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MALAYSIA

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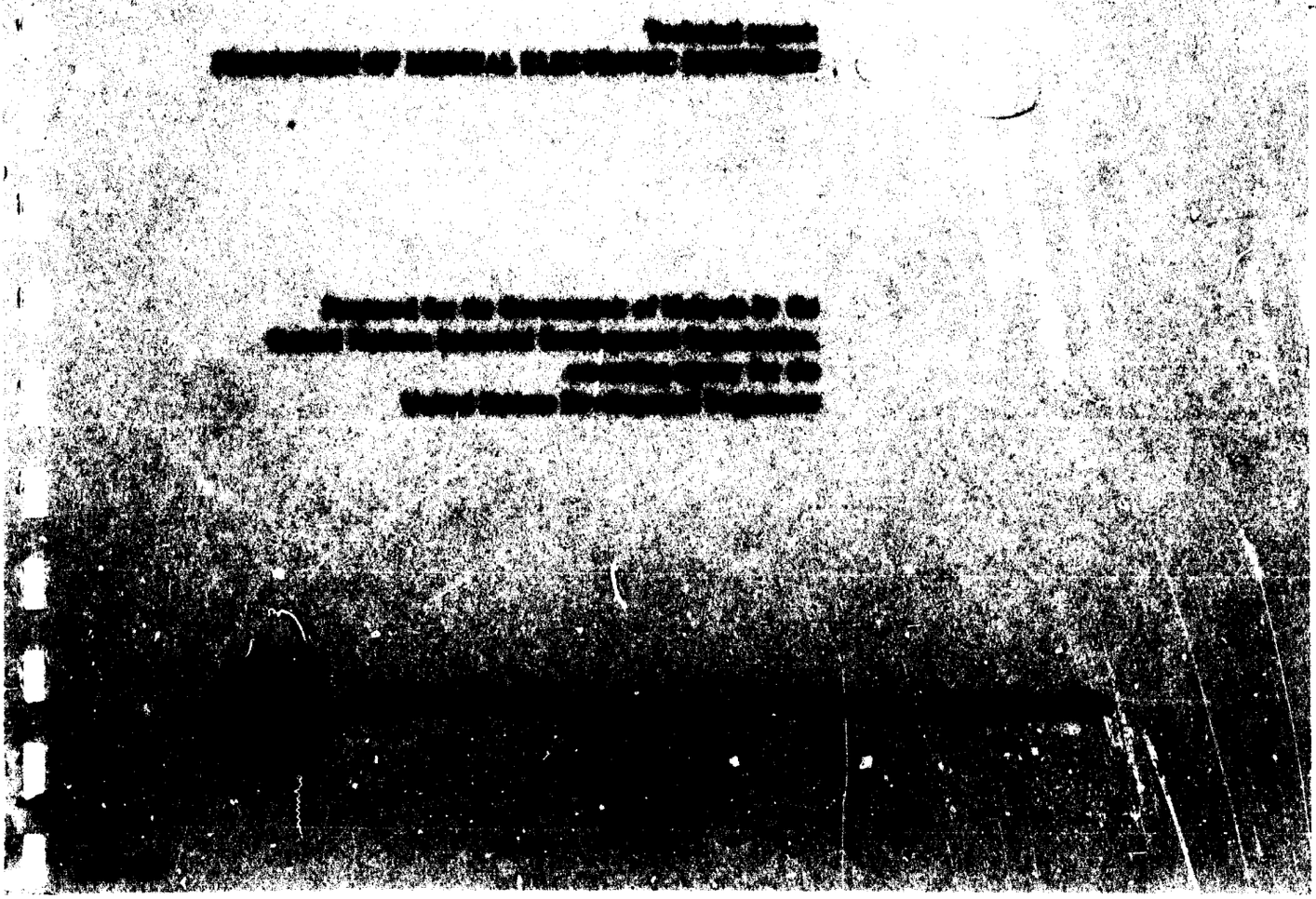

United Nations Development Programme

INDUSTRIAL PROJECT IDENTIFICATION AND DEVELOPMENT TEAM

DP/MAL/72/001

MALAYSIA

Technical report: Promotion of medical electronic equipment

Prepared for the Government of Malaysia
by the United Nations Industrial Development Organisation,
executing agency for the United Nations Development Programme

Based on the work of Vassili I. Golubev, expert in medical electronic equipment

United Nations Industrial Development Organisation
Vienna, 1976

Explanatory notes

A comma (,) is used to distinguish thousands and millions.

