MALAYSIA

EXISTING PROGRAMMES

In Malaysia the National Industrial Training and Trade Certification Board (NITTCB), under the Ministry of Labour and Manpower in co-operation with the private sector, has developed national standards at basic, intermediate and advanced levels for 19 industrial trades. To assist training institutions, the NITTCB has prepared national training syllabuses for 18 trades at basic level and work is now in progress to prepare syllabuses for these trades at intermediate and advanced levels. The Board will also undertake the specification of training standards and syllabuses for other industrial trades. The certificates to be awarded by the NITTCB will command acceptance in both public and private sectors. The Directorate of Technical Education is in overall charge of lower-level technical education.

Technician training is provided in three institutions - Ipoh Polytechnic, the National Institute of Technology, and the MARA Institute of Technology.

Engineering degree courses are run by the National Institute of Technology. This Institute also runs diploma courses in engineering, which are mainly broad-based and conventional. The University of Malaya has an engineering degree course of four years' duration.

Ipoh Polytechnic runs diploma courses on a sandwich pattern of two years' duration, so in this institution efforts are made to link technical education with practical training in industry in an effective manner. One more polytechnic, at Kuantan in Pahang, is in process of development. This polytechnic is understood to be designed to run agricultural product processing courses besides sandwich technician courses, and will have an enrolment of over 1,000 students. The Government has given high priority to the development of technical education and training at all levels.

It was heartening to note that the expansion and intensification directed towards strengthening facilities for technical education are being co-ordinated at the highest level by the Economic Development Division of the Prime Minister's Secretariat. Also, through the National Advisory Council on Industrial Training, the various training programmes conducted in the industrial institutes are being effectively monitored so that they are related to actual needs of industry and the economy as a whole. This in the long run will check the haphazard growth of technical institutions, and as a result the labour market will not suffer from fluctuations in supply.

The Technical Teachers' Training College conducts a three-year trade teachers' course for training vocational teachers in the engineering trades. This is one field where shortages of properly trained and qualified teachers at all levels continuously hamper the development effort. The Government has utilized, and is still anxious to make the best use of, training facilities offered by other countries in the Asian region.

OVERSEAS TRAINING

In view of the shortage of high-level manpower, efforts have been made to augment the supply from local institutions through the provision of more scholarships for overseas training. During the period 1971-73, a total of 1,962 scholarships, including the MARA awards, were given in various fields - most of them in science, technology and education. In addition to such Government scholars, there are an estimated 18,000 private students undertaking a variety of courses in foreign institutions.

SALIENT FEATURES OF TECHNICAL EDUCATION PROGRAMMES

Industrial training is being organized in vacations. Facilities offered by industry are utilized by the MARA Institute, the National Institute of Technology and the University of Malaya. Training facilities are offered by most sizeable industries.

The training programme run by the Tele-communications Centre, the National Electricity Board and the Railways Training Institute are by far the most satisfactory both in quality of training and in material resources. The training is meaningful in that it caters for the needs of the Government as well as of the private sector.

In Malaysia they have injected a technical/vocational stream into the education system from the lower secondary level. The result is that the end-product is job-oriented and the basic skills and knowledge are those sought after by employers.

Two-year programmes for ordinary grade technicians are run in the Ipoh Polytechnic. Engineering and commercial subjects are also run at diploma level. It is expected that the Ipoh Polytechnic will have an intake of 1,273 technicians in 1975 compared with an intake of 493 in 1970.

Vocational schools are run to prepare appropriate manpower for employment in accordance with precise requirements. The MARA Institute also runs vocation-oriented courses.

In Malaysia newer and diverse types of industry will require more and more technicians and middle-level personnel trained in specialized fields. During the pre-independence period the emphasis was mainly on the production of raw materials requiring technicians for a few narrow fields. Now that special and technology-intensive industries are coming up, the country will require technicians of a wider range. The technical and engineering personnel required to man and manage the industries will have to be fully equipped so that they can match their capabilities with the changing requirements of modern technological advance.

The country will thus face a shortage of adequately trained engineers and technicians in the various specialized fields and emerging technologies for some time. It will certainly seek effective assistance and technical co-operation from countries that have developed proper expertise and training facilities in the diverse specialities.

Malaysia has in the past utilized training facilities available in the countries of the Asian region for the training of technician teachers. It will certainly want to continue to avail itself of such facilities.

