upon the provision of the resources that are possible and the particular circumstances of the country concerned. From the industrial viewpoint this emphasizes the need for reliable manpower forecasting. Even though this is notoriously difficult, it is essential, since only by experience can it be improved. A good approach on

provision for technical education is to provide for the estimated manpower requirements as a minimum and to provide as much more as resources will allow. Some over-provision in this way is wise house-keeping since manpower forecasts usually underestimate and distribution across industries can be wrong. Within this more flexible approach individuals have a choice but it is limited by the number of places available in the various subject areas. This emphasizes the need for careful selection which includes suitability for the type of work as well as academic attainment. However it is often argued that social preference for the individual should be completely unrestrained. Many would agree that this is a desirable aim but it must depend upon the resources available to the particular country. Highly developed and economically successful countries can do this as demonstrated in the U.S.A. but in industrializing countries the situation is different. They tend to lie between two extremes - the schools either produce large numbers, creating a high demand for relatively few places in tertiary education, or they produce too few even to satisfy the minimum tertiary requirements for industry and commerce. Industrialization depends upon adequate financial provision, especially capital, and the availability of suitable manpower. Thus the provision of education is inevitably tied to economic progress and the major necessity is to endeavour to balance the two as far as possible. It would seem that developing countries tend to move from one to the other of the two extremes mentioned above since the more general education of the schools usually takes educational precedence. Much can be done however to introduce appropriate curricula and training in the schools on the technical side so that termination from the schools provides suitable qualifications for entering industry and commerce. All of these considerations emphasize the need to choose a flexible and integrated system of education at all levels, from school to university, which optimizes educational effectiveness and cost efficiency. Much can be done here if education is looked at as a whole rather than in isolated sectors of primary, secondary and tertiary.

Status, remuneration and job satisfaction

Having linked educational opportunity to the rate of industrialization this raises the question of status and job satisfaction. One of the major problems in the provision of technical education relates to the distribution of study levels, i.e. craft, technician and technologist or graduate. There is no doubt that the greatest need in industry is for technicians and yet this group enjoys the least status. Craft has been recognized for its innate skills since the early ages and graduates enjoy their university status and professional recognition. The function of technicians, however, is not generally recognized by the public at large (nor by some industrialists) and there has been a general lack of professional and academic recognition from the professional institutes. This has led to a lack of career structure and relatively poor remuneration. The need here is for a nationally recognized qualified service, e.g. a Technician Registration Board. This could be linked to special councils such as those now developing in the U.K. through the Technician Education and Business Education Councils (T.E.C. and B.E.C.). Furthermore, to refer back to the two extremes of individual demand and the availability of places in tertiary education: when demand exceeds availability there is a strong tendency (often backed by social pressure) to admit the most academically able irrespective of terminal study level. This produces individual frustration and dissatisfaction on two counts. First, the more academically able find themselves over-qualified for the job they eventually find themselves in. Secondly, the less academically able are not given an equal opportunity in jobs in which they would be satisfied. Naturally industry does not like this state of affairs either, and it also induces a tendency for educational institutions to up-grade their work prematurely. The painful but equitable solution here is

a quota system of entry in which ability is matched to the level of the terminal qualification. At the other extreme, where availability exceeds demand there is the dangerous tendency to produce "all generals and no non-commissioned officers".

The scale of industry and small industries

Turning now to the influence of the scale and size of industry and commerce. Large industries generally have good training programmes and support educational programmes for full-time, part-time and evening study. They are inclined, however, to under-utilize their educated and trained personnel, and this leads to frustration and dissatisfaction. Much depends on their growth rate, both in terms of size and the degree of developing sophistication. Fortunately large concerns in developing countries tend to grow and hence create more opportunities especially for the younger personnel. The situation is compounded by the fact that sufficient technicians, especially advanced technicians, are either not available or their value and capabilities have not been recognized. At the other end of the scale small firms generally develop through entrepreneurs, many of whom have themselves had little relevant education and training. In such firms the balance between success and failure can be very fine. Thus their tendency is not to appreciate the value of education and training and hence not to support it. It must also be admitted that educators often lack a real appreciation of the small firm and the ethics of making such a business successful. Even if the appreciation is there, or is forced upon them through the need to improve standards or for greater sophistication, their support is often limited by financial considerations. This means that some aid must come from government and other agencies. An encouraging sign in this respect is that some large companies, either through their need for the products of small firms or in the national interest (or both), are prepared to train more than their requirements to provide a source of supply to the small firms.

However, the overall industrial stability of a country depends to a large extent on the distribution of size and scale of companies, and it is here that the medium-sized firms play a significant role. Medium-sized firms are notoriously lacking in developing countries where the pattern tends to be a few large firms (often related to public utilities) and a plethora of small firms. This clearly also influences the education and training situation, and especially the very important training element. In these circumstances it is essential that technical educators be well experienced in their subject professions as well as good academic teachers. An essential aspect of their work must be to get out into industry and encourage participation in training and the provision of time off for academic study. Furthermore a large responsibility for the training function (or a good part of it) must rest with the educational institutions. This can be accomplished by the creation of Industrial Training Centres within the institution. The Hong Kong Polytechnic has such a centre which offers training at all levels in engineering drawing, workshop technology and engineering practice and manufacture. Such centres can also include a limited manufacturing unit and a variety of end-product training appropriate to the differing technologies. They provide a focal point for close co-operation with industry, especially in the development of sandwich courses which otherwise could not materialize due to lack of suitable training facilities in the industries themselves.

The development of the individual

Reverting to the "individual", reference has already been made to educational opportunity but what of the individual's development within the system? There is always a danger in technical education, because of the great emphasis placed on the needs of industry and commerce, that education and training programmes over-emphasize the vocational element - sometimes to the exclusion of all else! This tendency is compounded where the programmes lead to the sitting of external examinations, e.g. for professional institution recognition. Such programmes intrinsically also tend to emphasize the academic rather than the practical aspects. Thus it is essential that the objectives of technical education institutions should specifically include meeting the needs of the community and the individual student as well as those of industry and commerce. Indeed all of these, industry, commerce, community and the individual, are interdependent and must be taken into account in formulating the work of technical education institutions. The aim is not to produce automatons but people who can think for themselves and who are equipped to be good citizens and capable of enjoying the cultural aspects of life. These elements are not inconsistent with vocationally oriented programmes but are often excluded or given scant attention. Specialization, in itself, is certainly necessary - especially in an environment of increasing sophistication. However, it is probably true that most educational institutions tend to over-specialize particularly at the secondary and tertiary levels.

General studies

This leads on to the subject of general studies. Much emphasis is currently being placed on so-called liberal studies which, presumably, are intended to liberalize the student. In many instances this has been effected in an uncoordinated way with the result that its relevance, interest and value to the student, or to industry, commerce and the community, is highly questionable. The main objective of general studies must be to complement and contrast those relevant studies constituting the principle subject areas of the complete programme. In fact "complementary and contrasting studies" is probably the best general term to use. Such studies must achieve a balance to meet the needs of industry, commerce, the community and the individual, hence close consultation with all of these parties is necessary, especially as the studies will vary considerably according to specific main subject areas. To achieve this an appropriate institutional mechanism and organization is required. This matter is sufficiently important to demand a fair share of an institution's resources - it must not be skimped. One approach is the setting up of an interdisciplinary institute or centre to provide this service, using specially recruited permanent staff together with appropriate staff expertise right across the educational institution. Such a centre could also assume the responsibility of adult education (including leisure activity) and the briging together of students and members of the public in common study. This latter is particularly important in the lessening of elitism that often arises from those privileged to undertake tertiary education, however humble their origins. This centre approach could be extended to a region covering several institutions and employing strategically placed sub-centres - thereby effecting a substantial economy and a wide-ranging core of expertise. But the willingness of institutions to collaborate is notoriously lacking and some degree of outside persuasion may be necessary.

Re-education and continuing education

Having advocated the need for more general education - how is it all to be packed into a programme? This raises the question whether it is necessary to pack in as much as tends to be thought necessary. There is much that is never, or seldom, used in later life. Furthermore much of what is used can be out of date by the time it is actually used. This raises the problems of continuing education and re-education. The arguments here have been well documented and generally relate to spreading education and training over a longer period, even a life span, in an environment of rapidly advancing technology, techniques and social development (including increased leisure). The need can be assumed and the major problems relate to the provision of resources and organization. An obvious approach is for shorter initial periods of education and training with additional periods of continuing education or re-education later. This requires very careful planning because of the problem of packing programmes and because key people from industry cannot be released easily - especially for periods greater than a few weeks, or for several days a week for a few months. It therefore makes sense to link the whole educational process with part-time and evening work. In any case these latter are vital in developing countries. They provide opportunity for those not able to gain full-time education places and, even more significantly, for very able students whose family circumstances force them to take employment where time-off for study is not available. This in itself requires a sound organization of part-time and evening work covering a full range of study levels closely linked to the full-time programmes. It is therefore logical and economic to extend this organization to encompass the continuing education and re-education work which, in fact, the Hong Kong Polytechnic will be implementing. If the work is well done, as it must be, and meets the needs of industry, then a greater proportion of the cost must be borne by industry. This would be reflected in two ways, increased fees and an increased industrial staff establishment to facilitate the periods away. However, additional government support would also be required especially in times of economic recession. This is clearly an area for action by Industrial Training Councils and Boards where they exist.

It is important to emphasize here the need for good library facilities, both static and mobile. This not only applies to books and learning resources of all kinds but also to the provision of substantial study places. Adequate housing is a particularly severe problem in countries whose societies are industrializing and home conditions are often not conducive to study. It is also important to ensure that student contact hours are not so great that such facilities are insufficiently effective.

Scholarship policy and other opportunities

In the context of the last few paragraphs it is relevant to raise the question of scholarships and other opportunities. Present scholarship schemes are largely out-dated and need re-thinking. Often the financial reward is insufficient and much depends on the level of educational grant awarded by the government authorities. If the government award is small or by a loan system then more might be done to create greater scholarship opportunity. Incentive is important here, and one possibility is to introduce a scheme of senior students tutoring junior ones on the promise of an eventual scholarship. The experience would be invaluable to the students and the scheme economical to run. Unfortunately scholarships and other opportunities are often ill planned (if planned at all) and, all too often, not relevant to the needs of industry and commerce. They tend to concentrate on the academic rather than the practical and professional aspects. Much can be done within one's home country - indeed

it is essential to understand the home scene. However this must not be exclusive, since it is necessary to know "how the rest of the world does things" and to adapt these, where appropriate, to the specific situation at home. In educational institutions it is particularly important to provide such opportunities for staff of all kinds, to avoid the "ivory tower" syndrome. Adequate allowance for this should be made in institutional budgets (10% - 15% of the total professional staff cost is a general figure to aim at).

Finally reference must be made to the care needed in the selection procedure. Pure academic ability must not be the sole criterion, although it happens all too often. Equal weighting must be given to the "need and desire to know", the relevance of the experience to the individual and the personal qualities of the candidate.

THE SPECIAL NEEDS

Relevance to needs of the economy, environment and safety

I turn now to the more specialized needs in technical education arising from an industrializing society. Firstly it is necessary to consider some aspects of economy related to industrializing societies. It is certainly extremely important but very difficult to strike the correct balance between capital intensive and labour intensive activity. This is greatly influenced by the relation between internal consumption and exports. The general trend is to move from labour to capital intensiveness because of the tendency for cheap labour to become less cheap. Cheap labour, if employed successfully, leads to economic gain which in turn provides greater affuence and a higher standard of living. The resulting less cheap labour demands greater product standards and sophistication if market competitiveness is to be retained or improved. In general this process needs to be accompanied by some outside aid - finance, resources and manpower expertise, i.e. a transfer from those who have to those who have not. There is a limit to this however and the gap between the two is widening. The limitation concerns the nature of human beings and their actions. For example there are those who argue that the resources of the space programme would have been better used for the benefit of the "have nots". This neglects the fact that even if the space programme had not come about the equivalent resources would almost certainly not have been used in this way. This is no particular indictment - it is simple a realistic appraisal of human action as it happens in our world at the present time. Thus the corollary is that aid must be accompanied by a high degree of self-help, i.e. for self-generated technology. This requires an ability to optimize resources and manpower. These are some of the factors often contained in references to "appropriate" or "relevant" technology. They emphasize the economic limits within which industrializing societies have to develop and therefore clearly emphasize the difficulties of finding the resources to educate and train. However, the economic factors of this kind do not complete the needs. The consequences of these factors on standards and the environment, including safety aspects, must be included. These latter are areas where there is the greatest divergence between satisfying the needs and what is actually contained, or not contained, in educational and training programmes. They are much neglected even though many isolated elements concerning them may be taught. Increasing industrial sophistication demands better standards in design, manufacture, handling, materials control, testing, inspection and safety - the latter both to the employee and to the product consumer. Equally industrialization brings in its train a host of environmental problems such as excessive noise, air and water pollution, waste of all kinds (especially water and materials), odious smells and deteriorating urban environments. They present a severe threat to health and "the good life", as Plato saw it.

Interdisciplinary activity

All of these standards, environmental and safety aspects must be considered in the industrial development cycle, by companies large or small. Relevant education and training are essential - both for those directly concerned with the development and those on the receiving end, i.e. the public. The educational need here is to bring the separate elements together into cohesive broad areas of study through interdisciplinary institutes, schools or centres which function in close co-operation with industry, government agencies and public bodies. A possible institutional organization for such interdisciplinary units is shown in Diagram 10. This indicates a normal structure of divisions and departments on which is superimposed a secondary interdisciplinary unit structure. These units are largely autonomous with their own permanent staff. They include associated staff from relevant departments and are linked for their academic validation process through the Academic Board, Divisional Board or a department according to their size and the primary nature of their broad subject areas. They have strong advisory committees with considerable relevant membership from outside the institution. It will be seen that this approach provides a good ambience for providing the right kind of education and training meeting the standards, safety and environmental needs that influence good economic decision. Hopefully it will also encourage social benefit to be weighted realistically with cost.

Self-employment

A further area of growing need relates to the education and training for the self-employed. This largely refers to the distributive trades and concerns, usually very small businesses. Examples are shop-keeping, garages and agencies of various kinds. Deficiencies of education and training in these areas have been brought clearly into focus through the developing trade organizations, distributive boards and training councils. They pose a special set of problems requiring new approaches in management, marketing, sales, etc., combined with more specific subject areas relating to the particular trade. The field is wide open for development and presents considerable potential for the exploitation of "in-plant" courses, either separately or in groups. The practice of staff going out into the working environment to teach and instruct is attractive and usually effective and could be employed much more frequently than it is. It could be encouraged by linking it organizationally with the part-time and evening work institutional structure.

Special training needs of females

Finally there is the essential but difficult need to cater for education and training of the female sex. Much depends here on custom and tradition and the breaking down of social barriers. It also depends on the degree of shortfall of required manpower and, perhaps, on the prevalence of "women's lib". In general, institutions concerned with technical education do all they can to encourage female students, though the same cannot always be said for female staff. But they are usually forced to concentrate on specific subject areas known to be popular, e.g. commerce, accountancy, languages, social work, domestic science, etc. Tradition dies hard, as does prejudice, and the main avenue of advance here seems to lie with the schools and, perhaps, equality in opportunity, salary and conditions through national legislation.

DEVELOPING APPROPRIATE SUBJECT AREAS

Subject areas of growing importance - The Asian and Pacific scene

So far this paper has been more concerned with general principles. This section becomes more specific and is related to such questions as the subject areas of growing importance especially in the Asian and Pacific context. There is of course no single answer to this, and one of the objectives of the workshop is to consider and opine on it. The Asian and Pacific group of countries varies widely in area, population, geography, natural resources and state of development. Many countries are highly agricultural, and in them many small industries have emerged, or are emerging, some of which are growing rapidly. Others, like Hong Kong, have few or no natural resources, possess a very dense population and depend upon successful international business and industrial export for their survival. In these circumstances it is clearly impossible to present one set of appropriate subject areas. However, in order to provide a basis for group discussion, Diagram 13 provides a classification of areas of interest in Hong Kong. They are classified in terms of broad subject divisions and interdisciplinary activity and therefore exemplify the principles put forward in earlier parts of the paper. The asterisks attached to certain subject areas signify joint activity moving across divisional/departmental boundaries, and the number of these clearly demonstrates the need to avoid isolation of subjects within departmental compartments. Clearly, developing areas in the fields of agriculture, fisheries and forestry need to be added for the Asian and Pacific scene. They are, in fact, of significance in Hong Kong and the subject of current discussion.

Levels of study

Perhaps of more significance is the estimate of the distribution of levels of study of these developing subject areas together with those already established. A preliminary estimate for Hong Kong suggests about 15% for technologist/graduate level, 45% at higher technician level and 40% at ordinary technician level. This again emphasizes, but in numerical proportion, the importance of technician manpower in industrializing societies.

Appropriate technology

Reference to Diagram 13 also reveals a number of areas which have been highly developed in the industrially advanced countries, e.g. press tools, food technology, instrumentation and testing. Appropriate technology was mentioned earlier and an important aspect of this is the transfer of technology. A recent definition of this by the Hong Kong Polytechnic is:

> "Technology transfer means the dissemination of technological know-how and information (in terms of product design, production techniques, management systems, etc.) from advanced countries to developing countries, and from established large enterprises to small ones."

Clearly this definition places significant responsibility on the educational process and this in turn requires educational establishments to employ experts in relevant subject areas both from within and outside a country.

The leading and supporting roles of technical education

New subject areas or those involving transfer must obviously be planned on a realistic time-scale of national development. Not all countries, industrialized or otherwise, are good at planning. When educationalists ask industry what

subjects they require, they are, more often than not, told of today's requirements rather than tomorrow's. Yet failure to provide suitably qualified people in new relevant areas of development brings coals of fire on the heads of the educationists - they are not doing their job properly. Closer co-ordination will obviously improve this situation but the most effective measures are to ensure that education staff spend more time in industry and hence get for themselves a feel for future needs, and that the institutional structure and organization of education and training programmes is sufficiently flexible to rapidly accommodate changing needs. It is, therefore, evident that institutions must take the initiative in playing a leading role in technical education and, hence, in industrial advance. At the same time they must ensure that adequate support is given to existing and developing short-term acvitivies.