References to dollars ($) are to United States dollars, unless otherwise stated.

The following exchange rate of the Malaysian dollar ($M) is used in this report, unless otherwise stated: $US 1 = $M 2.56.

The following abbreviations are used in this report:

ECG	Electrocardiograph
EEG	Electroencephalograph
FIDA	Federal Industrial Development Authority
LED	Light-emitting diodes
MEE	Medical electronic equipment
MIDF	Malaysian Industrial Development Fund
Sdn. Bhd.	Private limited company

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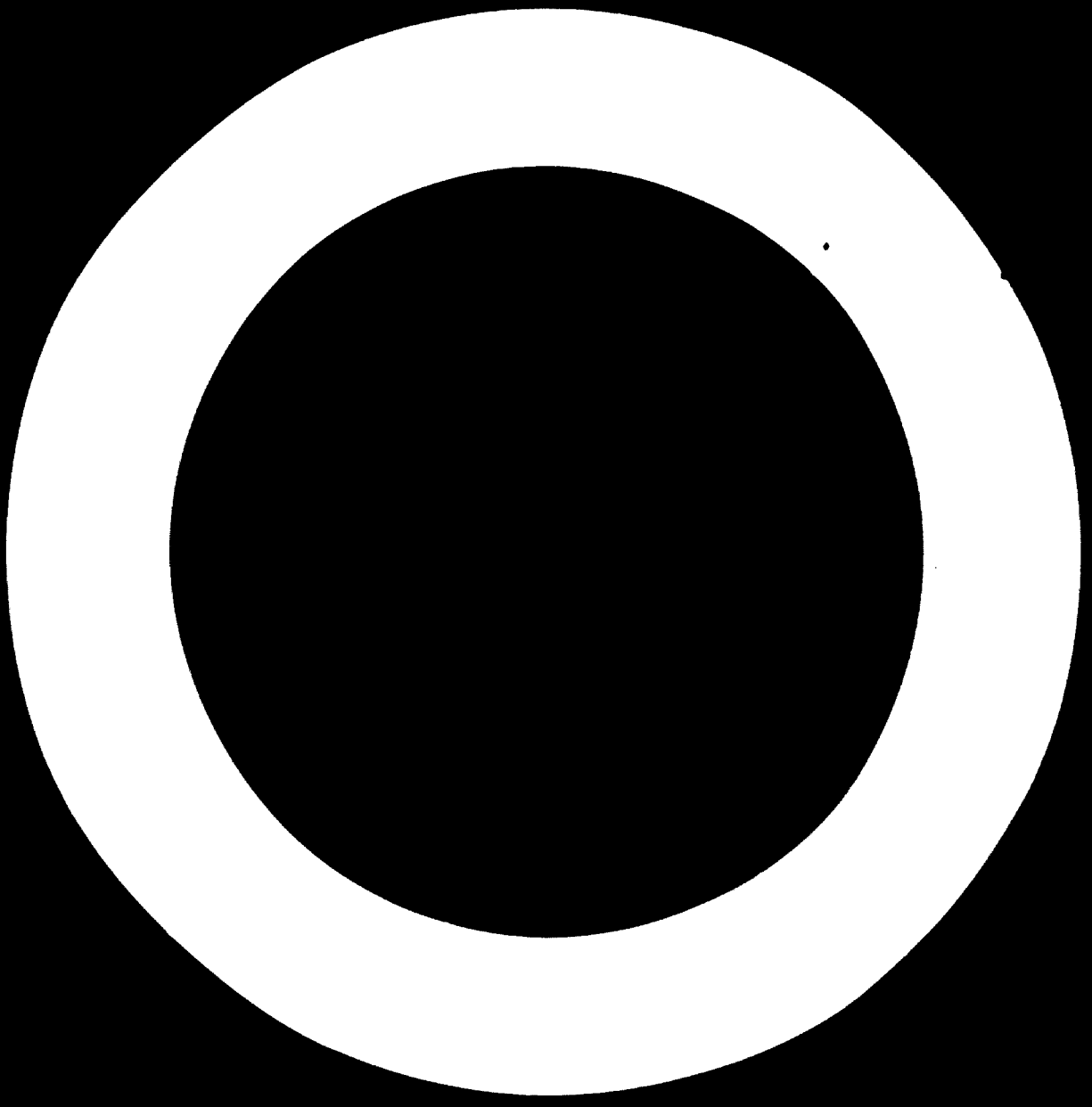