The present demand both for middle (diploma) and professional (degree) technologists is very great for both public and private sectors. An example was shown in a report by the Economic Planning Unit of the Prime Minister's Department entitled "Manpower Requirement in Malaysia in 1955-1970". Malaysia during that period alone needed at least 575 technologists a year at diploma level and 320 at degree level. The shortages are still serious.

Malaysia

MANPOWER NEEDS

The shortage of skilled manpower has in the past few years been one of the constraints on the expansion of industry, and wages for skilled workers have shown an upward trend. The overall constraints however, include not only skill shortages but also shortages of construction materials and, to some extent, administrative bottlenecks.

A Survey of Professional Engineering Needs conducted by the Government in 1973 indicated that the public sector had very high vacancy rates: nearly 25% at professional and sub-professional levels. During 1971-1975, the requirements for professional manpower (in engineering, architecture, surveying, etc.) were estimated at 8,000, and for technician-level manpower at 2,200. These figures pertain only to the public sector needs broadly at university and college and polytechnic levels. The requirements at these levels and at the craftsman level in both the public and the private sector are not known with any degree of certainty.

During the five-year period (1971-75) output of degree graduates from engineering courses has been about 600, and from diploma courses in Engineering, Architecture, Surveying, and Town and Country Planning about 1,750. About 300 to 400 students - including those on scholarships and private students in Engineering, Architecture, Surveying, Town and Country Planning etc. - have been returning to Malaysia during the five years, after training in institutions overseas. Thus, in total, the availability of professional level manpower in the related areas for the five-year period is about 900-1,000.

Training of middle-level manpower is primarily the concern of the MARA Institute of Technology, the Ungku Omar (Ipoh) Polytechnic, Tunku Abdul Rahman College, and similar institutions. Their enthusiasm, clarity of purpose, and wide spectrum of work enable them to be involved in the training of supervisors, clerks-of-works, building technicians and others.

Another institution which should concentrate on the training of middle-level manpower is the former Technical College which, as a result of growing aspirations, has been transformed into the Institute of Technology. Provided that its courses are not too theoretical and its output is not geared entirely to the needs of government technical departments, this Institute could well pioneer a wide variety of courses outside the formal system.

Skilled worker training is currently provided at the Industrial Training Institute in Kuala Lumpur and in Prai which, according to their published information, would have a capacity of about 700. Because they are new, these institutes suffer from inadequate staff, salary and status compared with those with a corresponding responsibility for the manufacturing industry.

In addition to these government programmes, agencies such as PAM (Persatuan Akitek Malaysia), Malaysia Institute of Engineers, MIP (Malaysian Institute of Planners), TAM (Technical Association of Malaysia), while not primarily devoted to education and training, can improve the occupational competence of their membership by means of organized courses, demonstrations of technological improvements, "coaching" technicians, and helping to set up quality training programmes. The Malaysian Institute of Engineers and the Faculty of Engineering at the University of Malaya can, for example, undertake a programme of up-grading technical assistants, while the PAM can independently provide training courses for professional personnel needed in architectural offices. It may be useful also for these organizations, in collaboration with the University of Malaya, Universiti Sains Malaysia in Penang, Institut Teknoloji Kebangsaan and Institut Teknoloji MARA, to organize further training courses for engineers, architects and planners which would enable them to deepen their knowledge of the general and theoretical aspects of their profession.

Since the Malaysian Armed Forces now use highly technical equipment and advanced types of organization they should, like other employing establishments, be required to help train many kinds of qualified personnel. As much of the training is directed toward imparting knowledge, skills and personality traits that apply equally to civilian pursuits, there is much to be gained by accepting their training capabilities for development purposes.

Like any other developing country, Malaysia suffers from shortages of qualified personnel at all levels and in all key posts. However imperfect the available statistics may be, they reveal shortages of professional manpower, middle-level personnel and skilled workers; shortages which exist, paradoxically, side by side with unemployment. Among the measures by which such qualified manpower can be trained and increased, stress is laid on the need for training a new breed of professionals described as graduate technologists, who can combine a broad understanding of physical development processes with specific implementation skills. The main point of emphasis is that universities in this country have an obligation to embrace technology as a discipline. The training of middle-level personnel, on the other hand, is considered to be the proper function of institutes of technology.

At the moment there are four institutions of higher learning providing courses for the professional and management group, namely University of Malaya, Universiti Sains Malaysia, Institut Teknoloji MARA, and Institut Teknoloji Kebangsaan. For the training of technicians, there are three institutions: Politeknik Ungku Omar (Ipoh), Institut Teknoloji MARA, and Institut Teknoloji Kebangsaan.