A SYSTEMS APPROACH TO THE TECHNICAL EDUCATION PROCESS

This paper has now ranged briefly over the items incorporated into Project Three of the workshop, and ended on a note of flexibility. This word flexibility has recurred in many of the points made and should be the key password in education; unfortunately, it is all too often the opposite. In order to demonstrate the potential advantage of flexibility and, at the same time, pull together a few of the elements contained in this paper it is appropriate to refer to a systems approach to the technical education process. Since this is an approach adopted by the Hong Kong Polytechnic in its recent development plan, use will be made of its findings. Thus, to proceed systematically a set of educational objectives is defined as follows:

(a) To provide an integrated and effective education and training at an economic cost to meet the needs of commerce, industry, the community and the individual.

(b) To ensure maximum flexibility in course programmes and ease of transfer between appropriate and different levels of study.

(c) To give emphasis to part-time and evening programmes.

(d) To develop appropriate methods of learning.

(e) To encourage an ability to communicate effectively and to think critically and creatively.

(f) To create attitudes of rational judgement and the ability to make use of and apply knowledge.

(g) To encourage relevant consultancy and applied research.

(h) To co-operate closely with industry, commerce and professional bodies.

These objectives are relatively general but when they are aimed at the developing technology situation they lead to quite different approaches. The primary purpose must be to prepare students to adopt attitudes conducive to an industrializing society.

The next step is to define the system best suited to satisfying the objectives. At the heart of this is the learning process. At the outset it must be recognized that a large proportion of students in further education in developing countries have a high ability potential which has not been realized because financial limitations have prevented the provision of full educational

opportunity. This makes a self-learning approach an attractive proposition and, together with the need for flexibility, transferability and amenability to change, provides the base for a systems approach to learning. This can be achieved by the use of credit units of study which can be combined in different ways to provide complete programmes of study. This needs to be supported by considerable use of educational technology (programmed texts, audio-visual aids, closed circuit television, and, possibly, the computer) so that most of the lecturer's time can be devoted to small groups or even individual tutorials. In this way self-learning is complemented by a strong tutorial mode.

The need for breadth of study can be achieved by creating institutes or centres in relevant comprehensive areas of study which cut across the conventional departmental boundaries as already outlined. Combined with the unitary method this provides a powerful structure to facilitate the development of new areas of study very quickly. Thus specialization can be added to breadth as the technological need arises - and the demand satisfied in the minimum of time.

This system is particularly relevant to the important part-time and evening work previously mentioned and ensures that standards are equal to those of full-time study (which is not always true with more conventional teaching methods). Finally, the approach provides maximum opportunity to inculcate an open-minded attitude to problems leading to innovative and creative solutions.

Having defined the method it is then necessary to proceed to the educational programme structure. A typical arrangement is shown in Diagram 15 incorporating the following features:

(i) Flexible entry points including credit for units of work already completed satisfactorily.

(ii) A system of diplomas/certificates, higher diplomas/certificates and Associateships/Degrees.

(iii) Ease of transfer across programmes according to ability and progress.

(iv) A relatively high degree of self-pacing through the self-learning process.

(v) Provision of industrial/professional training units within and outside of the institution.

(vi) Pre-entry programmes to make up deficiencies prior to entry at a particular level (often utilizing the summer session).

This approach is particularly advantageous if adopted by a number of participating institutions and, in part at least, by the schools. In the case of Hong Kong the Polytechnic and the Technical Institutes are in fact co-operating closely and have almost finalized a common policy. Furthermore it lends itself to complete validation by the Technical and Business Education Councils of the U.K. which in turn should carry with it professional recognition of the appropriate professional institutions. In this way local qualifications can carry international recognition whilst the programmes can be specifically designed to meet the needs, and follow the customs and practice, of a particular country.

Finally, Diagram 15 can be used to exemplify the proposed quota system of entry and exit from programmes according to student ability and the needs of industry and commerce. This is shown in Diagram 16 with hypothetical numbers at the entry and exit points. It clearly indicates the distribution of different levels of study.

THE IMPORTANCE OF PLANNING

Now it will be evident that throughout this paper constant reference has been made to the importance of planning - in education and training, in government and in industry and commerce. Indeed the use of the adjective "industrializing" in the title of Project Three denotes time - dependence which in turn demands a logical planning sequence. This is clearly in itself a subject area of considerable importance in technical education and will therefore command the final words in this paper.

Planning can be defined as the development of a concept concerned with the active implementation of the process of change within a defined framework. It is essentially interdisciplinary, involves optimization, and is very necessary from the small detail to the very large overall problem. Failure to plan adequately can cause the deaths of a 100 people from the dangers of a simple toy as easily as from a complex aircraft.

Basic methodology at all levels of planning is available although developed countries themselves have been much more successful at the detail than at the overall problem. Developing countries need to do both very well. Many techniques are available with high-sounding names such as normative forecasting, delphi techniques, decision tree theory, morphological research, scenarios, to name but a few of about 100 versions. They can lead to very complex planning systems but much is common sense applied in a logical fashion! The essential is to use small, knowledgeable teams which balance numerical with human factors.

Planning methodology can be described under the following sequential headings:

Objectives (requiring to be well defined);

Output (useful application);

Criteria of performance (accuracy of data credibility);

Techniques (integration of these to embrace the complete system);

Perturbation (significance and timeliness);

Success rate (includes feedback for future planning).

These can be applied to simple or very complex problems and when properly applied can do much to eliminate wasteful effort. They must, of course, be linked with good management capable of timely decision to provide the human as opposed to the mechanical evaluation.

Thus it is contended that a high degree of planning "know-how" is essential for developing countries. For a relatively small investment in acquiring and practising planning techniques for all levels of activity, much could be achieved in defining the "appropriateness" of technology for a

particular developing country. Furthermore it will do much to promote self generated technology.

Perhaps every technical education institution should make its next development task the creation of an interdisciplinary centre of planning.

PROJECT THREE

PRESENTATION OF LEAD PAPER 3 BY DR LEGG AND SUMMARY REPORT OF PLENARY SESSION

Dr Legg introduced his paper, which was divided into four sections, planned to cover the main topics of the Project and to suggest specific solutions rather than concentrating on generalized statements. He illustrated his presentation with slides (of diagrams now appended).

Diagram 2 dealt with industry and its effect on the individual. Dr Legg indicated the dangers of looking at technical education in isolation and affirmed his view that all educational sectors should be integrated in an attempt to balance available provision with the number of qualified school levers.

Diagram 3 highlighted the lack of status of technicians and its consequences in terms of poor career and salary prospects. Dr Legg indicated that an approach to this problem was formulated in the UK through the recognition of technicians as a profession.

Diagram 4 showed that large industries supported technician training, whereas small firms gave poor support at this level, which might reflect on their success or failure as businesses. The employment of technicians by small firms could assist their growth and development into medium-sized firms, with a measure of stability.

Diagram 5 related to training and the possible establishment of industrial training centres as a means of bridging the gap between industry and educational institutions through part-time, block-release and sandwich courses.

Diagram 6 concerned the individual and the benefit he could gain from interdisciplinary centres and their broadening effect on his overall training.

Diagram 7 showed how education and the individual should plan for life rather than in sectors or compartments. Dr Legg stressed the importance of continuing education and re-education.

Diagram 8 was concerned with scholarships and their use for increasing integration of educational staff, students and industry. Dr Legg emphasized that scholars should be selected carefully and in accordance with a plan, and that relevant authorities should include a scholarship cost element in their budgeting.

Diagram 9 made the point that self-generated technology could optimize local resources for the development of industry in developing countries.

Diagram 10 dealt with subject divisions and interdisciplinary units. Dr Legg led the delegates through the various areas of the chart and discussed their inter-relationship.

Diagram 12 related to self-employment and the need for relevant education for the purpose and drew attention to the need for equal opportunities for women and girls in educational institutions.

Diagram 13 advocated a systems approach in a logical fashion.

Diagram 14 illustrated the planned and developing subject areas in the Hong Kong Polytechnic, the main areas being engineering, applied science, commerce and design. Areas where joint departmental activity was occurring were also indicated.

Diagram 15 indicated proposed programmes that could be followed by entrants at different levels. Dr Legg explained that breadth of learning could be facilitated by the use of the credit unitary system; with its adoption, greater co-operation between technical institutes and the Polytechnic could take place, avoiding the duplication of resources in a particular area, for example printing.

Diagram 16 related to the quota system of admissions and output of students, and the need for ensuring the correct level of entry into programmes of study and equating terminal ability with course output level.

Diagrams 17 and 18 illustrated the need for a logical approach to the solution of planning problems which was better undertaken by small teams of specialists who could bring balanced judgement to individual areas as against a larger group which would tend to over-plan. Institutions were often not cost effective and had no way of determining whether they were spending public money wisely.

Diagram 19 compared international undergraduate technology programmes in terms of staff/student ratio and the average departmental recurrent annual costs per student.

The Chairman thanked Dr Legg for presenting his paper and invited questions. He used his prerogative as chairman to ask about the criteria for the establishment of advisory committees and faculties within the Polytechnic, and about interdisciplinary studies.

Dr Legg answered that all the Polytechnic's divisional departments had advisory committees, as had all its schools. Studies in interdisciplinary areas promoted flexibility of thought, which otherwise tended to be restricted to narrow sectors or compartments by the conventional curricula.

After thanking Dr Legg, the Chairman invited preliminary questions and comments, and the following points were made:

Wastage

To a question concerning Hong Kong's approach to the problem of wastage caused partly by insistence on high entry qualifications, Dr Legg replied that there was no real answer; there were more highly educated school leavers than could be absorbed in tertiary education, and the only long-term answer was the development of industry and commerce in general.

Credit Unitary System

One questioner noted that it was not possible to identify the duration of technician courses from Dr Legg's diagram. Dr Legg emphasized that the credit unitary system was self-pacing and that the diagram could therefore not show any particular number of years.

Liberal Studies

Several participants supported the inclusion of such studies in technician programmes, but were in doubt about the proportion they should bear to the whole. Dr Legg's view was that approximately 25% of courses should consist of contrasting or cultural studies, which might appear in a programme or might be done outside academic hours.

Planning and Feed-back

Dr Legg considered that the planning of educational programmes should be carried out by small interdisciplinary teams, who should work out steps in logical progression; such planning, as a discipline of its own, was only just getting off the ground. Although his presentation may not have shown how feed-back should be taken into account in the programme, feed-back was essential, and was usually processed by advisory committees. Concerning where the initiative came from for planning courses in new areas, Dr Legg answered that such developments were usually initiated at board of governors level; if Government were involved, the appropriate advisory bodies were consulted; his staff were encouraged to go out into industry to identify needs.

Technicians as a New Breed

Comment was made on the remarkable way industry in Hong Kong had developed over the years in spite of the fact that no trained technicians has been available, the answer was that craftsmen who had received no formal training as technicians formed the hard core of the technician cadre, and it was now a question of building on that.

Training of Entrepreneurs

In reply to a question about the right education and training for entrepreneurs, Dr Legg replied that this depended on the definition of an entrepreneur; if he could be defined as someone who had flair and success in business but little more, he needed an open type of education, because being confined by an over-full and rigid curriculum discouraged free thinking and inhibited an awareness of wider horizons.

Technician Education for Women and Girls

Dr Legg was asked whether there was any specific provision for females in his Polytechnic's intake quota, and he replied that they were automatically eligible for inclusion, but it was fair to comment that the future of the further education and training of women and girls lay in the schools.

Optimum Utilization of Polytechnic Resources

Dr Legg made the point that Hong Kong could benefit very much from using the Polytechnic staff as consultants.

DIAGRAM 1

TECHNICAL

"TECHNE" - ARTS CRAFTS SKILLS
SCIENCE - ENGINEERING
BUSINESS - COMMERCE
DESIGN - COMPUTING

INDUSTRIALIZING SOCIETY

PRIMITIVE ⟶ SOPHISTICATION INVOLVES PEOPLE
ESSENTIALLY A DYNAMIC PROCESS
(USUALLY IN A CLIMATE OF INADEQUATE RESOURCES)

DIAGRAM 2

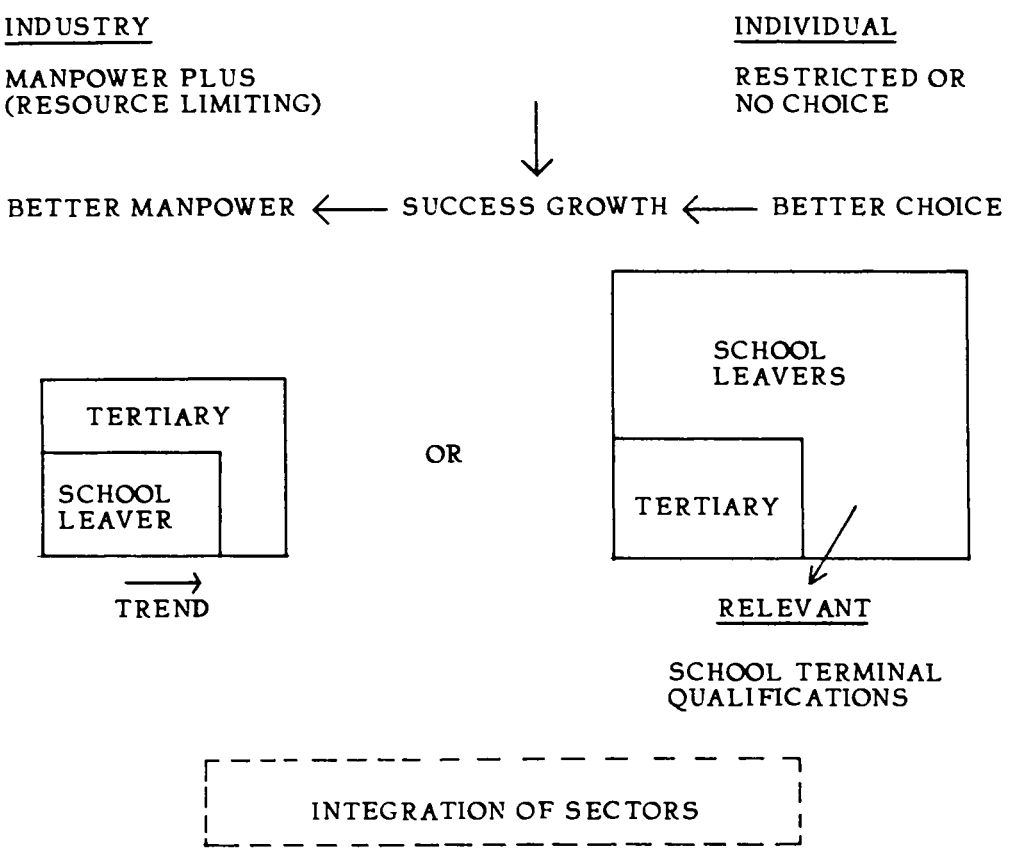


DIAGRAM 3

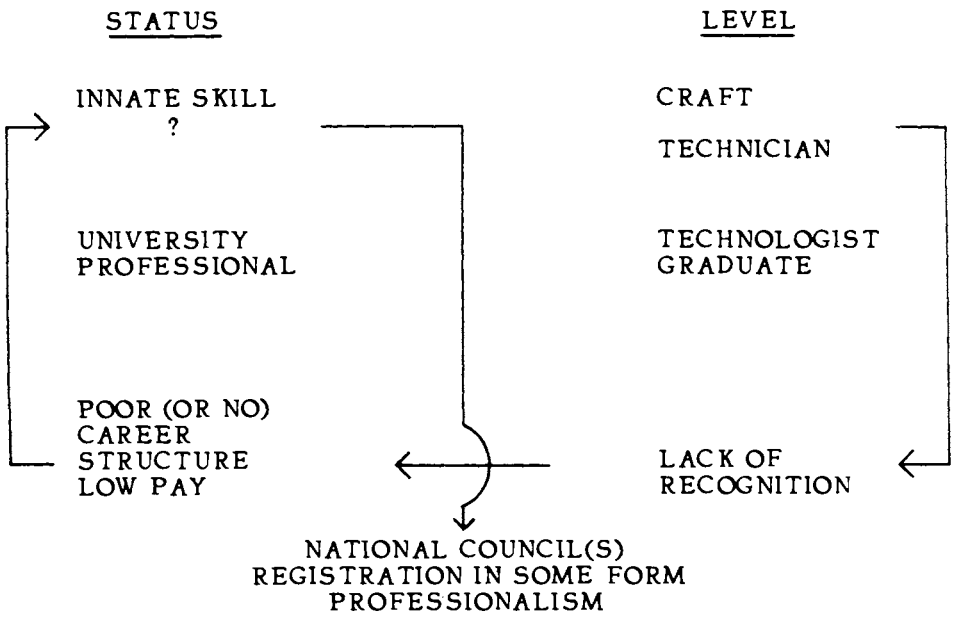
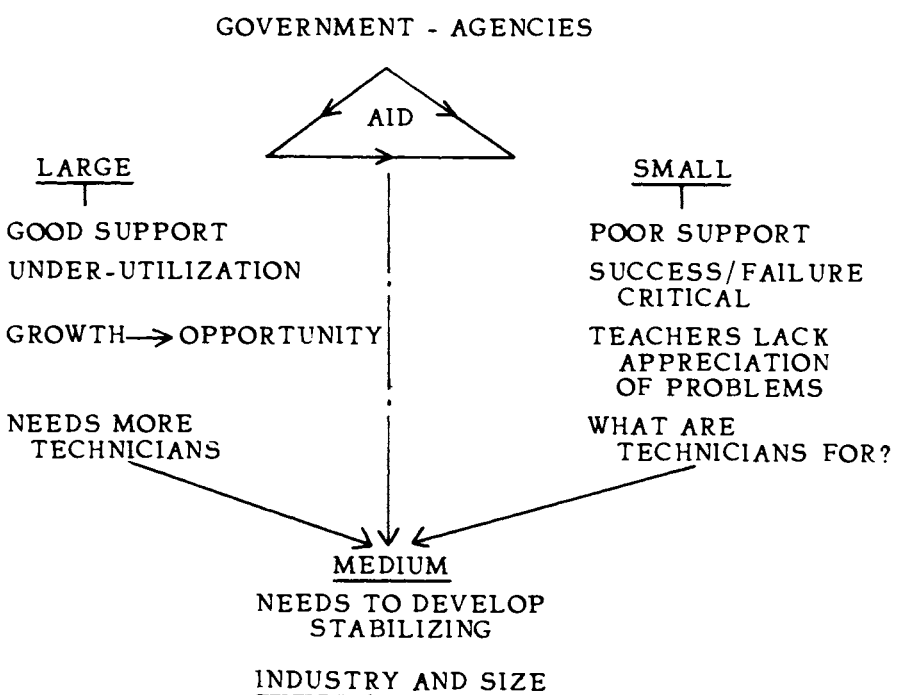