SUMMARY

This report forms part of the project entitled "Industrial Project Identification and Development Team" (DP/MAL/72/001) of the United Nations Development Programme (UNDP). The project arose from a request by the Malaysian Government in February 1972, and following its approval by UNDP, field operations were initiated in December 1972, with the United Nations Industrial Development Organization (UNIDO) as the executing agency.

During the 1960s most industrial projects in Malaysia were identified and implemented by private sector initiative. However, the Malaysian Government established the Federal Industrial Development Authority (FIDA) in late 1967 to assume over-all responsibility for the promotion and co-ordination of industrial development. With the introduction of the Second Malaysia Development Plan covering the period 1971-1975, it became clear that FIDA's machinery for identifying potential new industrial projects should be strengthened in close co-operation with existing industries or other potential investors. The objectives of the project were therefore to strengthen the capability of FIDA to identify, evaluate and initiate viable industrial projects and to develop the skills of its staff by providing on-the-job training in those functions.

This report deals with the part of the project concerned with the possibility of promoting the manufacture and/or assembly of medical electronic equipment in Malaysia. The work programme covered a period of four months, from October 1975 to February 1976.

The report consists of the following four chapters:

I. Modern medical electronic equipment
II. The development of MEE in Malaysia
III. Maintenance, service and repair of MEE
IV. Market analysis of biomedical electronic equipment

Chapter I presents the main ideas of the functioning of MEE and describes the units and blocks which these machines contain. It also points out the main lines of development of MEE, which include: thermographic examinations for the diagnosis of cancer, inflamation and blood circulating disorders; tomographs for layer roentgenocontrast examination; ultrasonic units for diagnosis and treatment without surgical operations; the use of the laser techniques for surgical operations; rotational radiation for the most effective destruction of malignant tumours; devices using high tension particles (protons, electrons, mesons) for the treatment and diagnosis of cancer.

Common medical equipment such as roentgen devices, electrocardiographs, electroencephalographs, monitors, etc., are being developed with a view to saving

time in examination and increasing their oapaoity and reliability. Progress has been made in the development of telemetric systems for visual control and prooesses. Important and distinctive features of an up-to-date design of MEE are the use of modules, integrated circuits, and the application of the principles of ergonomics.

Chapter II considers the technical potential of the electro-technical industry to promote MEE in Malaysia. It shows that while the local electronics industry is not in a position to manufacture MEE, it is able to assemble modern MEE because the local electronics industry produces all the components and units required to meet current international MEE design standards. However, the lack of skilled personnel and engineers with experience in the field of MEE, and the shortage of raw materials, which are mainly imported, might create problems in organizing an assembly plant.

Chapter III deals with the problem of maintenance, service and repair of MEE in Malaysia, which are currently ensured by trading companies and foreign firms under service contracts involving considerable annual expenditure.

Chapter IV surveys the internal market for MEE in Malaysia. Domestic demand is not very large, and is mostly for electrocardiographs, defibrillators, monitors, display units, X-ray units, pH meters and diathermy instruments. Although much demand is increasing from year to year, it is not feasible to manufacture MEE solely for the domestic market. Taking into account the present level of skill in the electronics industry, the inexpensive manpower and the favourable geographical position of the country, the demand for MEE from neighbouring Asian countries and the possibility of assembling practically all types of MEE, the establishment of an assembly plant seems feasible (see list of MEE recommended for production in annex III). However, before a final choice of MEE for future production is made, an in-depth economic analysis of the different types of equipment is necessary.