The Politeknik Ungku Omar is specifically set up to train technicians only, while the Institut Teknoloji MARA and Institut Teknoloji Kebangsaan also provide courses at the professional level. The sources of supply for the other categories of worker are the vocational schools, the Institut Kemahiran MARA and the Industrial Training Institute.

EXPECTED MANPOWER SUPPLY

The four higher institutions listed above should take care of the total supply of the required manpower at professional level. The output of engineers and technicians from the institutions concerned is shown in Appendices 2 and 3, pages 72 and 73. In view of the considerable number of students overseas, the manpower situation is not too bleak. The output of technicians from Ipoh is now getting into its stride. It is optimistically forecast that, even if there are not enough technologists for the building industry by the end of 1975, they will certainly have them by the Third Malaysia Plan period.

SUITABILITY OF TRAINING

Because development in Malaysia has not yet reached a take-off position, the demands for technicians and engineers are not so diverse and specialized as to require extra training facilities. The development and planning of technical education has been monitored and co-ordinated effectively, so that the training imparted is sufficient in academic content and well-oriented to industrial needs.

Malaysia

INDUSTRY, TRAINING AND TECHNICAL INSTITUTIONS

Craftsman Training

This is dealt with by the Manpower Department which was established on 8 May 1969, and provides three services, a training service, an employment service, and a labour market information service. The training service has the task of formulating and implementing industrial training programmes to meet the nation's needs for skilled labour. It provides apprenticeship courses, preparatory trade courses, skill up-grading courses, instructional techniques courses, and trade instructor training courses.

Trade Test Standards

Procedure in developing trade test standards is now well established and, to date, standards for three trades - refrigeration and air-conditioning, gas welding, and earth moving equipment and constructional machinery mechanics - have been drawn up at the Central Trade Standard and Testing Committee level.

In-Plant Training

The in-plant training service is expected to have its full complement of staff by the end of 1975, and the improved staffing position will enable the full range of planned in-plant training activities to be implemented.

Skills Up-grading Courses

In the skills up-grading courses, attention will be devoted to assessing the needs and interests of industry so that the training programmes can produce maximum results.

Employment Service

The object of the employment service is the effective utilization of the nation's manpower resources. It assists job-seekers to be placed in suitable employment and enables employers to obtain suitable workers. This is effected through a network of 20 full-time and 25 part-time employment offices in peninsular Malaysia.

Technician Education

In Malaysia there are three institutions where diploma-level education is imparted. A short summary of each is given hereunder.

1. Ungku Omar Polytechnic, Ipoh

The Polytechnic provides two-year full-time courses in engineering technologies and in business studies, while the course in accountancy is of three years' duration. The Polytechnic's certificate is issued to candidates successfully completing the two-year courses. The three-year course in accountancy leads to the award of the Polytechnic Diploma.

The following courses are provided: Electrical Engineering (Power); Electrical Engineering (Communication and Electronics); Control Engineering (Industrial); Mechanical Engineering (General); Mechanical Engineering (Production); Mechanical Engineering (Automotive and Diesel); Mechanical Engineering (Air-conditioning and Refrigeration); and Mechanical Engineering (Marine).

The pattern of industrial training now in vogue provides the whole of this training in a six-month block, sandwiched between the first and second year, leaving the students free at the end of the second year to move straight into a job. Many industries participate in this sandwich programme.

The Polytechnic treats its industrial training programme very seriously, realizing the importance of it and the prominent part it plays in shaping the otherwise inexperienced student into a responsible technician. The public sector has realized the importance of this training and co-operates whole-heartedly by having well-planned training schedules with gradually increased responsibility for the student.

Some firms, particularly in the public sector, have anticipated the next logical step and have sponsored students. This not only helps the students at one of the most needy times of their life, but gives the firm a potential float of technical manpower and allows for greater flexibility in the prediction of staff requirements over a period of at least two years. It also encourages a sense of loyalty to the firm in the students whom it has helped. To date, approximately 70% of all students at the Polytechnic are sponsored, but as the message continues to get across, the Polytechnic is optimistic and looks forward to the time when there will be 100% sponsorship.

2. MARA Institute of Technology

MARA Institute of Technology promotes the creation of a group of professional and semi-professional Bumiputras who will become equal partners with other ethnic groups in the commercial and industrial enterprises of the nation. In the current academic year, education is being provided to more than 5,000 students on four campuses. The Jalan Othman campus programme offers extension education. The Kuching and Kota Kinabalu campuses presently offer first-year curricula for a number of specialized courses and will in the future offer full curricula for these courses. The Shah Alam campus is the main campus of a fully-equipped $ 44 million complex.