DIAGRAM 4



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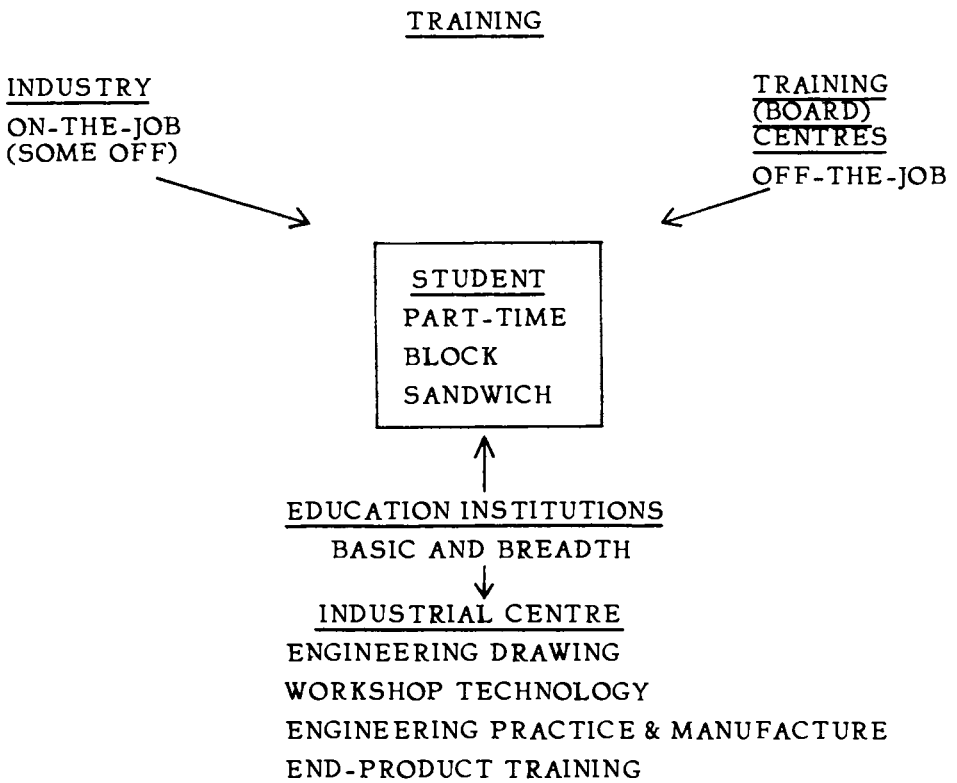


DIAGRAM 6

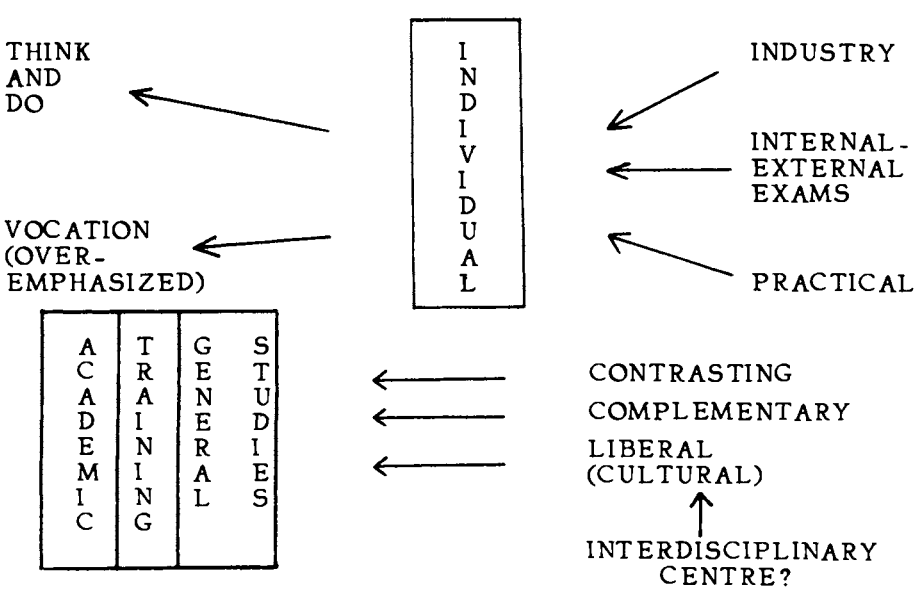


DIAGRAM 7

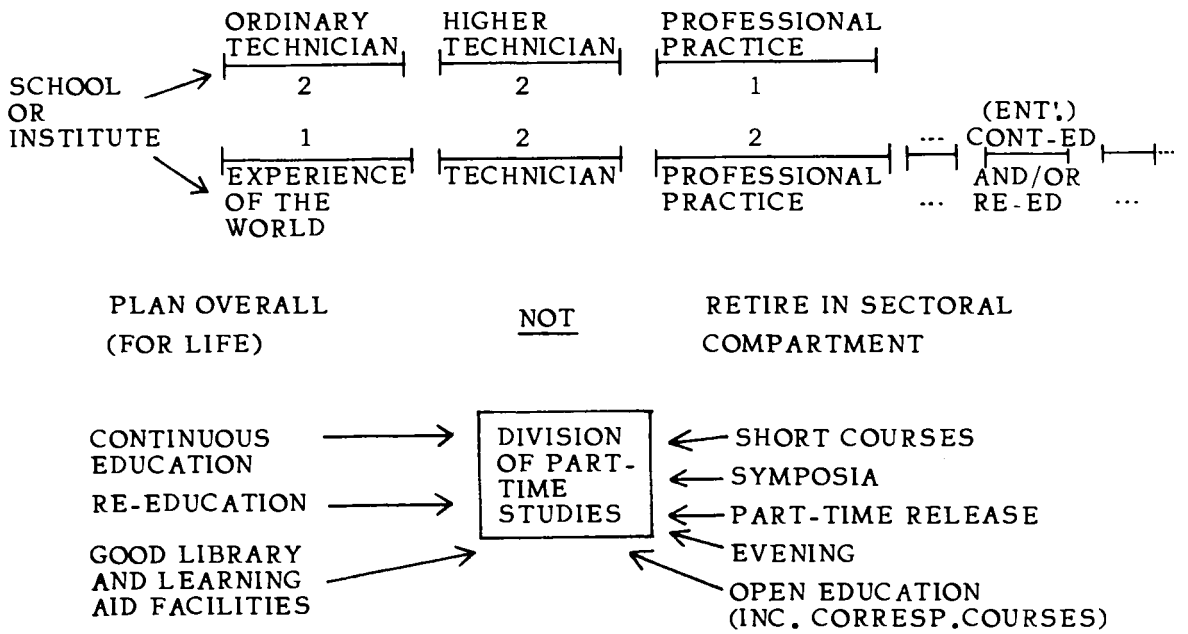


DIAGRAM 8

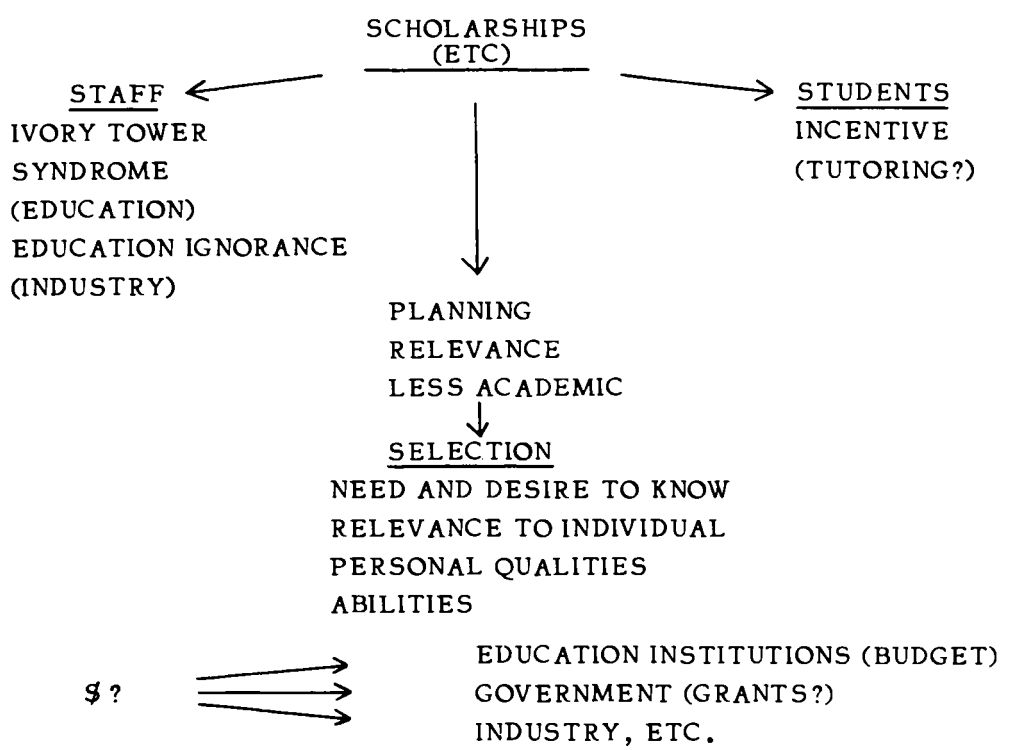


DIAGRAM 9

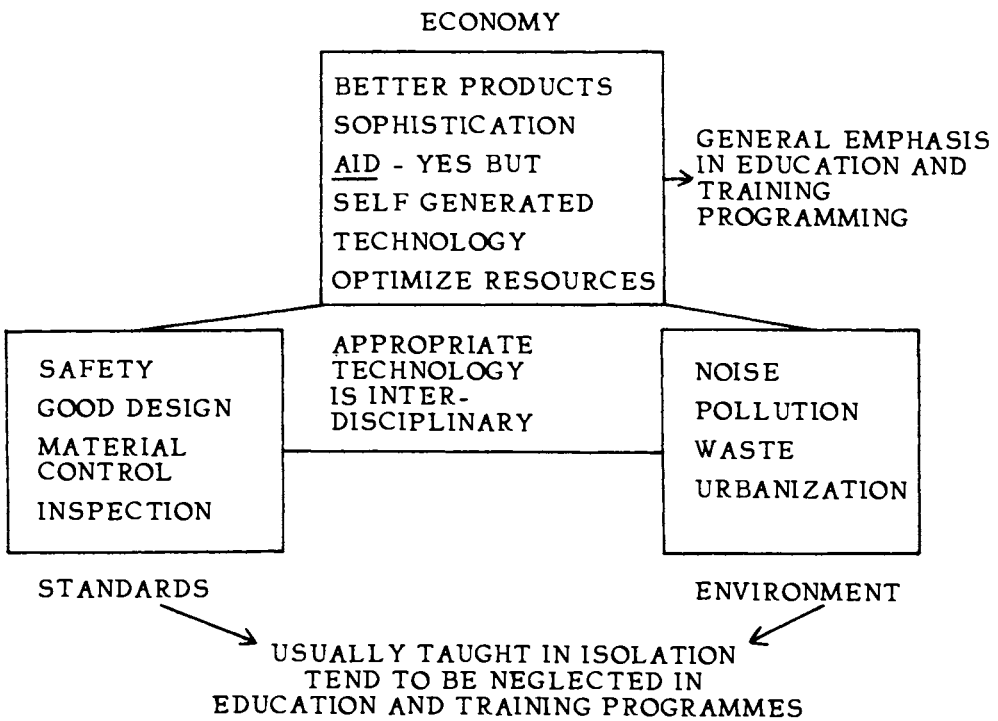

ECONOMY
BETTER PRODUCTS
SOPHISTICATION
AID - YES BUT
SELF GENERATED
TECHNOLOGY
OPTIMIZE RESOURCES
GENERAL EMPHASIS IN EDUCATION AND TRAINING PROGRAMMING
SAFETY
GOOD DESIGN
MATERIAL CONTROL
INSPECTION
APPROPRIATE TECHNOLOGY IS INTER-DISCIPLINARY
NOISE
POLLUTION
WASTE
URBANIZATION
STANDARDS
ENVIRONMENT
USUALLY TAUGHT IN ISOLATION
TEND TO BE NEGLECTED IN
EDUCATION AND TRAINING PROGRAMMES

DIAGRAM 10

SUBJECT DIVISIONS AND INTERDISCIPLINARY UNITS

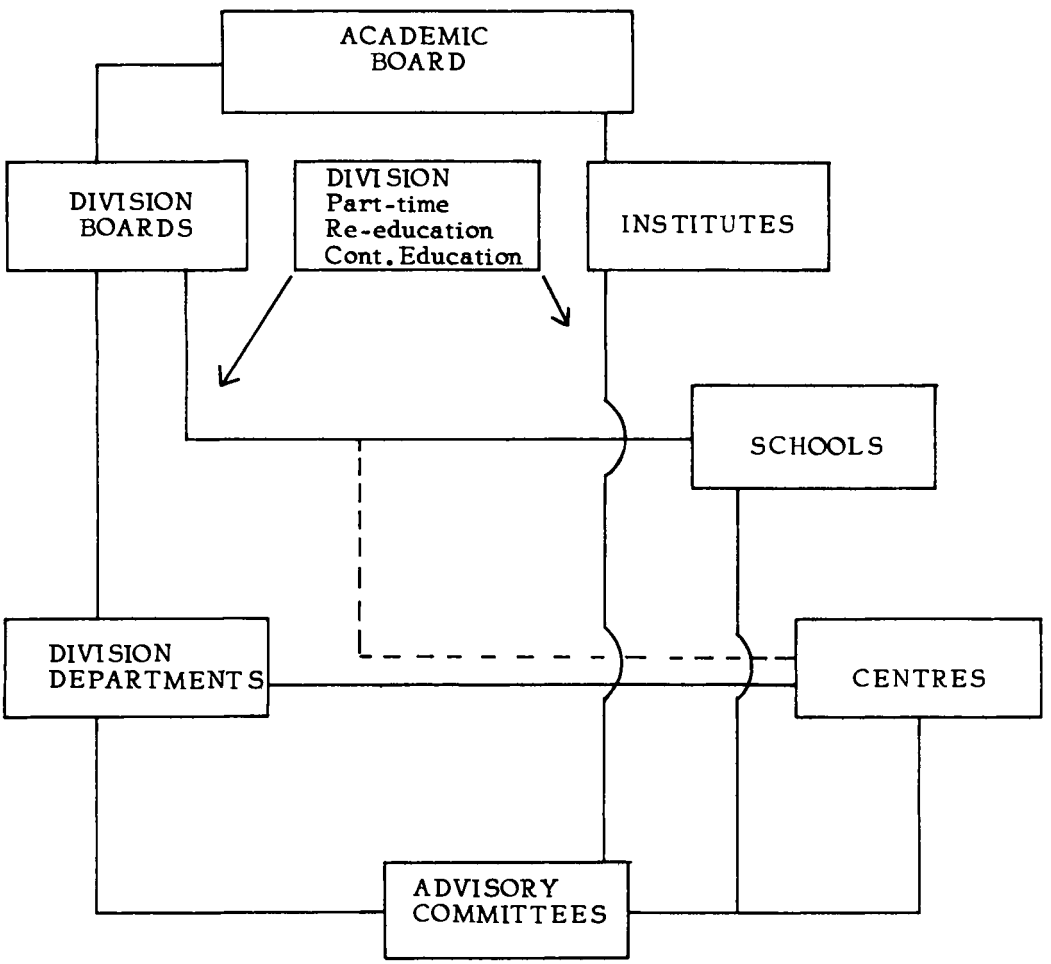


DIAGRAM 11

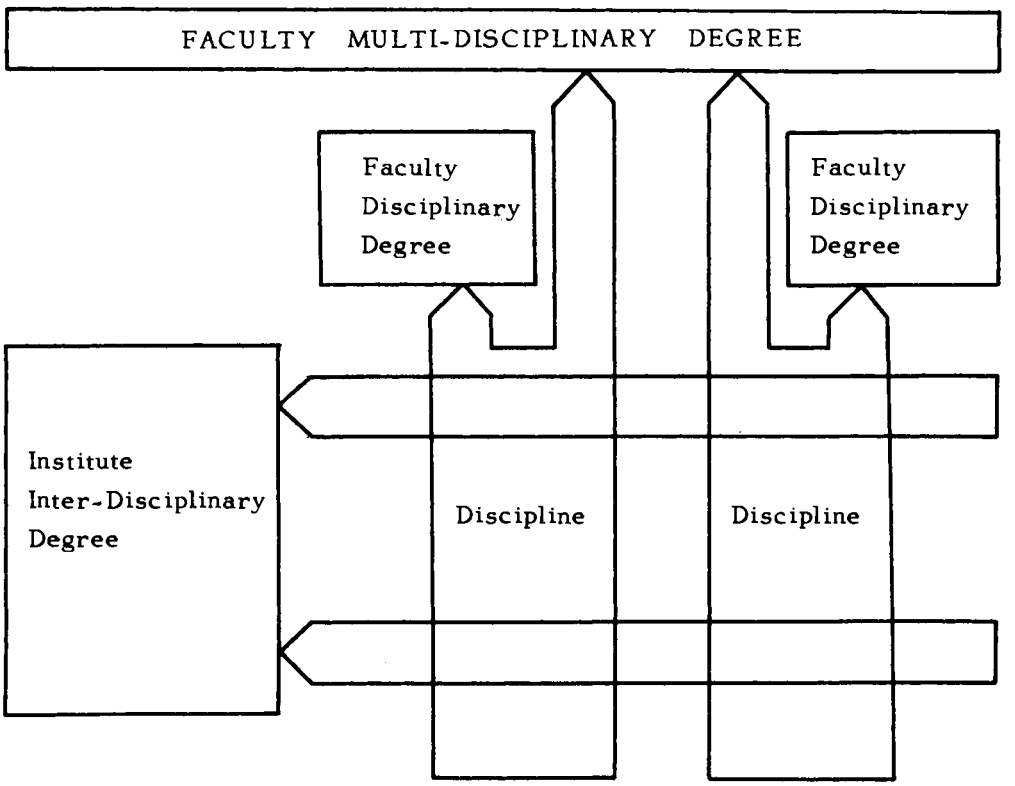

FACULTY MULTI-DISCIPLINARY DEGREE
Faculty Disciplinary Degree
Faculty Disciplinary Degree
Institute Inter-Disciplinary Degree
Discipline
Discipline