Recommendations

1. A central workshop should be established to meet the service, repair and maintenance needs of all hospitals in Malaysia.

2. The University of Malaysia should establish a course on the basics of MEE.

3. Experimental production of some types of MEE should be initiated (see annex III).

4. An economic analysis of selected types of MEE should be made.

5. The possibilties of produotion of X-ray tubes should be studied.

INTRODUCTION

During the 1960s most industrial projects in Malaysia arose from private sector initiative, and industry concentrated mainly on supplying the protected domestic market. Most new plants were sited near the main population centres, and during the period of the First Malaysia Development Plan (1966-1970) manufacturing output grew by 10.4 per cent, compared with 5.4 per cent for the economy as a whole, while 54,000 new jobs were created.

In late 1967 the Malaysian Government established the Federal Industrial Development Authority (FIDA) to assume over-all responsibility for the promotion and co-ordination of industrial development and to advise the Government on tariffs and investment incentives to new industries. Following the establishment of FIDA and a simplification of investment incentive and tariff protection approval procedures, there was a rapid expansion in the approval of new industrial projects. With the introduction of the Second Malaysia Plan (1971-1975), which aimed at a 12.5 per cent increase in manufacturing output, a doubling of manufactured goods and the creation of 108,000 new employment opportunities, it was considered that greater efforts would have to be made by the Government, and in particular FIDA, in identifying and promoting the implementation of new industrial projects. As a result, the Government of Malaysia submitted in February 1972 a request for UNDP assistance in industrial project identification and development, which was subsequently approved and implemented as the "Industrial Project Identification and Development Team" (DP/MAL/72/001). The amount originally requested from UNDP was $US 168,100, and the proposed government counterpart contribution was $US 106,000 in kind. The objectives of the project were to strengthen the capability of FIDA to identify, evaluate and initiate viable industrial projects and to train staff in the skills required to perform such functions and to prepare pre-feasibility studies.

This report covers the part of the project relating to the promotion of the medical electronic equipment (MEE) industry in Malaysia. The purpose of the MEE project was to advise FIDA on projects to manufacture and/or assemble MEE of all types that could be promoted in Malaysia. The duties of the expert on MEE included, in particular, the following:

(a) Assisting in the preparation of an in-depth study of the potential for manufacturing selected items of MEE, taking into account the potential suppliers in Malaysia, the availability of labour skills and the potential export demand;

(b) Assisting in the selection of the most suitable projects and in the preparation, where appropriate, of pre-feasibility or feasibility studies;

(c) Providing advice on the implementation of those projects;

(d) Evaluating, as and when requested, proposals for the manufacture of MEE submitted to FIDA by potential investors.

The expert was assisted by the MEE team at FIDA, which, from 6 November 1975 to 20 February 1976, collected information relating to the future domestic production of various types of MEE. It concentrated its attention on the following subjects:

The availability of the required resources in the country for the production or assembly of certain types of MEE

Industrial potential in the field of MEE

Manpower

The internal market for MEE

The external market for MEE

Trends in and prospects for the development of MEE

Malaysian potential for exporting MEE

A number of electronics enterprises, trading companies and hospitals in different parts of Malaysia were visited in order to make the findings as comprehensive and up-to-date as possible. This report covers only the use of electrical and electronic units of MEE, and does not consider the problems of electromechanical and mechanical units. It deals with all the above-mentioned matters, and includes a complementary study of MEE servicing, maintenance and repair.

I. MODERN MEDICAL ELECTRONIC EQUIPMENT

A. Essential information about medical electronic equipment (MEE)

This section describes the main principles and functioning of MEE and electronic units used in medical electronic machines, and considers modern trends in the development of MEE.

The main electronic blocks used in medical electronic machines are: preamplifiers, amplifiers, power amplifiers, regulated power suppliers, displays, X-ray tubes, etc.