The courses of study available at the Institute are organized under twelve schools: Accountancy; Administration and Law; Applied Sciences; Architecture, Planning and Surveying; Art and Design; Business and Management; Computer Science and Mathematics; Engineering; Hotel and Catering Management; Mass Communication; Library Science; Preparatory Studies.

These schools are assisted in their academic programmes by the Library Services Division, the Language Centre, and the Practical Training and Employment Unit.

One problem facing Malaysia as it embarks on an intensive programme of industrialization and economic development is training a sufficient number of engineers and technicians. The School of Engineering has established engineering and technical assistant courses in Civil, Mechanical and Electrical Engineering. All students admitted since July 1974 follow a two-tier system of engineering education. The first tier is of three years' duration, and after successful completion of the course the candidate is awarded a Diploma. Students who have done well in the first-tier examinations will be considered for admission to the second tier for an engineering course of a maximum of three years' duration. At the end of the second tier, successful students will be awarded the Advanced Diploma in Engineering.

The courses offered by the School for the two-tier system are in Civil Engineering, Mechanical Engineering, Electrical Engineering (Power), Electrical Engineering (Electronics), and (to Diploma level only) Land Surveying.

The main engineering and vocational courses offered are:

(a) Accountancy

Diploma in Accountancy; Institute of Cost and Management Accountants (UK); Association of Certified Accountants (UK).

(b) Administration and Law

Diploma in Administration. Institute of Chartered Secretaries and Administrators (UK); Bachelor of Law (UK); Barrister at Law (UK); Private Secretarial Course. Diplomas in Animal Health and Production, Food Technology, Forestry, Industrial Chemistry, Microbiology, Planting Industry Management, Rubber and Plastic Technology, Fisheries Technology, Textile Technology, and Science.

(c) Architecture, Planning and Surveying

Pre-diploma course. Diplomas in Architecture, Town and Country Planning, Building Economics, Building, and Valuation; and a Certificate for Town Planning Technicians.

(d) Art and Design

Pre-diploma course. Diploma in Art and Design (Fine Art), (Graphic Design), (Industrial Design), (Fine Metalwork), (Pottery and Ceramics), (Textiles), (Fashion Design). Certificate in Photography; Art Teachers' Diploma.

(e) Computer Science and Mathematics

Diploma in Computer Science; Institute of Actuaries (UK); Diploma in Actuarial Science; Diploma in Statistics; Institute of Statisticians (UK).

(f) Engineering

Diplomas in Civil Engineering, Electrical Engineering (Power), Electrical Engineering (Electronics), Mechanical Engineering, and Land Surveying. Advanced Diplomas in Civil Engineering, Electrical Engineering (Power), Electrical Engineering (Electronics), and Mechanical Engineering.

(g) Hotel and Catering Management

Diploma in Hotel and Catering Management; Certificate in Hotel and Restaurant Services.

(h) Practical Training and Employment Services

The objectives of the Practical Training and Employment Unit are fourfold: to provide students with practical experience in their respective courses of study and with insights into their eventual careers; to assist those courses where practical training is required for the award of a diploma or certificate; to equip students with practical experience so that they have improved opportunities for employment on graduation; and to help graduates secure suitable employment. These objectives are achieved by performance of the following functions: maintaining liaison with various business organizations, and with government and quasi-government bodies for the purpose of placing students for practical training and employment; organizing

supervising and controlling practical training programmes for the Institute; evaluating the training undertaken by students; organizing the payment of students' subsistence allowances and other expenses; and informing students of job opportunities and assisting them in securing employment.

Most practical training programmes are conducted during the long vacations of June to July and November to December. When longer training periods are required, students work as trainees during term-time. Although the original intention was to place students for training in their specialized fields, it has only been possible to approximate to such placement.

All students enrolled in courses of three years' or longer duration will be eligible for training upon completion of the first year. All students enrolled in courses in which practical training is required for the award of a diploma or certificate will be eligible for practical training in the first year and after. Preference will be given to students whose courses have practical training as part of the curriculum: placement of other students will be subject to the availability of funds. There is a course tutor unit to arrange and organize practical training. This unit will arrange for course tutors or lecturers to supervise students in this field. Such field supervision will be certified and approved by the unit. All students undergoing practical training will be entitled to $ 2.50 per day as subsistence allowance. Internal travelling claims will be considered after the training period.