DIAGRAM 12

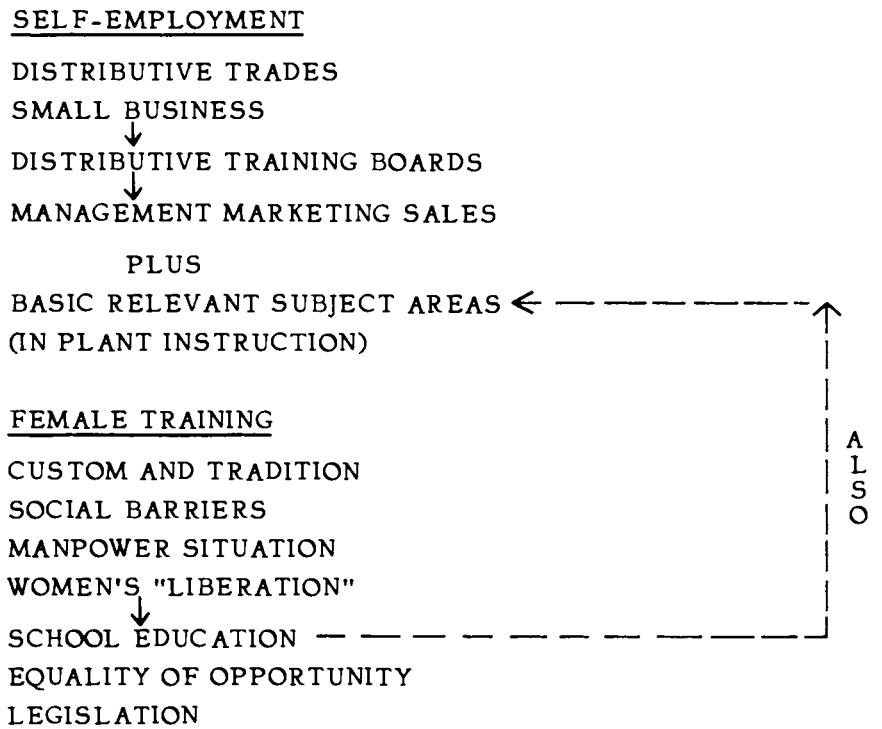


DIAGRAM 13

A SYSTEMS APPROACH

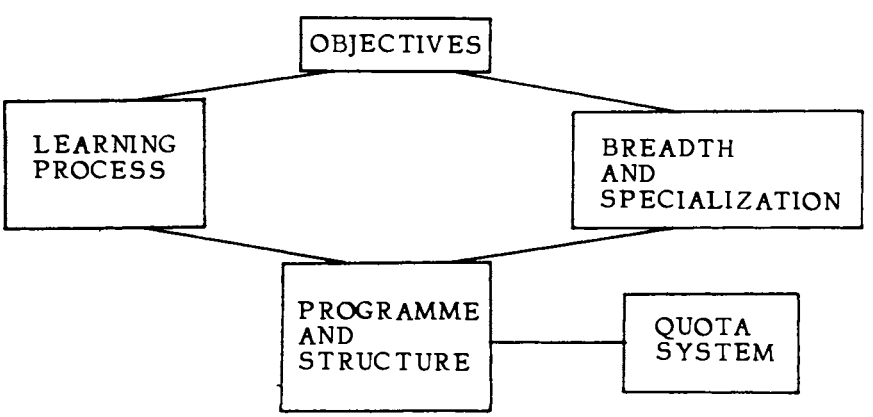


DIAGRAM 14

PLANNED AND DEVELOPING SUBJECT AREAS IN HONG KONG POLYTECHNIC

DIVISIONS

ENGINEERING	APPLIED SCIENCE	COMMERCE & DESIGN
Water resources engineering	Material technology	"In plant" management studies
*Traffic engineering	Polymer technology	Machine shorthand
Rock mechanics	*Packaging technology	Executive sec. with language
Coastal engineering	*Surface protection and finishing	*Textile marketing & management
Marine and power plant automation	*Food technology	Product, garment)
*Transportation	*Health science	Textile, packaging) design
Marine engineering (sea-going)	*Cybernetics	Graphic, environ-) mental illustration)
Press tool	Chemistry & science lab. techniques	Photography and animation
Plastic moulding	*Industrial automation	*Ceramics & jewellery
Work study	Systems analysis	*Japanese language
Inspection	Computer programming	Translation studies
Quality and reliability	Applied statistics	*Fashion and clothing technology
*Operational research	*Engineering mathematics	*Textile chemistry
*Central system engineering	*Business mathematics	*Textile technology
General engineering studies	Naval architecture	Hotel & catering
*Conservation of energy	Shipbuilding (technician)	Supervisory management studies
*Bio-radical engineering	*Radar navigation (Hydrofoil-hovercraft)	Industrial relations
Ocean engineering	*Navigational aids	*Library studies
*Safety	*Town planning	International marketing business
	Surveying & building technology	*Social work (and health)
	*Building services	Media communications
	Chemical technology	Economics
	Industrial chemistry	Social sciences
	Industrial physics	Commercial law
	*(Human) Biological studies	
	*Ergonomics	

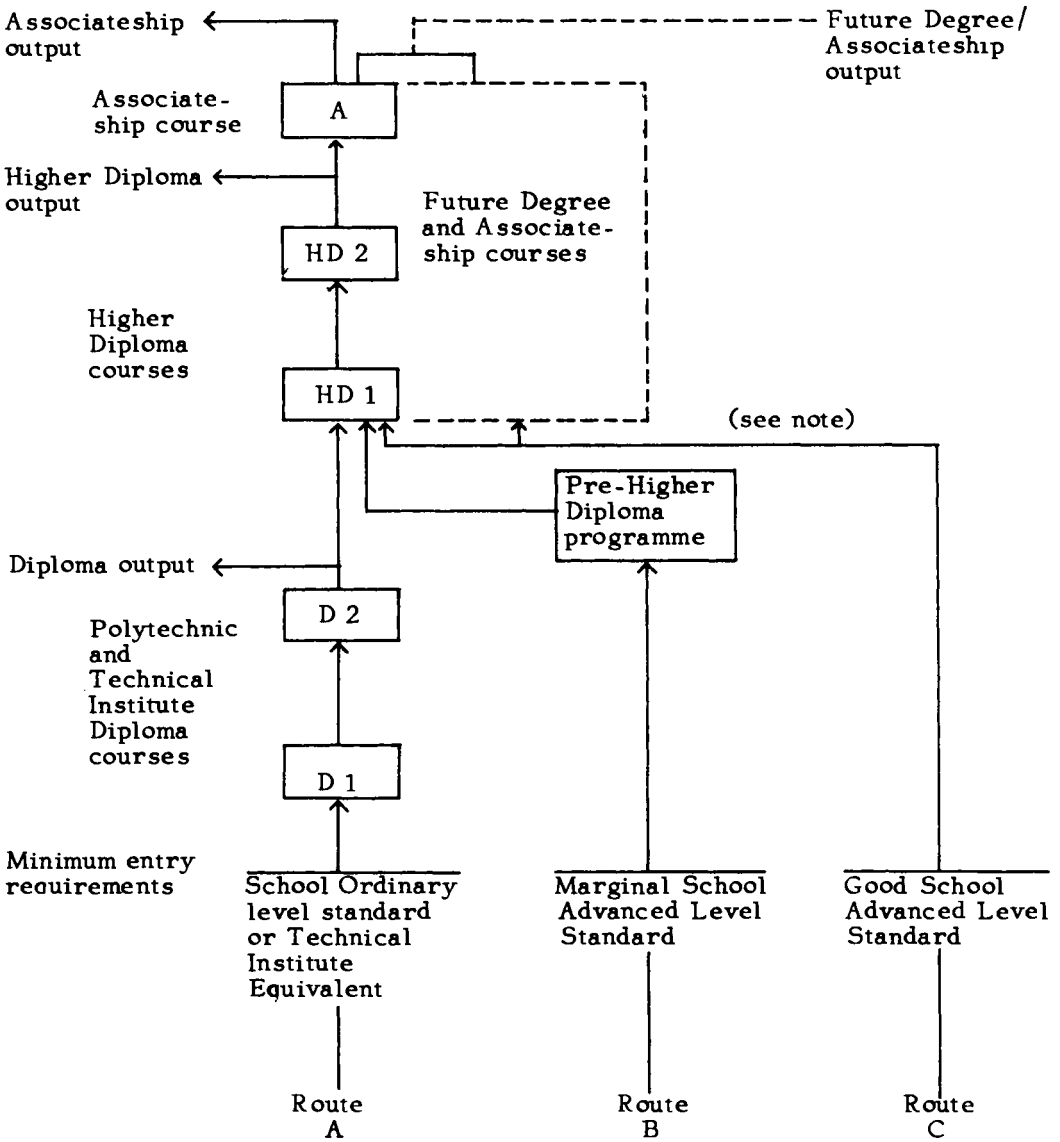
INSTITUTES/SCHOOLS/CENTRES (INTERDISCIPLINARY)

INSTITUTES	SCHOOLS	CENTRES
Medical services and social health	Instrumentation and testing	Materials technology
Education and educational services	Environmental studies	Transport studies
Extension studies	Urban and regional planning	Public service studies
Industrial (initially the industrial centre)		Packaging

*Denotes joint departmental activity

DIAGRAM 15

PROPOSED PROGRAMMES AND AWARDS



Note: Students enrolled via Route C are required to undertake supplementary studies which may occur before, during or after the Higher Diploma Course.

DIAGRAM 16

SAMPLE DISTRIBUTION OF STUDENT NUMBERS RELATED TO A QUOTA SYSTEM OF ADMISSIONS AND OUTPUT

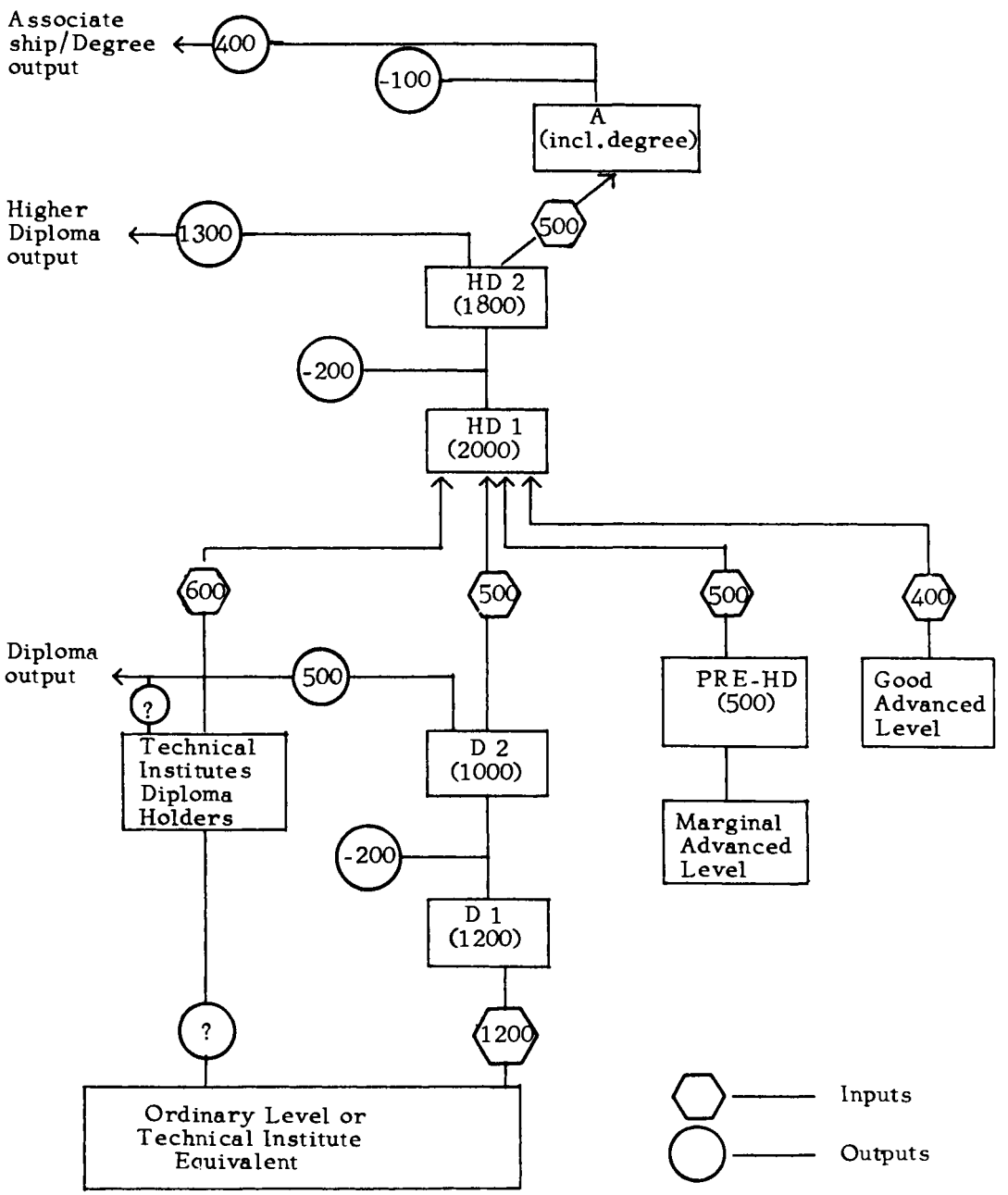
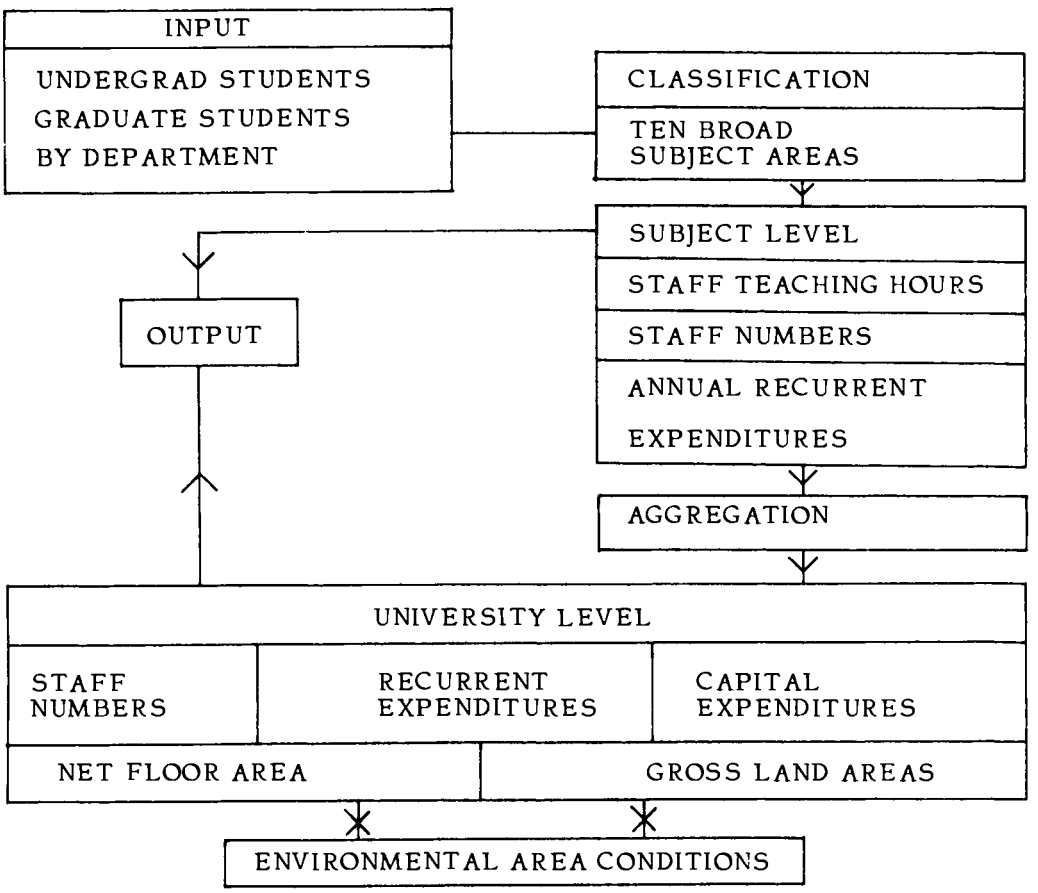
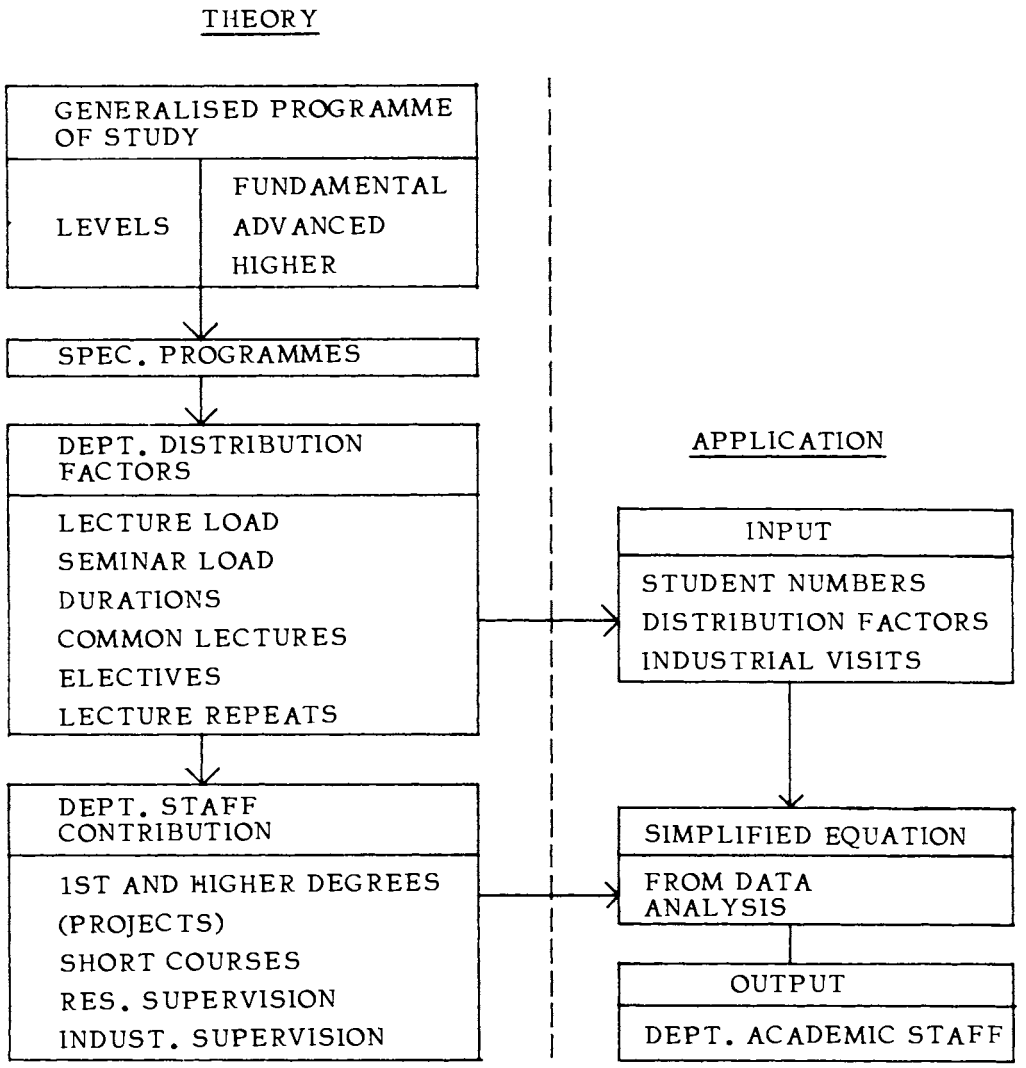