To manufacture and assemble medical electronic instruments the following initial elements are necessary: transistors, diodes, capacitors, resistors, high-frequency circuits, thermistors, relays, ultrahigh frequency tuners; transformers, high and intermediate frequency panels, switches, package integrated circuits, switchboard, sockets, buttons, wires, etc.

The main lines of development of MEE are: thermographic examination machines (the main advantage of which is the absence of harmful radiation) for roentgenocontrast examination; ultrasonic units for diagnosis and treatment; rotational radiation using high tension particles (electrons, protons, mesons) for treatment and diagnosis of cancer; monitors; surgical diathermay devices; and implantable stimulators.

The principles of microelectronics and miniaturization from the basis of the modern design of MEE, and are its most significant and distinctive features.

X-ray machines

Two kinds of X-ray machines are used in medicine - one for diagnosis and one for therapy. The diagnosis units generally have a voltage output of from 100 to 150 kvp (kilovolt peak) and current of 25 to several hundred milliamperes. Voltage output of therapy units may surpass 400 kvp with a current of several hundred milliamperes. Today's X-ray machines are used for many purposes, such as the investigation of bone fractures, the diagnosis of tuberculosis, cancer, kidney and other ailments, and the treatment of cancer and many other diseases. The fluoroscope employs a fluorescent screen rather than film to produce an X-ray picture. In many ways the fluoroscope is similar to a television picture

tube. In the fluoroscope, X-rays pass through the patient's body from one side and the X-ray picture is produced from the fluoroscope screen placed at the opposite side. The actual picture is not produced. It is a shadow image. Where the X-rays pass easily through the body, they cause a light area to appear on the fluoroscope screen, and if they pass through bone or other more dense material, a dark area is produced on the screen.

The stationery X-ray machines are different in size, power and versatility. All, however, have approximately the same circuitry. They can also have dangerous effects, such as the destruction of bone and tissue which can result from over-exposure. The most important part of the X-ray machine is the X-ray tube in which the actual rays or X-rays are produced. X-rays are produced when electrons strike the target and suddenly decelerate, causing rays to be given off by the target. The frequency of X-ray waves depends on the voltage and current. In modern tubes tungsten is used for the target. It is attached to a massive copper anode which is cooled by convection or an oil-cooling system.

Electrocardiograph

The electrocardiograph (ECG) electronically picks up, amplifies, and records minute electrical impulses from the heart in order to produce a chart or electro-cardiogram. This is a chart that indicates the amplitudes, intervals, rates and rhythm of the heartbeat. This instrument is employed for diagnostic purposes in hospitals and clinics since an electrocardiogram is always included in a complete physical examination.

The physical activity of the heart produces a minute electromotive force, or potential, of both negative and positive polarity, and the heartbeat is compared with normal, established standards to obtain information concerning the physical condition of the patient.

The electrocardiograph is connected to the patient with electrodes, the number of which, and to some extent the location on the patient's body, is determined by the system being used.

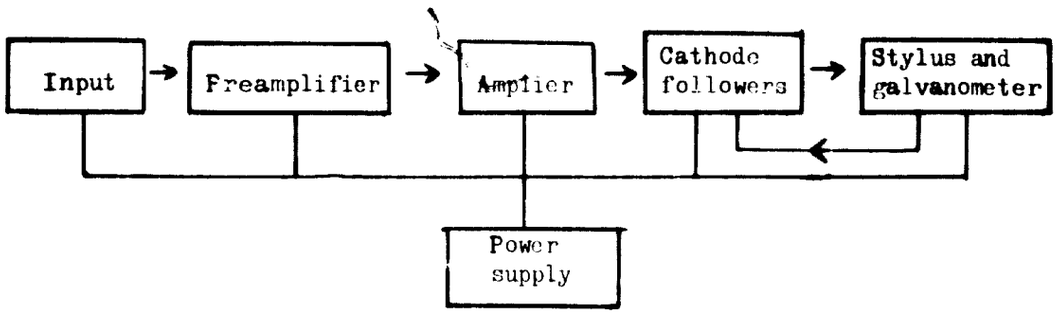

Figure I. Block diagram of a typical electrocardiograph

Figure I shows a block diagram of a typical electrocardiograph. The first block is the input circuit; the various leads from the patient's body are connected to the instrument through this block, and a number of cathode followers are used for balancing the electrode resistances. The standard cell is also located in this section. The second block is the preamplifier, where the input signals are amplified by balanced push-pull amplifiers. Cathode followers through which capacitors are charged also make up part of this section. The D.C. amplifiers in the following circuit build up the signals to the level required to drive the final coupling stage. The cathode followers have neon regulators to restore the proper D.C. level or bias of the amplified signals. In the last block are the stylus and galvanometer, which are both used to produce a trace on the graph paper.