By virtue of close and constant contact with firms, business organizations, and other bodies, the Practical Training and Employment Unit is able to assit graduates in securing employment. Organizations are informed of the nature of courses, the number of graduates available for employment and the time of availability. As the number of graduates increases in future, the role of this Unit will become correspondingly more important. Its functions will expand to provide advice on employment opportunities and to supply firms and organizations with suitably qualified graduates. It may even become directly involved in the provision of career guidance to the rapidly increasing student population.

3. National Institute of Technology

The National Institute of Technology was formally established as a university on 14 March 1972 under the National Institute of Technology (incorporation) Order, 1972.

Since its establishment the Institute has had three faculties: the Faculty of Engineering, the Faculty of Architecture (now known as the Faculty of Built Environment), and the Faculty of Surveying. Also there is a centre known as the Centre for Science and Humanities Studies which is of faculty status. Courses offered at the Faculty of Engineering, Architecture and Surveying are at two levels, viz. diploma and degree levels, and are divided into the specializations shown in the table on page 66.

For the degree level courses the entry requirement is unique when compared with the other universities in Malaysia. The qualification required is the Malaysian Certification of Education with a minimum of second grade and with credits in Bahasa Malaysia, Mathematics and a pass in English Language or Special English, as well as credits in at least three of the following subjects: Additional Mathematics, any physical science subject, any technical subject, General Science and Additional General Science.

Malaysia

A holder of a good diploma from the Institute may be considered for a degree level course.

Candidates for diploma courses must not be more than 25 years old and have passed the Malaysian Certificate of Education examination with at least a Grade Two and with credits in Bahasa Malaysia, a pass in English Language or Special English, and credits in Elementary Mathematics and General Science or any physical science subject.

TABLE 1

COURSES OFFERED BY THE NATIONAL INSTITUTE OF TECHNOLOGY

FACULTY OF ENGINEERING	
Degree Courses	Diploma Courses
Civil Engineering Electrical Engineering Mechanical Engineering	Civil Engineering Electrical Engineering (Communication) Electrical Engineering (Power) Mechanical Engineering
FACULTY OF BUILT ENVIRONMENT	
Degree Courses	Diploma Courses
Architecture Quantity Surveying Urban and Regional Planning	Architecture Quantity Surveying Urban and Regional Planning
FACULTY OF SURVEYING	
Degree Courses	Diploma Courses
Land Surveying Property Management (formerly valuation)	Land Surveying

The University of Malaya Faculty of Engineering runs, alongside the degree courses in engineering, courses leading to a doctor's degree and post-doctoral research.

The Faculty also runs a one-year pre-engineering course. After successfully completing this course, a student is admitted to the first year of the four-year

degree course. The Faculty offers Bachelor of Engineering courses in Civil, Mechanical, Electrical and Chemical Engineering.

The Faculty has a student strength of 470 students with an annual intake of over 160 students. Subjects in the first two years are common to all branches of study. Specializations are allotted in the third and final years to meet the professional requirements of relevant branches of engineering.

The bachelor's degree course in Engineering run by the Faculty of Engineering of the University of Malaya has been recognized by the professional bodies such as the Institute of Engineers.

The Faculty has good workshop and laboratory facilities and excellent facilities for research work. Practical experience is an integral part of the degree course; students being allotted to various undertakings in the first year and third year classes.

During the long vacation, students in their first year are required to undergo practical workshop training at an engineering establishment to supplement their training at the University, and as part of the exercise they are required to submit a report. The contents of the report should cover details of the training the student received personally, observations relating to engineering processes with which he has come in contact during this period, and a brief survey of the organization within the works. The report, which should contain from 1,500 to 2,000 words, should be written from the student's own experience. It should be completed before the student leaves the place of training, and shown to the employer for approval and signature.

In the third-year course, each student must submit a technical report and observations on what he has done, experienced and learnt from his practical experience in industry, an engineering undertaking, or a government department. The report is judged on the student's general appreciation of engineering works, and his ability to learn and report on them and make constructive criticism. The report must have sufficient technical content and details of the jobs handled by the student himself.

The student is advised to avoid writing long essays and use illustrations to help to explain the jobs clearly. He is encouraged to reach his own conclusions and express his views on the works after having obtained the views of more experienced personnel. He is reminded that the ability to present a good engineering report is a valuable asset in his future career, and that it is an opportunity for him to gain experience. The benefits derived from practical experience very much depend on the initiative shown by the student himself. If he thinks it does not afford sufficient opportunities, he is required to discuss his problem with the person in charge at the earliest opportunity.