DIAGRAM 17



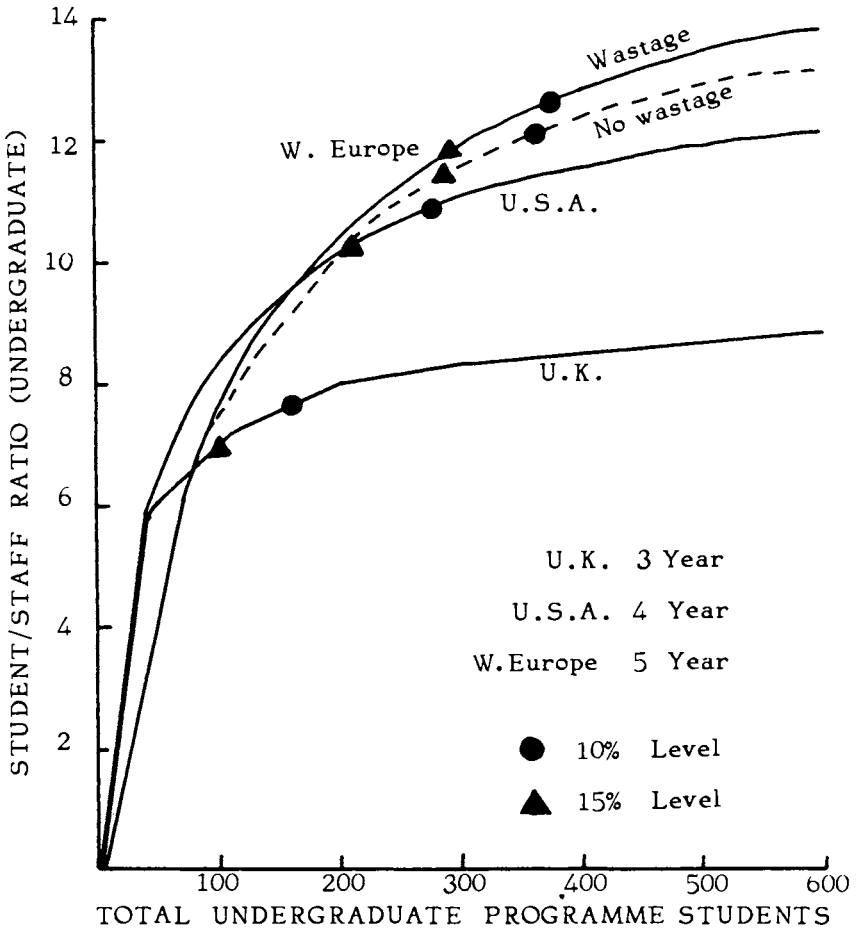
OUTLINE APPROXIMATE OVERALL DATA BASED UNIVERSITY MODEL

DIAGRAM 18



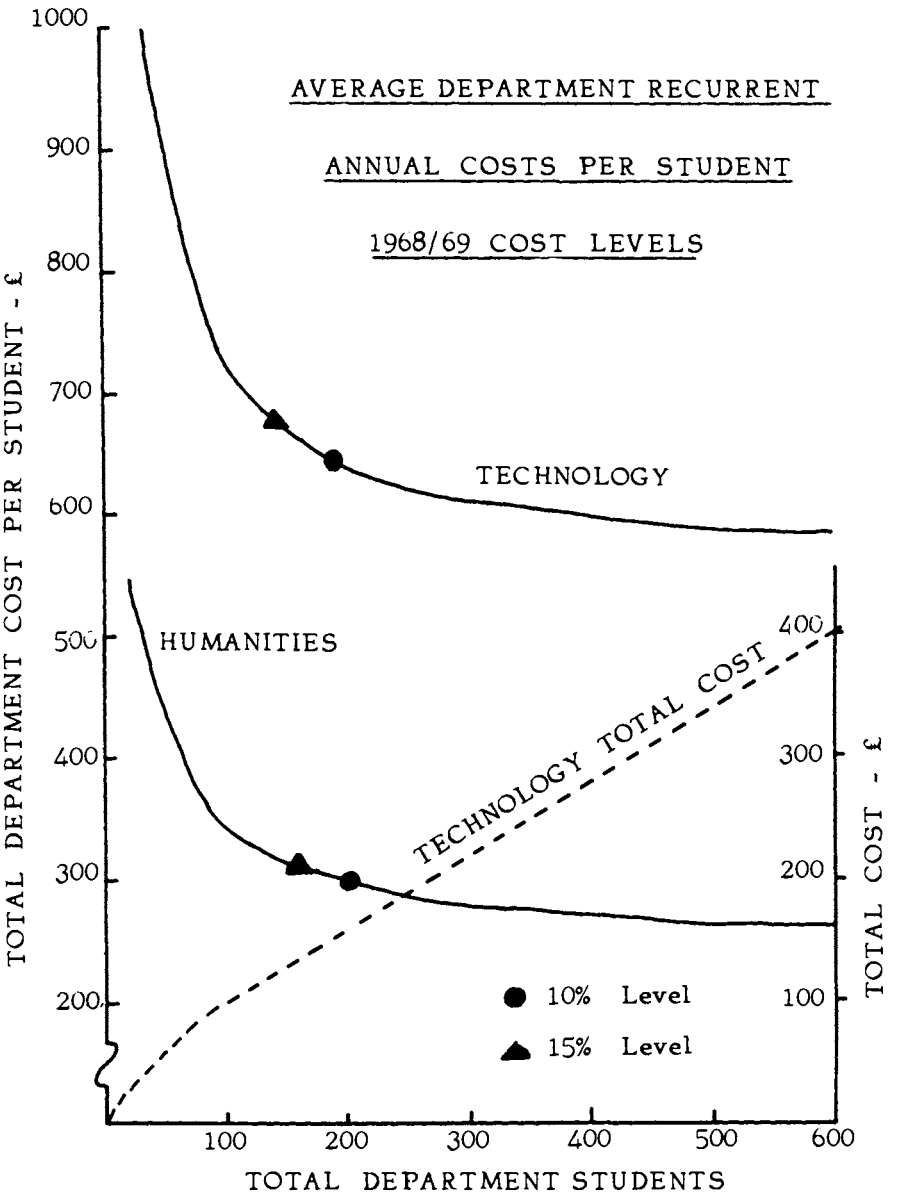
DEPARTMENTAL ACADEMIC STAFF MODEL

DIAGRAM 19



INTERNATIONAL COMPARISON OF UNDERGRADUATE TECHNOLOGY PROGRAMMES

DIAGRAM 20


AVERAGE DEPARTMENT RECURRENT
ANNUAL COSTS PER STUDENT
1968/69 COST LEVELS
TOTAL DEPARTMENT COST PER STUDENT - £
1000
900
800
700
600
500
400
300
200
TECHNOLOGY
HUMANITIES
TECHNOLOGY TOTAL COST
400
300
200
100
TOTAL COST - £
10% Level
15% Level
100
200
300
400
500
600
TOTAL DEPARTMENT STUDENTS

SUMMARY OF DISCUSSIONS

Discussions were held in group and plenary sessions and led to the Project Three conclusions and recommendations set out on page 6.

In considering the special characteristics of technical education in an industrializing society, the seminar adopted a cautious attitude towards setting up new educational facilities or courses at the technician level, having in mind the very high capital and recurrent costs of most courses at this level. It was felt that, in the long or even the medium term, better service was often done to the cause of developing a high quality cadre of technicians by tackling the problem where it first arises, in the schools. Most delegates felt that investment in the overall improvement of both primary and secondary schools was a high priority. Questions of school curriculum content related to further education or employment were not considered owing to shortage of time. Where facilities were clearly too expensive or the numbers of a particular category of technician required were not sufficient to justify them, the seminar felt that there should be more general exploitation than at present of existing facilities in other countries, through neighbourly co-operation. Methods of regional co-operation were considered separately.

The seminar adopted the views of the group concerned with scholarship policy. They emphasized that the criteria for scholarships should include the relevance of the prospective scholar's proposed course of study to the country's economic development as well as his academic attainments - which, it was noted incidentally, were sometimes too high rather than too low for the particular purposes that a scholarship board had in mind. Personal qualities such as the student's ability and determination to complete the selected course of study were also considered important, as were an inquiring mind and the ability to work with minimum supervision. Delegates referred to somewhat haphazard or even chaotic arrangements in some countries for considering alternative offers of scholarships from different donors. It was agreed that there should be so far as possible a positive but realistic response to offers from bilateral, international, charitable and industrial agencies, and that the scholarships offered by home governments and other home authorities should be intelligently slotted in with these; also that the official machinery - normally a committee - should be so constituted as to ensure co-ordination.

Another process which should begin before the boy or girl left school was counselling or guidance about careers. Wherever possible this should be offered to children from the age of 14, and methods of getting it across effectively should include special training for selected prospective and in-service secondary teachers, career talks by industrialists, technical

teachers and other educators, open days or careers weeks in technical institutions (to which secondary school staff, school children, students and parents should all be invited), and careers exhibitions organized jointly by government departments and industry.

The importance of including general studies in the technician course curriculum was emphasized by two groups. Provision, at the larger technical institutions, should include a separate department with responsibility for general studies, liaising closely with other departments. In smaller institutions it was recommended that a senior member of staff should have specific responsibility for promoting and operating general studies throughout the institution; his or her enthusiasm and motivation were considered extremely important. This responsibility should include authority to draw within reason upon the services of other members of staff, and to use the resources of local industry. In most countries it was felt that the present situation as regards recruitment and training of staff to teach general studies left a lot to be desired. Recommendations were made on these lines.

Under this project, the seminar returned to the question of status for technicians. The seminar noted reminders by Dr Legg and Dr Chandrakant that it was unworthy for technicians to campaign militantly for higher pay if their quality and competence could not be seen to match it. Often they could be; and educational and technical attainment of technicians was often of a high order. If young people were to be encouraged to embark upon the courses which led to this attainment, the incentives must be there; and this meant that salary scales and conditions of service should reflect a recognition that when technicians were doing jobs at near-professional levels, which they often were, the differential between their own salaries and the professionals' should not be great. This recognition would come gradually with the successful performance by technicians of jobs that matched their education and training. In some countries, a lead needed to come from governments: several of them had for years been using for middle-level jobs either promoted tradesmen who could not quite cope with them, or professional engineers who would be better employed at a higher level and supported by people to whom they could delegate with confidence.

Along with salary scales pitched at a more appropriate level, which had to be adopted both by governments and by other employers, delegates agreed that systematic promotion opportunities must be made available; and that other contributions to the enhancement of the technician's status could be made through the establishment and recognition of technician societies or associations, or the expansion (as in the UK) of existing professional bodies to embrace the interests of technicians. "Post-technician" courses should also be provided to meet special needs, and these would help to promote status.

It was agreed that special measures were required to provide for the education and training of prospective self-employed entrepreneurs, in the interests of promoting small-scale industry generally and of getting individual enterprises set up on sound business lines; and that the entrepreneur who was already self-employed could be helped in a number of ways through informal courses for which the media of radio, television and correspondence could often be effectively used.

The group concerned, and the plenary session, recognized that there were still barriers to women becoming technicians in industry. Some of the traditional barriers might be broken down through the educational system,

but others not. The seminar considered that governments had a heavy responsibility for ensuring that the schools did not contribute to the preservation of such barriers; and that the authorities running polytechnics and other technical institutions had a less difficult job in ensuring that women and girls were not excluded from technician courses simply through the absence of appropriate facilities and arrangements or through administrative inertia.

One group, and the plenary session, considered the special requirements, in terms of areas of technician activity, of the Asian and Pacific regions. It was felt that transport, agriculture, the sea and the air were very significant areas; all the activities that went with these - for example mapping and surveying, oceanography and ocean engineering, telecommunications, aircraft and marine-craft, airports and sea ports, and technologies associated with the exploitation of water and other natural resources and the mitigation of natural disasters - gave rise to very substantial technician-level employment and therefore to technician education and training requirements. It was agreed to suggest that a regional clearing house or clearing houses might be set up which would have the function of collecting, sifting and disseminating information and ideas, solutions to problems and the results of research, in the areas of technologies particularly important to the region.

The seminar felt that although advanced technologies need not always be used and intermediate technologies were often more suited to the social and labour conditions obtaining in a particular country, it could not attempt to lay down any guidelines about what technologies were appropriate or how such technologies should be served by appropriate educational and training facilities. Often a new technology, and perhaps an advanced one, needed to be transferred to a developing country, and in that case the promoters of the industry or the individual enterprise concerned had the responsibility of providing specialist training; but governments should consider whether the provision of educational courses relating to the technology concerned was a public responsibility.

The seminar felt that technician courses had so far tended to be constructed too much in water-tight compartments, and that an interdisciplinary approach was greatly to be preferred in the interests of industry, of society, and of the individual. It was therefore urged that, when planning technician courses, the authorities concerned should always consider whether an interdisciplinary approach was desirable and feasible. This approach carried with it a requirement that teachers themselves be trained in an interdisciplinary way, and exposed to diversified subject areas. It was felt that only in this way would the technician be given the flexibility of mind that would make his knowledge and skills relevant to a variety of work situations and opportunities.

COMMONWEALTH AND REGIONAL CO-OPERATION

Introduced by Mr B.F.C. Fong and Mr S. Mahendra

Mr Fong outlined the organization, functions, and activities of the Commonwealth Secretariat, and in particular of its Education Division. He hoped his brief account would give hints about further action that could be taken to develop technician education in the Commonwealth regions of Asia and the Pacific.

The Commonwealth Secretariat was set up by Commonwealth governments in 1965. The Commonwealth now has 36 members, and about one-quarter of the world population lives in these countries. There are large and small nations and, independently of size and population, every member is an equal partner in this Commonwealth of nations. Mr Fong quoted from the Secretary-General's Fifth Report to the Heads of Commonwealth Governments at the Jamaica Conference, 1975, which read as follows:

"If we are to make use of the Commonwealth, we must be clear about what it is and which tasks it is equipped to tackle. The Commonwealth is neither a substitute for nor an alternative to the United Nations system, to which all our members belong and in which all of them place faith. It cannot do the work of the various regional organizations, economic and political, whose growth has been so hopeful a feature of the international scene in recent years and in which many of our members play an active role. The Commonwealth is something else, no less valuable, but different. Our organization was not created to meet a specific need nor to remedy a particular defect in the world. It is an endeavour in partnership and friendship and mutual self-respect. In this vast range of political, economic and geographical interests, only one type of nation is missing. There is no superpower in the Commonwealth."

The Secretariat of the Commonwealth governments is in London, at Marlborough House, put at the disposal of the Commonwealth by the Head of the Commonwealth, Her Majesty the Queen of England. The Secretariat is responsible to Commonwealth governments collectively and its work includes promoting consultation and collecting and disseminating information for their use. It also organizes meetings and other activities and, perhaps more important, is responsible for putting into effect decisions for collective action. This is done in a number of ways, including periodical meetings of Ministers. First and foremost, heads of Governments meet every two years at a selected venue in a Commonwealth country; their next meeting is scheduled to take place in London in June 1977. This will happily coincide with the Jubilee celebration of Her Majesty the Queen, Head of the Commonwealth, and it is therefore a most apt venue.

In terms of organization, the head of the Commonwealth Secretariat is the Secretary-General, Mr Shridath Ramphal. His predecessor was Mr Arnold Smith, who had served for two terms of five years each and is now a Professor at Carleton University in Canada. The present Secretary-General is assisted by two deputies, one from India and the other from Australia, Mr Husain and Mr Ross Deane. Under them are two Assistant Secretaries-General, Mr Anyaoku from Nigeria who looks after most of the functional divisions and Mr Anthony Tasker who is the Managing Director of the Commonwealth Fund for Technical Co-operation.

The Secretariat is very small but has an effective organization, responsive to the needs of Commonwealth member governments. Staff number about 300 and work in various divisions known by their respective subject areas like law, health, finance, international affairs, economic affairs, youth and education; the latest is a division for food production and rural development.

In the agreed memorandum of Commonwealth governments, the staff of the Secretariat should be as widely representative of Commonwealth countries as possible. Efforts are therefore made to recruit staff members from all parts of the Commonwealth.

The type of work carried out by the Education Division includes the role of clearing house for information about educational developments, monitoring educational trends, organizing conferences and seminars to meet needs of member governments as expressed by Ministries of Education or by Ministers at Commonwealth Education Conferences. So far, there have been six conferences of education ministers. They take place roughly every three years; the last or Sixth was held in Jamaica in 1974, and the next will take place in Accra early in 1977. Planning for this conference has been going on for about a year and preparations are now being finalized. The Ministers will meet and hold discussions on a particular theme, and also review the educational work of the Secretariat. The theme chosen for next year's conference is "The Economics and Education". What best mileage can be got out of the very restricted budgetary allocations of Ministries of Education? New ideas have got to be found to cope with the problems, both quantitative and qualitative. With existing allocations, more and more Ministries are finding it difficult to provide the growing numbers of places in primary as well as secondary schools, so that bold actions in experimenting with alternatives to formal education will have to be taken. The Education Division is much involved in this, and has commissioned one or two persons to look into this area and identify what efforts have been made and can be further made to find alternatives to formal education. Other recent activities of the Division have been focussed on areas such as book development, especially book production, which needs to be encouraged in developing countries, that is to say the indigenous production of cheap textbooks in order to support curriculum innovation in these countries. A specialist conference was held in Wellington, New Zealand, in 1975 on learning and teaching materials, and nearly all Commonwealth countries were represented. This was followed by the first Commonwealth Educational Broadcasting Conference in Sydney in October, 1975. The Education Division has also been turning attention to areas such as educational administration and supervision; three regional seminars have been held, the first in Sierra Leone, the second in Guyana and the third in Kuala Lumpur. A regional training course in educational administration is being planned in Kenya for the African member countries, and two or three regional training courses for senior people in book production are at the planning stage; the first will take place in Guyana for the Caribbean member countries.

Other work has been concerned with modern educational technology. In April, 1976, a group of Commonwealth educationists was organized by the Education Division to visit India to study the Satellite Instruction Television Experiment, and a report has been produced.

The programme for 1976/1977 (the Secretariat's financial year extends from 1 July to 30 June) included several seminars. The first, held in the Cook Islands in September, dealt with Education and the Community: Partnership for Development. The second is the present seminar/workshop on Technical Education and Industry. The third seminar/workshop, for the Caribbean region, will be on the Production of Low Cost Science Teaching Equipment and will be held in the Bahamas in November, 1976. A fourth, on In-Service Teacher Training Programmes, also for the Caribbean region, is to be held in Barbados in April, 1977.

Problems of organizing regional training courses may need to be discussed; views on whether any such courses should be organized to meet pressing needs in the area of technician education will be welcome.

An interesting programme has been proposed called a Commonwealth Programme of Applied Studies in Education. It is hoped that the Commonwealth Ministers will endorse this at the Seventh Commonwealth Education Conference. In a nutshell, this is essentially a problem-solving enterprise. There have been wide consultations with Commonwealth governments and institutions on this. Some educational problems need to be tackled on an inter-disciplinary basis. If member governments face a particularly urgent educational problem, in the area perhaps of examinations or curriculum or staff training, then a task force may be formed to make an on-the-spot study of the problem, assembling data and then proposing solutions. This will involve not only experts and consultants but also the people on the spot. This programme is expected to be launched after the education ministers meet in Accra in 1977. In the Asia and Pacific regions, no doubt there are such problems. One of them perhaps is the problem of unemployed school leavers.

A number of studies of educational topics are produced in the Education Division's Education in the Commonwealth series. Every two years a kind of register containing the latest educational research reports is produced. Directories of educational institutions are also compiled and published. In association with the Association of Commonwealth Universities we have published a book on research strengths in the universities of Commonwealth developing countries. Thus, anyone who wants to know, say what particular facilities the University of Hong Kong has in any particular branch of academic research, will find it listed in that Directory. The facilities available in terms of staff, equipment, places available for other Commonwealth countries and so on are also listed. The Commonwealth Secretariat leaflet lists the publications available, and these include:

Special Education in the Developing Countries of the Commonwealth

Survey of Correspondence Institutions in the Commonwealth

Mathematics Teaching in Schools

Education in the Developing Countries of the Commonwealth - Research Register 1971-1973

New Media in Education in the Commonwealth

Educating and Training Technicians

A quarterly CELC (Commonwealth Education Liaison Committee) newsletter is also published, in which Commonwealth educationists or interested people write of and are informed of educational developments in the Commonwealth. This Committee was set up in London to advise the Education Division on its work programmes, and comprises representatives of every Commonwealth High Commission in London. Meetings are held about once every three months, through which the staff of the Education Division are guided in the interim between Commonwealth Ministers' Conferences.

As the world becomes more easily reached, there is greater scope for Commonwealth and regional co-operation. There is greater inter-dependence between countries, particularly developing countries, and more pooling of resources; also regional and Commonwealth co-operation are necessary to take best advantage out of the different circumstances that prevail in each country situation. In that connection, a brief quotation from the Secretary-General's recent speech delivered on the occasion of an international symposium held in London on Science Policy for Development applies to technology policy in many member countries. This is what he says in connection with regional co-operation:

"The developing world is not homogeneous. It has eight countries only with a population of over 50 million, and 60 with a population of less than 5 million. The solution to the problem of the small countries lies inescapably in greater regional efforts in pooling their available resources of scientific personnel, institutions and funds for their mutual benefit. For them, regional co-operation has an important role to play in the implementation of science policy no less than in general development policy of which it is a part. The large developing countries who are fortunate to have the potential for mounting the required efforts in the science and technology field cannot fail to derive benefit from co-operating with other developing countries but they must also assume a clear obligation to support the efforts being undertaken by countries more deficient than themselves in scientific and technological personnel. The organization of co-operative effort in science and technology spanning the Third World is an exercise which is bound to occupy the attention of policy makers in science no less than in other fields of development."

Turning to the role of developed countries in this regard, he says:

"In the evolution of a science policy for development, there are important, indeed critical roles for the developed world also. They are roles which should be seen as helping to create an international environment propitious to the efforts of the developing countries themselves, as facilitating such efforts by adequate resource transfers, and as supplementing them by supportive work and by restraint on policies that could only frustrate and hinder development. They are roles which require, of course, that development be the substantive goal of the science policy of the industrial world. The redress of poverty must become an end attainable because of, and not despite, the science policy of the rich. It is not without significance that it was the principal resolution of the Seventh Special Session of the General Assembly, seeking to advance implementation of the New International Economic Order, that called for a United Nations Conference on Science and Technology for Development to be held in 1978/1979. That resolution also called for the developed countries to 'significantly expand their assistance to developing countries for direct support to their science and technology programmes, as well as increase substantially the proportions of their research and

development devoted to specific problems of primary interest to developing countries and in the creation of suitable indigenous technology in accordance with feasible targets to be agreed upon.'"

As Dr Chung himself pointed out, the gap between the developed and developing countries is too wide, and if this gap is not bridged through regional or Commonwealth or other international co-operation, then perhaps this, as he hinted, could lead to global violence.

In the area of co-operation either on a regional or on a pan-Commonwealth basis, machinery of some sort for exchanges of persons and information on technician education and training can be considered. For example, there could well be offers of places in technical institutions of Commonwealth countries in the region which other Commonwealth countries could take advantage of. How to get this type of information so that the opportunity is not lost? Of course, the Education Division can act as a clearing house, but an opportunity is given by this seminar for delegates to meet one another face to face, establish closer contacts and set up machinery to take advantage of training facilities that are already in existence in Commonwealth countries in the regions. There could also well be study visits of technician teacher trainers or planners so that they could acquaint themselves further with work done by other countries; or there could be consultations. This is an area which could be investigated so as to formulate some recommendations in that direction. Another area perhaps is the area of attachments of teaching personnel to industry, not in the candidate's own country but in another country, preferably a developing country so that the problems are not too different in terms of environment; or there could be special regional training courses mounted to meet specific needs of member countries. In this connection perhaps the Colombo Plan Staff College can be approached as it has excellent facilities to mount a special course - perhaps from one to three months - on curriculum design for technician education or any other aspect in which member countries feel they need further training for staff connected with the development of technician education.

The idea of having a standing conference of Commonwealth technical educators for the region so that representation from the various countries will have the opportunity to meet regularly to discuss common problems and to improve the systems of training deserves support.

The Commonwealth Fund for Technical Co-operation - Mr Mahendra

The Commonwealth Fund for Technical Co-operation is a multilateral development fund administered by the Commonwealth Secretariat, set up in 1971 and supported by all Commonwealth governments on a voluntary basis. The Fund is the Secretariat's main instrument for the provision of technical assistance. Its operations are conducted through three main programmes. First, there is the General Technical Assistance Programme, under which experts, advisory or operational, from all parts of the Commonwealth are made available in a wide range of inter-related fields of economic and social development, including, of course, technical education and training. Experts have so far been recruited from 21 Commonwealth countries, over 40% of them from developing countries. Secondly, there is the Export Market Development Programme, under which technical assistance is provided to countries wishing to develop exports of agricultural or manufactured products. This includes market research and trade promotion studies. Thirdly, there is the Education and Training Programme, under which awards are made to enable

students from Commonwealth developing countries to undertake study or training in other Commonwealth developing countries.

In considering Commonwealth and regional co-operation in developing technical education and training, the Secretariat, through the CFTC, has an important role. CFTC is not in the same league as the bigger international organizations; its resources are modest; but it enjoys wide support among member governments because it is essentialy a programme of self-help in which the recipients are also donors. Other factors which have contributed to its popularity are the speed and flexibility of its operations.

The main thrust of the CFTC Education and Training Programme is aimed at the training of middle-level personnel from Commonwealth developing countries in other such countries, usually in the same region. The Programme supplements national programmes and other schemes of co-operation by providing awards to enable developing countries to share their education and training facilities and assist in each other's development. This in fact is a form of third country training. A wide range of education and training activities is supported under the Programme, the institutions concerned varying from universities to trade schools. They include training attachments, study visits and participation in seminars and workshops which are developmentally oriented and have a substantial training element. Support is not generally given to participation in conferences which are merely intended for an exchange of information.

Awards are made on the basis of requests by member governments, who decide their own priorities. Within this framework, programmes which will materially contribute to a country's economic and social development are favoured; for example programmes of agricultural development, including forestry and fisheries; education, including technical education and training, teacher training, educational planning and administration; industrial development, particularly small scale industries; transport and communications; development planning and statistics.

Each government has appointed or designated an official agency or an officer through whom the programme is administered - see the last page of the paper on the Education and Training Programme. Any requests coming from a country has to have the support of these agencies, and requests received directly from individuals will be referred back to the agency for clearance before it is processed. Appropriate forms for submission of requests are ET1 and ET3.

Sometimes expert advice outside the Secretariat has to be sought and it is fortunate that in the UK there are a large number of specialist institutions and bodies to consult. In implementing the Programme constant reference is made to the Directory of Education and Training Resources, published two years ago. It has two sections, the first devoted to university and the second to professional and technical institutions in developing countries at the post-secondary level. The Directory is in the process of being revised.

Though the main thrust of the Programme is to develop middle-level personnel and the operations are largely limited to training in developing countries, the terms of reference have been slightly relaxed at the Board of Representatives meeting which took place last week (27 September, 1976) in Hong Kong, one day before the Finance Ministers meeting. Among other matters, proposals were considered for extending the terms of reference

of the CFTC to permit a limited amount of training in developed countries. This was done largely because some member countries felt they were precluded from using the opportunities available under the Programme because of its limitation. As a result, the Board has now agreed to permit the CFTC to fund a limited amount of training in developed countries provided no satisfactory facilities are available in developing countries. It has set a ceiling of £100,000 annually, and this is subject to review as the Programme develops. lt has also recommended certain guidelines for requests to be met under this Programme.

Firstly, awards should be made where assistance was not available under bilateral or multilateral programmes. Secondly, preference should be given to training programmes of not more than one year's duration. Thirdly, preference should be given to training attachments in fields identified by requesting governments as being of indisputable importance to national economic development, for example export market operations, industry, and management. Finally, awards for participants in seminars and workshops with a high training content should be preferred to awards for attendance at conferences that are simply for exchanges of views.

Although this extension has been permitted, only a fraction of the training to be supported in the future will be training in developed countries, and the main emphasis will continue to be training in developing countries.

Some examples of the type of assistance that has been provided under the Programme are given here. Starting with Hong Kong, for understandable reasons Hong Kong has made little use of opportunities available under CFTC's Programme so far. During the financial year 1975/1976, awards were made for officials of the Education Department to undertake two short study visits, one to Singapore to study the Centralized Workshop Scheme and the other to Malaysia and Singapore to study the work of the Federal Examinations Syndicate. Three officers of the Education Department were also supported for courses at the Regional English Centre in Singapore. Currently two statistical clerks of Hong's Census & Statistics Department are following a 10-month course at the International Education Statistical Centre in Calcutta. Hong Kong has been provided with services of two British experts to organize courses for instructors in tool and die making.

Hong Kong's education and training facilities have been barely used under the Education and Training Programme, apart from a study visit to Hong Kong, among other Commonwealth countries, by the Permanent Secretary of the Ministry of Education, Bahamas, to study the educational system. The only noteworthy CFTC sponsored training activity here was a 5-month technician training course at the Medical Rehabilitation Centre, for two trainees from the South Pacific, one from the New Hebrides, and the other from Western Samoa. We have had some feedback on the latter project. Subsequently, a World Rehabilitation Fund expert who visited Western Samoa recently wrote to CFTC to say how impressed he was by the excellent work the Samoan trainee was doing at the General Hospital, functioning as the technician in charge of the unit there.

In considering technical co-operation among developing countries, India has a very special place. The wide range of education and training facilities and expertise available in India has been and is being used extensively under the CFTC's Programme. A good example is the training of 24 technicians from Tanzania who have recently completed a specially arranged course at the Small Industry Extension Training Institute in Hyderabad

in preparation for small industry development in the Ujamaa villages that are a central feature of Tanzania's rural development.

In Africa, Nigeria plays a role similar to that played by India in the Asian region in providing facilities. Nigeria itself has not used the Fund to any appreciable degree. A number of regional institutions in Africa, such as the Mananga Agricultural Management Centre in Swaziland and the East African Telecommunications Training School in Kenya, and national institutions such as the Kenya Polytechnic in Nairobi, have been used for training nationals of other Commonwealth countries. A senior construction engineer from Sri Lanka recently began a two-year assignment with Malawi's Ministry of Works and Supplies. Mr Fong has already referred to the importance that our Secretary-General attaches to regional co-operation; this is an important element in the Secretariat's programmes, and wherever possible CFTC awards are made to enable students to train in their own region. Technical education staff from Bangladesh, Fiji, India, Malaysia, Papua New Guinea, Singapore and Sri Lanka have been granted awards to follow courses at the Colombo Plan Staff College for Technician Education in Singapore. The Staff College was also provided with the services of two experts, both from Britain, one short-term and the other long-term, to assist Dr Chandrakant in developing the programme of the College.

In the Pacific region, the University of the South Pacific is an important regional institution where students and trainees from other South Pacific islands follow courses on CFTC awards, and the short courses are particularly popular. Among those who followed the one-month course for training officers and instructors earlier this year were four trainees from the Gilbert Islands. The Vice-Chancellor of the USP is Dr James Maraj from Trinidad who was at one time Director of the Secretariat's Education Division and later Assistant Secretary-General. His services were provided initially for a two-year period through the CFTC. The Regional Telecommunications Training Centre in Fiji has been assisted by the Fund for traffic staff. National institutions such as the Derrick Technical Institute in Suva and the Honiara Technical Institute in the Solomon Islands have also been used for regional training with CFTC assistance. The South Pacific Commission has undertaken, also with CFTC assistance, the task of preparing a directory of training facilities in the South Pacific which will contain information on facilities available in institutions, government departments and industries, and should be a useful tool in promoting intra-regional training in that area.

In the Caribbean region, CFTC awards have been made for nominees of several countries to follow degree courses in engineering and agriculture at the University of the West Indies. The Mona campus of the University has a diploma course in radiography, which students from the Bahamas recently completed with CFTC awards. The East Caribbean Institute of Agriculture and Forestry in Trinidad, the Caribbean Meteorological Institute in Barbados and the Bahamas Hotel Training School in Nassau are other regional institutions to which Commonwealth Governments have sent students on CFTC fellowships. Advisers on technical education, one from Britain and the other from Canada, are at present serving two-year assignments in the Bahamas.

Practical training attachments have proved very valuable in familiarizing trainees with practices and techniques successfully developed in other Commonwealth countries. An example is the attachment of a trainee from the Sri Lanka Sugar Corporation to Guyana Distilleries Ltd. to study the distillation and blending of liquor.

The education and training facilities in Singapore are being increasingly used for the placement of trainees from other Commonwealth developing countries. The Singapore Port Authority has provided training for personnel from Ghana, the Cook Islands, Malaysia, Bangladesh and Mauritius through CFTC awards. An expert from Singapore has been recruited to help the newly formed Fiji Ports Authority. Malaysia's facilities are also being used under the programme. Malawi has sent students on technician courses to the Telecommunications Training Centre in Kuala Lumpur, and a trainee from Botswana is following a two-year diploma course in radiography at the School of Radiography.

Another aspect of the Education and Training Programme is the Academic Exchanges Programme jointly administered by the Commonwealth Secretariat and the Association of Commonwealth Universities. Awards are provided for university staff for attachments or study visits to universities in developing countries, but a visit must last not more than three months and under this scheme the study visit of a senior lecturer from the University of Hong Kong was financed in 1976 to visit the University of Malaysia to develop links with colleagues working in the same area.

Two special programmes reflect the concern of Commonwealth Governments about developments in Southern Africa. The first is the special Commonwealth Programme for Rhodesian Africans; a trust fund has been set up to which Commonwealth governments contribute and scholarships are awarded to Africans from Rhodesia for courses in institutions in Africa and also in India. A similar programme has been launched for Namibians. The problem here is somewhat different in that the immediate need is for boys to have a secondary school education. Responding to this need the CFTC arranged in September, 1976 for 55 students to be air-lifted from Zambia to secondary schools in Ghana, Sierra Leone and The Gambia.

DISCUSSION

These statements were followed first by a short question and answer session in the course of which the following points were made: (i) examples of the break-up of regional arrangements, such as the University of Botswana, Lesotho and Swaziland, were due to special sets of circumstances, were more than counter-balanced by examples of successful arrangements, and should not dishearten the seminar from promoting greater regional co-operation; (ii) fellowships were available through the CFTC for Commonwealth countries in the two regions to take advantage of the programmes of the Colombo Plan Staff College for Technician Education; (iii) there was a good case for funds to be made available for the exchange of teaching staff at all levels between technician institutions, on the lines of the academic exchange programme between university institutions administered by the Association of Commonwealth Universities; (iv) it was open to the seminar to make generalized or detailed recommendations for ways in which the CFTC and other international and regional organizations might provide financial assistance for co-operation within the framework of the topics of the seminar, which ranged broadly from, e.g. apprenticeship and sandwich courses to levy/grant systems and manpower planning.