The National Institute of Technology is at present administered by an Interim Council in which professionals from the private sector are also represented. Students are sponsored by the Government, by statutory bodies, and by the private sector which includes international firms such as Guthrie Group, Shell, Cycle and Carriage, Osborne & Chappel, Sarawak Electric Company, and Tin Mining Co. There are no sandwich, day-release/block-release courses in the Institute: all courses are full-time.

MID-TERM APPRAISAL OF THE TECHNICAL EDUCATION SECTOR

In its document "Mid-term Review of the Second Malaysia Plan 1971-1975" the Government reports the following progress made by technical institutions.

Enrolment at the Ungku Omar Polytechnic increased from 493 in 1970 to 915 in 1973. The intake of students more than doubled and is expected to triple in 1975. A new marine engineering course designed to meet the increasing demand for marine engineers will be introduced. Provision has been made for the establishment of a second Polytechnic at Kuantan during 1974-75. This second polytechnic will have an enrolment of over 1,000 students....

The Institute of Technology, MARA, continued to play a key role in producing professional and sub-professional manpower to meet the nation's need for qualified Malays and other indigenous people. Enrolments in professional and sub-professional courses in accountancy, administration and law, applied science, architecture, business management, engineering, hotel and catering management and library science expanded rapidly from 2,142 in 1970 to 4,434 in 1973. A significant development was the introduction of an extension education programme. The aim of this extension programme is to offer professional and semi-professional courses to qualified Malays and other indigenous people who are not able to pursue courses on a formal and full-time basis. The first intake of students for this programme was 339 in 1973. Subsequent intakes will be on an annual basis. Total enrolments at ITM, excluding those in the extension education programme, will reach 6,000 by 1975....

The National Institute of Technology, formerly known as the Technical College, was raised to University status in 1972, offering a two-tier programme at diploma and degree levels. Enrolments at the Institute increased from 692 in 1970 to 1,516 in 1973. Teaching, workshop and laboratory facilities were expanded to cope with this increase in enrolments. The new degree programme at the Institute offers courses in mechanical, civil and electrical engineering and architecture. While it is intended to re-site the present Institute, a major part of the allocation for the Institute during 1974-75 will be directed towards the expansion of student residential facilities at the present site....

TRAINING ORGANIZATION IN THE NATIONAL ELECTRICITY BOARD OF MALAYSIA

The existing training provision is inadequate for the present and future needs of the National Electricity Board. In spite of the envisaged expansion, no capability exists at present to train workers in all the specific skills and techniques utilized by the NEB or to organize short and long-term courses of training for overcoming deficiencies in certain skills. In relation to its expansion, NEB envisages an annual recruitment by 1980 of 120 apprentices, 130 semi-skilled trainees, 90 technicians and 30 engineers. Moreover, it has a need to provide up-grading refresher and up-dating training for electrical fitters, cable jointers, overhead linesmen, electricians, fault finders, meter mechanicians and power operatives. Additionally, it needs to provide development training aligned to its own activities, in technical, administrative and supervisory subjects for its staff, which totals at present about 10,000 persons and is expected to rise to 16,000 to 19,000 by 1982 depending on the productivity achieved. It is one of the biggest training projects in Malaysia receiving financial assistance under the United Nations Development Programme.

The National Electricity Board is an autonomous body appointed by the Government to generate the supply of electrical energy for the economic development of West Malaysia and to make available such energy to consumers. Important features of the project are:

(a) Engineering graduates of the Board have to undergo a two-year pupillage during which they are attached to the various sections of the Board to gain experience. The National Electricity Board also accepts graduate trainees from outside the Board to undergo two years' attachment training similar to the pupillage. In the past two years especially, quite a number of officers have been sponsored for postgraduate studies abroad.

Scholarships are also awarded each year for diploma courses at the local technical college. Those who graduate are required to undergo cadetship for a period of two years where on-the-job training is being provided by attachments. At the end of this training period they are required to pass the departmental technician examinations before being confirmed as Technical Assistants.

Technician Cadets are usually selected from students graduating from the Ipoh Polytechnic and from within the Board. However, graduates of the Ipoh Polytechnic are appointed as Technicians on obtaining their diplomas. Those who are recruited from the technical schools have to undergo a three-year period of cadetship at the end of which they have to sit an examination. Training is given by attachments to the various sections.