The last point gave rise to further discussion and questioning, Mr Mahendra being asked for more detailed information about the history, objectives and procedures of the CFTC and the funds available to it. Most of this information was contained in a new CFTC booklet, "The First Five Years", copies of which had just become available and were distributed by

Mr Mahendra. It was noted that when the Fund was set up in 1971 the Commonwealth Secretariat had very little operational capability. In the light of their better understanding of the sort of assistance that might be available and the channels through which it should be requested delegates proceeded to consider to what extent the seminar's recommendations in this area might be detailed and specific.

In view of the very short time left to it, the seminar, on the suggestion of Mr Fong, set up a small working party to prepare a draft set of recommendations for consideration in plenary session on the next and final day. The working party was asked not to lose sight of the theme of the seminar - co-operation between technical education and industry - or of the seminar's Objective (c), the suggestion being made that the Secretariat might itself, or through consultants, prepare some sort of compendium of effective policies, programmes and activities in the various areas of co-operation between technical education and industry for the guidance of all concerned. Finally, the point was made that non-governmental organizations and institutions, not excluding the universities or autonomous polytechnics like the Hong Kong Polytechnic, were not under the CFTC's rules outside the ambit of the Fund's possible assistance provided that any requests in which they were involved were endorsed and transmitted in proper form by the government concerned.

The seminar in plenary session on the final day, Thursday the 7th October, duly received a draft from the working party and discussed it point by point. The amendments made to the draft were mainly verbal and designed to point them more specifically towards practical action by the various authorities to which they were directed. The Secretariat was authorized to undertake any final editing that might be considered necessary. Subject to these amendments and any further verbal improvements, the draft was approved as the seminar's formal Recommendations for Commonwealth and Regional Co-operation.

ORGANIZATION OF THE SEMINAR

OBJECTIVES AND OUTLINE OF CONTENTS

OBJECTIVES

It is intended that the seminar should bring together senior persons representing the Commonwealth countries of the region who are concerned with the education and training of technicians for industry, in order:

(a) to study information received concerning legislation, organization and institutions in each country designed to prepare young people for skilled employment, and especially information concerning (i) educational and training co-operation between industry and the public education system, and (ii) relationships between industry and the system through representation on boards, councils, committees, examining bodies etc;

(b) to examine how the most fruitful partnerships between technical education (particularly technician education) and industry can be achieved;

(c) to provide material for a publication on measures, activities, schemes and arrangements, which have proved effective in some countries and which other countries might find helpful when considering improvement in their own systems;

(d) to consider and recommend follow-up activities including possible schemes for Commonwealth co-operation in this area, taking into account other international, multilateral and bilateral arrangements, particularly those under the Colombo Plan.

OUTLINE OF CONTENTS

Project One - Partnership: The National Framework

(a) Legislative framework - apprenticeship and industrial training legislation - other relevant legislation - statutory requirements - statutory bodies.

(b) The machinery of government - responsibilities of labour/education/other departments - government agencies - manpower planning machinery - joint overall planning.

(c) Financial framework - departmental responsibilities - industrial training boards/councils/funds - levy and/or grant systems - financing the supply of teachers and trainers.

(d) National advisory/co-ordinating bodies - professional bodies - qualifying bodies - examining bodies - representation of industry.

Project Three - Partnership: Educational Institutions and Industry

(a) Division of responsibility for education/training - management influence - theory/practice integration - capacity of industry for in-plant/in-company/on-the-job training - assessment of training - individual or collective action? - collective training centres.

(b) The product of the schools: pre-vocationally trained? - selection, diagnosis, aptitude testing - career counselling and job placement - employment at what stage? - the role of the training officer - release for related technical education - sandwich/block/day/evening.

(c) Course content - the role of advisory committees - factors affecting the curriculum, the syllabus - whose requirements to be met? - external/local/internal examinations - employability.

(d) Coming and going between college and industry - representation of industry on governing bodies - supply by industry of part-time teachers - visits to colleges by industrial training officers/training staff/managers/skilled workers - visits or attachments to industry by teachers, students.

Project Three - Technical Education in an Industrializing Society

(a) The needs of industry and individual choice - status and remuneration - job satisfaction - the scale of industry - the special needs of small industries.

(b) The development of the individual - general studies - scholarship policy - opportunities for further education or training at home or overseas based on ability - re-education and continuing education.

(c) Relevance to needs of the economy - environmental, product and safety standards - self-employment - special training needs of women and girls? - interdisciplinary activity.

(d) Areas of growing importance - the Asian and Pacific scene - level of development - appropriate technology - the leading and supporting roles of technical education.

PROGRAMME

DAY	MORNING		AFTERNOON		EVENING
Monday 27 Sept.	9 a.m. - 10.30 a.m. (Coffee) REGISTRATION OF PARTICIPANTS	11 a.m. - 12.30 p.m. (Tea)	2 p.m. - 3.30 p.m.	4 p.m. - 5.30 p.m.	
Tuesday 28 Sept.	10 a.m. - 11.15 a.m. Opening Ceremony (P)	11.30 a.m. - 12.30 pm General Briefing (P)	Country Papers (P)	Project I lead (P)	6.30 H.K. Government's Cocktail Reception at the Excelsior Hotel
Wednesday 29 Sept.	Project I Groups (G)	Project I Groups (G)	Visit to Kwun Tong Technical Institute and to Hong Kong Polytechnic		
Thursday 30 Sept.	Project I (Conclusions) (G)	Project II Groups (P)	Project II Groups (G)	Project II Groups (G)	
Friday 1 Oct.	Project II Group (Conclusions) (G)	Consideration of I Group reports (P)	Cultural tour of Hong Kong Island (2 p.m. start - abotu 6 p.m. finish)		
Saturday 2 Oct.	Cultural tour of the New Territories (9 a.m. start - about 4 p.m. finish)				
Monday 4 Oct.	Consideration of II Group reports (P)	Project III lead (P)	Project III Groups (G)	Project III Groups (G)	
Tuesday 5 Oct.	Project III Group (Conclusions) (G)	Commonwealth and Regional cooperation (P)	Visit to Sonca Industries Ltd. and to Texwood Ltd.		7.30 for 8.30 H.K. Government's Dinner Reception at the Furama Hotel
Wednesday 6 Oct.	Consideration of III Group reports (P)	Inter project (Conclusions) (P)	Tour of Hong Kong waterways and islands		
Thursday 7 Oct.	10.45 a.m. - 12.45 p.m. Recommendations for Commonwealth and Regional cooperation Conclusions (general) (P)		Delegates disperse		7.30 Commonwealth Secretariat Party

NOTE : P - denotes plenary session G - denotes group session

SPEECHES AT THE OPENING CEREMONY

Speech by Dr The Hon. S.Y. Chung,
Senior Unofficial Member of Legislative Council

Mr Chairman, Ladies and Gentlemen,

It gives me great pleasure to have this opportunity to welcome the distinguished overseas delegates to Hong Kong. For those of you who are visiting Hong Kong for the first time, I am sure you will have a unique experience which you will pleasantly remember for a long time. For those of you who have been here before, I am sure you will welcome the opportunity to renew your acquaintance and happy memories.

One of the major world problems today is the development gap between the advanced countries and the developing nations. Take for an example the developing countries of Asia; these emerging nations contain almost one-third of the world population but it is reported that their share of the world's industrial output is less than 4 percent. Such unfavourable comparisons equally apply to those developing countries in Africa and Latin America.

Taking another common yardstick to express the economic gulf between the industrially-developed and the less-developed countries, the average yearly per capita national income of North America reaches as high as US $5,000 and of the European Economic Community about US $3,5000. In contrast, the average per capita income of the developing nations in Asia barely exceeds US $250. In fact, many of the developing countries in Asia have a per capita income as low as US $100 to US $150.

The widening economic gap between the rich and poor nations has been and is still causing growing concern, particularly in the context of the so-called "North-South" problem. The ancestors of the people in these developing nations were to some extent unaware of the high material standards of the economically-developed countries and were therefore prepared to accept what they had, despite how little that was. With the tremendous improvement in world communication and transportation in recent decades, the peoples of these developing economies are no longer isolated from other parts of the world nor are they ignorant of the affluence in the developed countries.

Rightly or wrongly, the peoples of the emerging economies expect a better share of the world's material wealth. It is generally recognised that unless this economic gap is narrowed, there would be growing discontent among the peoples in the less developed countries and if this is allowed to continue without correction it could lead to global violence.

One of the major causes of the developmental gap between the advanced and the developing countries is widely believed to lie in the disparity in the levels of science and technology between these two groups of countries. The United Nations has conducted much research in this area and, as a result, the strategy in the UN Second Development Decade for the industrializing countries attaches great importance to the role of science and technology and stresses the urgent need for acceleration in technology transfer and in self-reliance.

For successful transfer of technology and to narrow the technological gap the recipient country must have the capacity and capability to accept the technology transfer. To elaborate on this point: even if a developing country is provided with sufficient funds to procure industrial plants from an advanced country and given sufficient markets for its products, the developing country will not succeed in its industrialization unless it has the technological capability not only to operate and manage these purchased plants but also to improve upon them from time to time so as to bring the technical standards of the plants up-to-date as time goes on. Hence, unless the recipient country has the technical manpower, both in appropriate quality and adequate quantity, it is difficult to successfully implement the technology transfer and industrialization. For this reason, the development of technical education and industrial training is of paramount importance in the industrializing nations.

Turning to the domestic scene, for over a hundred years and until the early 1950s, Hong Kong has been living on entrepot trade. It was only 20 years ago, as a result of changed circumstances beyond our control, that Hong Kong lost its traditional source of income and had to shift its economic dependence to the manufacturing industry as its arable land was so limited. Furthermore, because Hong Kong had no natural material resources and was, at that time, in need of many employment opportunities for its inflated population, its manufacturing industry had to be import-oriented material-wise, export-oriented productwise, and labour-intensive. From very little beginnings Hong Kong is now known throughout the world as a centre of manufacturing for light consumer and engineering products.

The success of Hong's industry is reflected in rising wages and salaries. Today, Hong Kong's industrial wages are the highest in Asia after Japan and Hong Kong's professional salaries are even among the highest in the world. Coupled with high cost of land and building construction, Hong Kong is no longer a low-cost territory as it used to be 10 or 15 years ago.

Resulting from these changed and still changing circumstances, Hong Kong's manufacturing industry cannot continue to compete with other low-cost territories in price in world markets. Hong Kong is aware of this situation. However, since Hong Kong's economic survival depends on its exports, Hong Kong has no alternative but to find ways and means to maintain its competitive position in the export market. It is therefore obvious that Hong Kong must improve its industrial productivity through mechanisation of its existing industries as well as develop more sophisticated and technologically advanced industries. Hong Kong has to follow the foot-steps of the industrially-advanced countries whose industries, faced with severe competition from low-cost territories, have to compete not in price but on quality and technology. For this reason, the development of technical education and industrial training in Hong Kong is of great importance to our future well-being.

Only seven years ago, technical education for a population of four million people in Hong Kong was limited to one of the two universities and the then Hong Kong Technical College. The total number of places for full-time technical education was less than 2,000 - 500 at the University of Hong Kong and 1,400 at the Technical College.

Realising the urgent need to significantly expand technical education, the Hong Kong Government has in recent years made great strides. The first Technical Institute, designed primarily for technicians and craftsmen, was opened in 1969 at Morrison Hill. It can accommodate about 1,400 full-time equivalent students. Since then two more such Technical Institutes have been built in Kowloon and the fourth one is scheduled to commence operation in 1977. At the University of Hong Kong, a new department of industrial engineering was established in 1973 and the total enrolment in the faculty of engineering and architecture has increased to over 800.

The greatest expansion in technical education in Hong Kong occurred with the establishment of the Hong Kong Polytechnic which was converted from the Technical College in 1972 for the training of technologists, professional engineers and high level technicians. The ambitious Polytechnic development programme calls for an increase to 8,000 full-time equivalent places and to 20,000 part-time evening places by 1978.

Both the Government and industry recognise that there is increasing demand for technical education and that there was and still is a lack of training facilities and technical education opportunities in Hong Kong. Therefore despite Hong Kong's financial stringency in the last two years, the Government has continued to divert substantial public funds toward the great expansion of technical education. By the end of this decade, Hong Kong should be able to provide sufficient technical education facilities for a total enrolment of 50,000 places for full-time, part-time day and evening students. In order to put this number of 50,000 places into proper perspective, it will be equivalent to 1% of the total population in Hong Kong, or 2½% of the working population or 5% of the manpower employed in the industrial sector.

We in Hong Kong also realise that technical education without industrial training is just like a half-baked potato. Since 1970 some efforts have been made in promoting industrial training and a bill on industrial training was enacted this year. Efforts are also being made jointly by the Government and industry to establish training centres for different trades. Two such training centres, one for clothing and the other for the construction industry, are being set up.

As we in Hong Kong are in the midst of a vast expansion of our facilities for technical education and industrial training, we specially welcome the opportunity of hosting this Commonwealth Regional Seminar on Technical Education and Industry. Through the exchange of knowledge and experience, Hong Kong will certainly benefit from this Seminar.

Ladies and Gentlemen, it now remains for me to wish you all every success in the deliberations at your Seminar and a very pleasant and interesting stay in Hong Kong.

Speech by Mr B.F.C. Fong, Assistant Director,
Education Division, Commonwealth Secretariat

Mr Chairman, your Excellencies, Delegates, Ladies and Gentlemen,

I would like first to express our grateful thanks to Dr Chung for honouring us by opening this seminar. As one who combines academic distinction with a leading role in the industrial life of this great city, Dr Chung is a shining example that education and industry are not necessarily worlds apart, and that, in Hong Kong, one is enriched by the other. I should like to thank him also for drawing our attention to the critical needs of developing countries for industrial skills to achieve developmental goals and for self-reliance. The plight of Third World countries suffering from a deficiency of technical expertise is well known to you; I therefore need not dwell further on this point, and bother you with facts and figures.

Next, I should like to extend a very warm welcome to all delegates, observers, and the guests present, on behalf of the Commonwealth Secretary-General, Mr Shridath Ramphal, and to convey his greetings to you. As you perhaps already know, Mr Ramphal is here in Hong Kong to officiate at the Meeting of Commonwealth Finance Ministers. Understandably he is unable to be with us this morning, but hopes to meet you before we disperse. I may add that Mr Ramphal has a keen personal interest in the subject of education and training as he himself comes from a developing country, Guyana. Besides that, he looks upon industrial training as an essential component of Commonwealth co-operation in industrial development in pursuance of the New International Economic Order; and Commonwealth Heads of Government have attached high priority to this as a means of diminishing the gap between the rich and poor nations.

I also wish to express the Secretary-General's gratitude to the Hong Kong Government and to the Education Department in particular for their kind offer to host this seminar and generosity in putting its resources at our disposal, and also to the Polytechnic for its contributions. Excellent arrangements have also been made for our physical comfort and to cater for our professional and cultural interests. For all of us, particularly for those who are here for the first time, the magnificent buildings of Hong Kong, its major engineering installations, its bustling commerce and industry and its dynamic educational institutions will provide inspiration for our work over the next two weeks.

The Commonwealth Secretariat's Education Division is responsible for the initial planning and organizing of this seminar. You may be interested to know in passing that the Division's history goes back to some 16 years ago when it began in the form of a Commonwealth Education Liaison Unit. That Unit was set up on the recommendation of the first Commonwealth Education Conference held in Oxford in 1959. The high priority given to technical education and industrial training is shown by the decision to hold one of the first Commonwealth Specialist Conference in the area of technician training. This was the Conference on the Education and Training of Technicians held in Huddersfield, England, in 1966. It gives us great pleasure to see that we have with us at this seminar at least three people who were present at that conference. One of them was Dr Chandrakant, who is presenting one of the lead papers for this seminar. At Huddersfield, Hong Kong was then represented by Mr C.T. Kell, Assistant Director (Further and Technical Education) and Mr S.Z. Sung, Principal of the then Technical College.

It may be recalled that at that specialist conference the host was Mr Alexander MacLennan, then Principal of the Huddersfield College of Education (Technical). Most of us recognise Mr MacLennan's immense contribution to technical education in the Commonwealth. We commissioned his book "Educating and Training Technicians" in order to develop and update the thinking of the 1966 Huddersfield Conference, and published it quite recently. We have sent copies to all delegates and a few copies of the conference report itself will be made available to delegates for reference during the seminar.

We cannot claim to have done as much in this vital area of education as we should have liked. Our activities can only be as extensive as our resources permit and were, initially, confined to studies of facilities available in industry for practical training. But the establishment of the Commonwealth Fund for Technical Co-operation in 1971 added a new dimension to the activities of the Secretariat; and much of the movement between developing countries of the Commonwealth for technical training has been sponsored by the Fund's Education and Training Programme. It seems therefore natural that, at this seminar, we shall explore further how the Fund can assist in promoting a wider exchange of expertise and experiences. Meanwhile, Commonwealth Education Ministers meeting in Lagos, Nigeria, in 1968 and also in Canberra, Australia, in 1971, have strongly urged greater activity in the field of technician training. They will be due to meet again early next year in Accra, Ghana, at the Seventh Commonwealth Education Conference. Commonwealth Education Ministers will no doubt be very much interested in not only the report of this seminar but especially the practical actions you will recommend as a result of your deliberations.

We are very conscious in the Secretariat of the immense activities under bilateral and international aid auspices in the area of technical education and industrial training. We shall take into account the efforts of other international organizations such as UNESCO, ILO, and the Colombo Plan in order to avoid wasteful duplication of efforts but more positively to make our contributions where the needs are most urgently felt. In this connection, I have the added pleasure to welcome the representative of ILO, Mr R. Campbell, and Dr Chandrakant, Director of the Colombo Plan Staff College for Technician Education who is also one of our consultants. The other consultant is none other than the eminent Director of your Polytechnic, Dr Keith Legg.