Practical training is also provided from Government and other statutory bodies to qualify them to sit for the Local Electrical Engineer Certificate and Chargeman Certificate.

(b) The Electrical Inspectorate is responsible for the issue of Electrical Engineer and Chargeman Certificates. The Board also provides facilities to enable lecturers and instructors from technical institutions and personnel from other statutory bodies to gain practical experience.

(c) The capacity for training is limited to the electrical and mechanical fields, and the number of trainees at any one time varies according to the existing facilities available.

(d) Usually a five-year forecast is made annually to meet the needs of the Board. By 1980 the NEB envisage an annual recruitment of 120 apprentices, 130 semi-skilled trainees, 90 technicians and junior technicians and 30 engineers. There is also a need to provide up-grading, refresher and up-dating training for electrical fitters, cable jointers, overhead linesmen, electricians, fault finders, meter mechanics and power operators and to provide development training, aligned to the Board's own activities, in technical, adminstrative and supervisory subjects for its staff, which totals at present about 10,000 persons and is expected to rise to between 16,000 and 19,000 by 1982 depending on the productivity achieved.

(e) Scholarships are awarded annually by the Board for full professional diplomas, degrees and postgraduate studies both locally and abroad. Direct control and supervision are maintained by the respective departments under the overall control of the Education and Training Department.

(f) The issue of certificates for Electrical Engineers (Local), Chargemen and Wiremen are issued by the Chief Electrical Inspectorate. Examinations for technicians and special grades are conducted by the Board for employees in the NEB.

(g) Periodically officers attend in-service courses or study tours with manufacturing companies and electricity supply organizations abroad, especially in U.K. and U.S.A. The Board also recruits and trains its own personnel at the lower technical level.

APPENDIX 1: OFFICIALS MET AND VISITS UNDERTAKEN

Officials

Md. Tahir-bin Abdul Majid	Director of Technical Education
Mr. V. Murugesu	Dy. Director of Technical Education, Kuala Lumpur
Mr. M. Rafiq Khan	Senior Organisor, Technical Education, Kuala Lumpur
Mr. T. T. Chian	Dean of Faculty of Engineering, University of Malaysia, Kuala Lumpur
Mr. Nitichingham	In-charge, Training Board, National Electricity Board
Dr. A. Amin	UNESCO Expert on Training and Development Electricity Board
Mr. R. Bell	Project Manager, Industrial Trade Instructor Training
Mr. H. E. Carter	Syllabi and Training Standards Expert
Che Mat Bin Abu Baker	Industrial Training Co-ordinator, Ministry of Labour
Mr. En Malek Nahu	Ministry of Youth Training Division
Mr. Kassim Md. Deni	Scholarship and Placement, Public Services Division
Md. Shaari bin Md. Noor	Telecom Training Centre, Kuala Lumpur
Mr. Arshad Bin Marsidi	National Producting Centre
Mr. C. Ung	Ex-Director of Technical Education (now with MARA)
Mr. Nathan	Ministry of Education and Liaison Officer

Institutions Visited

MARA Institute of Technology; Tele-communication Training Centre; National Productivity Centre; National Institute of Technology; University of Malaysia.

Malaysia

APPENDIX 2: OUTPUT IN ENGINEERING AREAS

From Degree Courses - 1971-1976

Courses	Actual		Estimated				Total
	1971	1972	1973	1974	1975	1976	
Civil Eng.	16	9	55	15	62	71	228
Electrical Eng.	17	20	23	35	40	45	180
Mechanical Eng.	46	47	27	50	55	60	285
Chemical Eng.	-	-	18	35	44	44	141
Total	79	76	123	135	201	220	834

From Diploma Courses - 1971-1975

Courses	Actual		Estimated			Total
	1971	1972	1973	1974	1975	
Civil Eng.	39	58	58	71	119	345
Mechanical Eng.	44	53	72	125	116	410
Electrical Eng.	62	65	66	108	104	405
Land Surveying	27	10	21	46	87	191
Architecture	24	30	26	34	37	151
Building Economics/ Quantity Surveying	23	21	17	31	39	131
Town and Country Planning	11	24	11	23	52	121
Total	230	261	271	438	554	1,754

APPENDIX 3: OUTPUT OF TECHNICIAN ASSISTANTS AND TECHNICIANS (1973-1976)

Institutions	1973	1974	1975	1976	Total
Technical Assistants					
Kebangsaan I. T.	240	315	350	420	1,544
MARA I. T.	43	67	102	100	364
Total	283	382	452	520	1,908
Technicians					
Ungku Omar Poly	212	386	432	582	1,747

Malaysia

APPENDIX 4: OUTPUT FROM INSTITUTIONS

Output of Engineers from University of Malaya - 1973-1976

Year	Civil	Mechanical	Electrical	Chemical
1973	38	42	14	-
1974	54	26	22	18
1975	76	22	21	15
1976	85	45	30	10

Output of Engineers from Institut Teknoloji MARA - 1973-1976

Year	Civil	Mechanical	Electrical
1973	-	-	-
1974	-	6	-
1975	4	4	6
1976	6	6	10

Output of Institut Teknoloji Kebangsaan - 1973-1980

	1973	1974	1975	1976	1977	1978	1979	1980
Diploma	259	315	350	420	490	560	655	735
Degree (Engineering)	-	-	-	-	95	160	185	225
Architecture	-	-	-	-	-	10	15	20

APPENDIX 5: ORGANIZATIONS OFFERING PRACTICAL TRAINING

Selangor (Kuala Lumpur)

Anglo-orient (M) Sdn. Bhd.
Azman, Wong, Salleh & Co
Bangkok Bank Ltd
Bangunan Wisma Yakin
Bangunan Yee Seng
Bernama
Cathay Advertising Ltd
Chase Manhattan Bank
Comcod Public Relations
Eric White Associates (M) Pty. Ltd
Esso
FIDA (Federal Industrial Development Authority)
First National City Bank
General Accident Fire & Life Assurance Corporation Ltd
Grant Advertising International Inc.
Harrison & Crossfield (M) Sdn. Bhd.
Hotel Nilton
Ibu Pejabat MARA
Ismail Mahyuddin Enterprise Sdn. Bhd.
Kassi, Chan & Co
Kwong Yik Bank
Lembaga Kemjuan Tanah Persekutuan
Lembaga Letrik Negara
Lembaga Padi dan Beras Negara (LPN)
Leo Burnett Sdn. Bhd.
Lever Brothers
Lintas Ltd
Malaysian Airline System
Malaysian Co-operative Insurance Society Ltd
Marketing Advertising (Pte.) Ltd
Mercantile Bank
Ministry of Culture, Youth & Sports
Ministry of Information, Malaysia
New Straits Times Press Ltd
Ogilvy & Mather (M) Sdn. Bhd.
Pearl & Dean (M) Sdn. Bhd.
Pejabat MARA Negeri Selangor
Pejabat Perhubungan Kerajaan Sabah
Perbandanan Pembangunan Bander (UDA)
Pernas Mining Sdn. Bhd.
Persatuan Kelab-Kelab Belia, Malaysia
Raja Salleh, Lim & Co
Royal Exchange Insurance
Safety Insurance Building
Shell Malaysia Ltd
Turquand, Young, & Co
Universiti Kebangsaaan Malaysia
Utusan Melayu (Bhd.)

Selangor (Petaling Jaya)

Alcan Malaysia Bhd.
Dunlop Malaysia Industries Bhd.
Guiness (M) Bhd.
Kumpulan Wang Simpanan Pekerja (EPF)
Lembaga Bandaran Petaling Jaya
Lembaga Pemasaran Pertanian Persekutuan (FAMA)
Maktab Kerjasama

Selangor (Klang)

Lembaga Pelbuhan
Malayan Banking Bhd.
Pejabat Daerah Klang

Malaysia

Selangor (Shah Alam)

Bahagian Kajian Luar Kampus, ITM
Fatimah Carey Office, ITM
Pejabat Pentaobiran, ITM
Statistical Centre, ITM
Steno Department, ITM
United Motor Works

Selangor

Malayan Banking, Bhd.
Malaysian Banking, Bhd.
Sabak Bernam
Tanjong Karang

Perak

Coopers & Lybrand, Ipoh
Pejabat Setiausaha Kerajaan Perak, Ipoh

Pulau Pinang

Malayan Banking
Suruhanjaya Pelabuhan Pulau Pinang
Universiti Sains Pulau Pinang

Kedahtan

Malayan Banking

Kelantan

Malayan Banking, Kota Bharu
Pejabat MARA Negeri, Kelanta, Kota Bharu

Negeri Sembilan

Pejabat MARA Negeri, Serimban

Johor

Pejabat MARA Negeri, Johor Bharu

Trengganu

Pejabat MARA Negeri, Kuala Trengganu