This must bring me to say a few words about the actual content of the seminar. The subject of the seminar is "Technical Education and Industry"; and this is intended to mean the relationships amounting to a partnership that ought to exist between them; the interface between them, to use a fashionable word. But let me add that, while the interface extends through all the strata from the education and training of postgraduates to that of semi-skilled workers, we wish this seminar to place the emphasis on the technician level. Indeed, the emphasis falls there in any case, because it is at the level of technician education and training that co-operation becomes so vitally important that the contributions of industry and the public education system must be absolutely complementary. Moreover there are problems at this level that are more acute than at other levels. In most countries there is a near-crisis shortage of highly skilled men or women. This may be because the possible role of the technician has failed to capture the imagination of employers, or at least to convince them that technicians must be accorded status and salary superior to those enjoyed by craftsmen and little inferior to

those enjoyed by professional engineers and other technologists. The problems at this level were clearly identified by the Huddersfield Conference and by subsequent Commonwealth Education Conferences, and we shall be following their lead if we concentrate on the interface at this level, without, of course, totally neglecting those relationships between education and industry that apply to all levels.

This emphasis on the technician level does not, we sincerely hope, mean that our seminar will be of no interest to the less developed countries of the two regions. It is true, on the evidence of their own country papers, that for some of them the interface between technical education and industry is at present mainly at the trade training and trade apprenticeship level. But in looking forward to the expansion of their facilities upwards into the technician level in the not far distant future, the representatives of these countries will have contributions to make, and will also want to learn of the experiences of their more developed neighbours, and of their successes and failures. Another important point is that these less developed countries in particular may be able to benefit from measures of regional co-operation in technical education and industrial training which are among the questions on which we wish to reach some practical conclusions.

This brings me to my two final points. The first is that when sponsoring education seminars or conferences the Commonwealth Secretariat always tries its best to ensure that practical action will result in some form or other, or preferably in several forms, which will help to solve or ease problematical situations faced by member countries. This means that, at our closing sessions, we shall want to formulate recommendations that are not just pious hopes or expressions of agreement about philosophy, but genuine and realistic proposals for improvements, for example in legislation or in organization or in training methods. We shall need to incorporate these recommendations in our report. We also have in mind the possibility that, if there is enough material, the Commonwealth Secretariat might publish an account of interesting measures, arrangements, innovations, case studies, success stories, whatever delegates think best; this will be for all to decide.

Finally, may I return to the point about regionalism, and say that the Commonwealth Secretariat attaches great importance to supporting co-operative arrangements within a region, if only because the smaller or poorer countries cannot economically set up their own educational or training facilities when only small numbers are required in particular grades or categories. Towards the end of the seminar, we shall be discussing more about regional schemes and programmes which are in operation or being planned, to show the framework within which the seminar can make its own recommendations. Among the literature we have already supplied are copies of papers and reports relating to the Secretariat generally and the education and training programme of the Commonwealth Fund for Technical Co-operation in particular. Of course, we are not the only people interested in regional action, and we are fortunate to have with us representatives who can tell us more about ILO and the Colombo Plan and their activities and potentialities in the Asian and Pacific regions. The South Pacific Commission and UNESCO have also expressed interest in our seminar and asked to be kept informed. It may be that you will want to direct some of your recommendations to one or more of these agencies. There is also room for pan-Commonwealth thinking and action for exchanges of ideas and people between the regions. That is why we have invited a distinguished representative from an African country to join us here. Dr Ajayi, besides being Principal of the

well-established Ibadan Polytechnic, holds national positions in education and training in Nigeria and has excellent contacts in other African countries. He may well be able to provide links within the African region as well as with other regions.

It only remains for me to wish you an interesting and enjoyable seminar.

SOME MAIN FEATURES OF COUNTRY PAPERS

Apprenticeship

Because the emphasis of the seminar has been placed on education and training at the technician level, several governments and individuals submitting country papers have regarded the subject of apprenticeship as marginal to the seminar on grounds that it traditionally relates mainly to craft training. However, for the less developed countries where education and training at the technician level is only now being introduced or planned, apprenticeship represents the main function for which there is substantial interplay between employers and training institutions. For any detailed examination of this relationship, legislation such as the Apprenticeship Act and Regulations submitted by Western Samoa and the Apprenticeship Scheme submitted by the Solomon Islands will be of interest. The Apprenticeship Council of Western Samoa includes representatives of industry, including the Director of Works, the President of the Chamber of Commerce, and three members representing employees (but not employers) in the building, engineering and electrical trades. The Solomon Islands (Labour Apprenticeship) Rules 1970 do not specify that the Apprenticeship Board should include representatives of industry. Of interest also is the Hong Kong "Guide to the Apprenticeship Ordinance 1976 and the Apprenticeship Regulation 1976", Appendix D to the Hong Kong country paper (this was not circulated, but copies are available). Also available for reference is a study by Dr Chandrakant, "Apprenticeship: An Analytic Study of Contemporary Developments of Education in Industry", which deals with the history and philosophy of apprenticeship in a number of countries, especially India, but including UK, USSR and USA.

The India country paper describes how the Apprentices Act of 1961 was amended in 1973 to provide for the training of engineering graduates and diploma holders (technicians) as well as of craftsmen, the object being "to provide practical training in industry at the end of theoretical training in educational institutions in order to condition them for gainful employment". This came into force only in August 1975, and has placed new training obligations on employers. Technician apprenticeship alos exists in Sri Lanka, the National Apprenticeship Act of 1971 having provided for control over apprentices at both craft and technician levels.

National Councils

These are an interesting selection, varying in function and "bite". The India paper describes the All-India Council for Technical Education, "the national body established by the Ministry of Education to advise the Central and State Governments on all aspects of improvement and development of technical education including technician education"; commerce and industry are strongly represented. The Bangladesh country paper states that a Council

of Technical and Vocational Education is to be set up as proposed at a Colombo Plan Seminar in 1975, and preliminary steps have been taken. Suggestions are also made in the paper about the functions and composition of such a council. In Fiji there is a National Training Council, a statutory body which has representatives from industry, commerce and government departments, but the paper suggests that this has not yet "bitten" at the technician level because technician courses have so far been geared to overseas schemes. In Singapore there is a National Industrial Training Council responsible for general policy relating to technical education and industrial training; it had sufficient authority to be responsible for the creation of the Technical Education Department as a separate entity within the Ministry of Education in 1968. That Department became the Industrial Training Board in 1973, see also para 4 below. Hong Kong has a Training Council with terms of reference set out in its paper and membership which well illustrates the strength of industrial representation. The Council has a committee on technical training in institutions.

Representation of Industry on Relevant Bodies

Understandably, the most industrialized countries, India, Singapore and Hong Kong, have the most bodies on which industry is represented. In addition to the Training Council, the Hong Kong paper describes the Industry Training Boards, the Polytechnics' Departmental Advisory Committees, and the Polytechnic Board of Governors, and show representation of industry in detail. The India country paper gives information about the All-India Council, and also about Regional Committees, State Boards of Technical Education, Boards of Studies, State Industrial Liaison Boards, and Advisory Councils for polytechnics, on all of which industry is represented. The Singapore paper, in addition to the National Industrial Training Council and the Industrial Training Board, mentions a Central Agency for Industrial Orientation, Trade Advisory Committees, and the ITB's Permanent Standing Committee on Apprenticeship and Trade Testing, as well as the Singapore Technical Institute and other training institutions run by the ITB, on which industry is well represented.

Industrial Training Boards

The scope of such boards varies between countries. In Singapore there now exists a single Board formed to centralize, co-ordinate and intensify industrial training. The Board itself runs training institutions, some general, some specialist - for example, for printing and for hotel and catering work. Other countries have adopted the UK precedent of establishing training boards to identify and provide for training needs industry by industry. In Fij industrial training boards have been set up by the National Training Council with representation from industry and educational institutions, act in an advisory capacity on matters relating to the training needs of industry. In Hong Kong the Industry Training Boards determine the manpower needs of the industry, prescribe job standards, design training programmes, liaise between managements, educational and training institutions and government departments, consider questions of financing industrial training and advise the Training Council on legislation.

Visits and Attachments

There are few references in the country papers to inter-visiting between technical education and industry, either at student or staff level on the

college side or at the level of skilled worker, manager or training officer on the industrial. The India paper mentions a number of co-operative activities which involve visits or attachments, including short-term training for teachers "extending over a period of three or four months, provided to all teachers of polytechnics in a phased manner, in industry". The paper also refers to attempts to promote the use of visiting lecturers and reports that "practising engineers, designers and consultants are serving as part-time faculty in many institutions". Sri Lanka states that there has not been much interaction between institutions and industry, but refers to the exchanges of views between educationists and non-educationists that go on in professional bodies and expresses the view that teachers should make visits to industry along with students for industrial tours. The Fiji paper says that communication between industry and its main technical institute is improving, but that there is not enough involvement of industrial representatives in the affairs of the institute, and that regular industrial visits and staff attachments are being planned.

Sandwich Courses

These also are characteristic of the more industrialized countries, because arrangements are difficult if not impossible where there is not sufficient demand in a small geographical area for particular categories of highly skilled technicians. The India paper mentions that sandwich course training can be provided under the Apprentices Act 1961, as well as training after completion of the educational course, and states that there are 46 sandwich institutions in the country offering technician programmes, with an annual admission capacity of 2,500 students. The Hong Kong paper states that sandwich courses will be offered by the Polytechnic in collaboration with industry or professional institutions, but that it at present runs only one sandwich course, a two-year technician diploma course in yarn manufacture.

Examinations

Details of the structure and methods of functioning of examining bodies have not been given and it is not possible to assess the representation of industry and its power to contribute to the formulation of syllabuses and examinations in any country. The India paper states that the evaluation of students on the basis of an external final examination has been the practice in the polytechnics, but a mixed evaluation system is being developed which combines continuous assessment and external examination; there are both Central and State authorities which contribute to determining the standards and content of what is taught. In Bangladesh there is a Board of Examination for Technical Education which, as in India, ensures that classroom and laboratory work is given due weight alongside the Board's own Part and Part II examinations. Fiji refers to its use of external (in the sense of being non-national) examinations, in this case the City & Guilds of London Institute and New South Wales and New Zealand certificates; but development is in directions more closely related to the needs of Fiji. The Hong Kong paper lists and describes the range of courses run by the Polytechnic and the certificates and diplomas involved.

Manpower Surveys

In India estimates of the demand for technicians are made by the Employment and Manpower Division of the Planning Commission at the Centre and by similar organizations at State level. The Planning Commission is assisted by

the Institute of Applied Manpower Research in making manpower studies and estimates. In Bangladesh manpower surveys are done by the National Manpower Council, Central Statistical Bureau, Labour Department and Planning Commission. In Fiji the Bureau of Statistics, a section within the Ministry of Finance, is responsible for manpower planning in consultation with the Central Planning Office. The Hong Kong paper states that each of the industry training boards is required to determine the manpower needs of the industry concerned and to make recommendations to the Training Council; a third series of industrial manpower surveys conducted by the training boards between 1974 and 1976 surveyed all the ten major industries.

Levy/Grant Systems

Fiji states that its National Training Council is responsible for the administration of a levy/grant system under which employers pay 1% levy of pay-roll to the council which is intended to assist in the cost of training at all levels. The introduction of levy/grant machinery is leading to the employment of training officers by larger firms, and the smaller are pooling resources in group training schemes. In Hong Kong two of the industrial training authorities (for construction and clothing) are empowered to impose a levy on exports of clothing items and on building and civil engineering contractors for the purpose of establishing and running centres to provide basic training. The Training Council was invited to advise whether a levy should be imposed on the industries but decided that, before it could recommend a general levy, the eight remaining industry training boards should be asked to consider the feasibility of training schemes based on levies. The UK Department of Employment has recently issued a consultative document for a scheme which would abolish the levy/grant system in favour of a "collective fund"; copies of the document are available.

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LIST OF PARTICIPANTS

DELEGATES

BANGLADESH

Mr A.K. Azad	Principal, Khulna Engineering College, Khulna.
Mr A.A. Faizul Kabir	Principal, Graphic Art Institute, Dacca - 7, Bangladesh.

BRUNEI

Awang Ahmad bin Haji Jumat	Acting Director of Education, P.O.Box 206, Bandar Seri Begawan.
Awang J.A. Benyon	Organiser of Technical Education, P.O.Box 206, Bandar Seri Begawan.

FIJI

Mr Saula Ledua	Senior Education Officer, Ministry of Education, Youth and Sport, Suva.
Dr A.V. Swamy	Principal, Derrick Technical Institute, P.O.Box 3722, Samabula, Suva.

HONG KONG

Mr A.J. Kingwell	Deputy Director of Education (Technical), Education Department, Hong Kong.
Dr Keith Legg	Director, The Hong Kong Polytechnic, Yuk Choi Road, Hung Hom, Kowloon.

Mr H.R. Knight	Assistant Commissioner for Labour, Industrial Training Branch, Labour Dept., Asian House, 12/f., 1, Hennessy Road.
Mr V.H. Greenwood	Senior Training Officer, Public Works Department, Murray Building, 20/f., Garden Road.
Mr Cecil S.O. Chan (Alternate, Mr Joseph Yip)	Joint Director, The Hong Kong Federation of Industries, Eldex Industrial Building, 12/f., Unit A, 21, Ma Tau Wei Road, Kowloon.
Mr Paul Lim	Director, The Chinese Manufacturers Association of Hong Kong, 64-65, Connaught Road C.

INDIA

Mr V.R. Reddy	Director (Tech.) & Additional Apprenticeship Adviser, Ministry of Education and S.W., Shastri Bhawan, New Delhi - 110001.
Dr V.C. Kulandaiswamy	Director of Technical Education, Government of Tamil Nadu, Madras 600 025.

MALAYSIA

Datuk Lokman bin Musa	Director, MARA Institute of Technology, Shah Alam, Selangor.
Syed Mustaffa bin Syed Ali	Principal, National Youth Training Centre, Dusun Tua, Selangor.
Syed Abdul Kader Al-Junid	Head, School of Engineering, MARA Institute of Technology, Shah Alam, Selangor.

PAPUA NEW GUINEA

Mr D.W. Mummery	Department of Education (Technical Division), Konedobu.

SINGAPORE

Mr Peh Tow Toon	School Adviser (Technical), Ministry of Education, Kay Siang Road, Singapore 10.

Mr John Toh Tio Hiong	Specialist Adviser, Ministry of Education, Kay Siang Road, Singapore 10.

SOLOMON ISLANDS

Mr Alan Hatfield	Principal, Honiara Technical Institute, P.O.Box G23, Honiara.
Mr Wainga T. Tion	Labour Division, Ministry of Foreign Trade, Industry & Labour, Honiara.

SRI LANKA

Mr R. Paskaralingam	Additional Secretary, Ministry of Education, Malay Street, Colombo.
Mr D. Amarasinghe	Director of Education, Technical Education Division, Ministry of Education, Malay Street, Colombo.

TONGA

Mr Pita Pua	Tonga College, Nukualofa.
Mr Tevita Pilimilose'Aho	General Service Supervisor, Ministry of Works, Box 51, Nukualofa.

WESTERN SAMOA

Mr D.F. Holmes	Principal, Technical College, P.O.Box 861, Apia.
Mr Martin Kleis	Commissioner of Labour, P.O.Box 431, Apia.

CONSULTANTS

Dr L.S. Chandrakant	Director, Colombo Plan Staff College for Technician Education, P.O.Box 187, Tanglin P.O., Singapore 10.
Dr Keith Legg	Director, Hong Kong Polytechnic, Yuk Choi Road, Hung Hom Kowloon, Hong Kong.

OBSERVERS

Dr. O.A. Ajayi	Principal, The Polytechnic, P.M.B. 5063, Ibadan, Nigeria.
Mr Robert B.P. Campbell	Chief Technical Adviser, National Service for Technical Skill Promotion and Job-Entry Training for Industry, ILO Regional Office for Asia, 11th Floor, United Nations Building, Sala Santitham, Bangkok 2, Thailand.
Dr Lee Kai Fong	Lecturer, Department of Electronics, The Chinese University of Hong Kong, Shatin, New Territories, Hong Kong.
Dr Andrew S.L. Chuang	Lambda Electronic Ltd., Melbourne Plaza, 33 Queen's Road, Central, Hong Kong.
Mr Nicholas Yek	Principal Trade Officer, Commerce and Industry Department, 46, Connaught Road, Central, Hong Kong.
Dr Leung Wi Sun	Dean of Faculty of Engineering and Architecture, University of Hong Kong.
Professor J.C. West	School of Control, Electrical and Systems Engineering, University of Sussex (U.K.), c/o University of Hong Kong.
Dr David S.B. Au	Divisional Manager, Manpower Development Division, Hong Kong Productivity Centre, 20/f., Sincere Building, Hong Kong.
Mr T.R. Maclean	Secretary, The Hong Kong Institution of Engineers, 1513 Hang Lung Centre, Causeway Bay, Hong Kong.
Mr W.J.K. Ellis	Principal Government Training Officer, Government Training Division, Lee Gardens, 2/f., Causeway Bay, Hong Kong.
Representing W.C.O.T.P.:	
Dr J. Chan	Academic Adviser, Hong Kong Teachers' Association, National Court, Nathan Road, Hong. Kong

Mr. M.C. Fong	Secretary Hong Kong Teachers' Association, National Court, Nathan Road, Hong Kong.

SEMINAR DIRECTOR

Mr B.F.C. Fong	Assistant Director, Education Division, Commonwealth Secretariat, London.

SEMINAR SECRETARY

Mr H.M. Collins	Senior Education Officer, Education Division, Commonwealth Secretariat, London.

Also representing the Commonwealth Secretariat:
Mr S. Mahendra, Chief Project Officer,
Education and Training Division,
Commonwealth Fund for Technical Co-operation.

THE HONG KONG WORKING PARTY

Mr K.W.J. Topley - Chairman
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Mr H. Cameron
Mr H.R. Knight
Mr A.L. Purves
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THE SEMINAR MANAGEMENT TEAM

Mr R. Bray, Seminar Manager
Mr J. Gillard, Chief Rapporteur and Liaison Officer
Mr K.F. Leung, Social and Amenities Officer
Mr Joseph Wong, Office Manager
Mr G.A.V. Ribeiro - Secretary.

THE SEMINAR RAPPORTEURS

Mr R. Harper
Mr R. Vardy
Mr F.K. Chan
Mr C. Durkin
Miss Shirley Im
Miss Miranda Lim

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