Electroencephalographs

The electroencephalograph (EEG) is basically similar to a number of electrocardiograph machines.

The EEG is used to detect and record the differences of potential at various areas of the brain. The EEG machine is found in most hospitals. It is invaluable in tests for tumours, brain damage and other physiological problems.

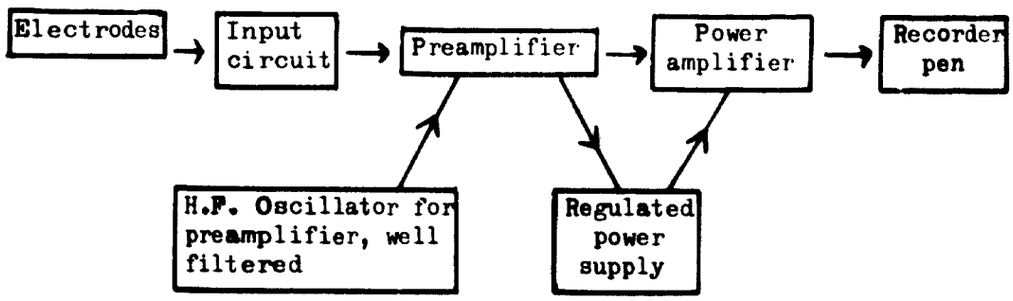

Figure II. Block diagram of one EEG channel

Figure II is a block diagram of one EEG channel. The input circuit contains the calibrating device, which may be connected by a switch to any one of the channel amplifiers.

The output of the input circuit is fed to a preamplifier stage, a dual tube in a special configuration called a differential amplifier. The gain control is located on the preamplifier control panel.

The power amplifier amplifies the weak signal from the preamplifier so that it can drive the following circuit called the recording pen blocks. The power amplifier consists of several push-pull stages, that are necessary to handle the signal without undue frequency and amplitude distortion.

A regulated power supply furnishes constant well-filtered operating voltages and a high frequency oscillator provides power for the preamplifier filaments.

As a rule a typical instrument has 8 recording channels, although most manufacturers make units with more than 24 channels.

Spectrophotometers

Spectrophotometers and analysers are the big group of medical electronic instruments which can often be used together with minicomputers for blood, liquid and gas analysis.

A spectrophotometer is an instrument used for measuring the relative intensity and frequency of light transmitted through test solutions of chemicals undergoing analysis. The device consists of two major parts, a light source called a monochromator and an accurate light meter called a photometer. Its applications in medicine are almost unlimited. Hospitals and medical research laboratories employ spectrophotometers in blood analysis, investigations of water contamination, etc.

The light source of the spectrophotometer can produce a wide band of frequencies. When a sample solution is placed between the light source and the light measuring device, the instrument can indicate the intensity and frequency of light which passes through the solution.

Basically, the monochromator consists of a light source (a lamp called an exciter) with a lens system and a device to separate the light into the various wavelengths. Generally, only a certain portion of the light spectrum is desired. The separation device stops all but that part from passing through.

There are two methods of separating the light. In one of them, the white light is broken up into the basic colours with the help of a p sm. The colours present the various wavelengths of light, from the longer wavelengths of red at one end of the spectrum, to the shorter ones of violet at the other. The second method of breaking down the white light into spectra is by deflection through the use of a device called a grating. It may be either a flat glass plate, or possibly a metal plate, with a smooth, shining surface on which parallel lines are very accurately etched. The wavelength which will be passed by the grating depends on the angle of the grating with respect to the light source.

A photometer is a light-sensitive unit, such as a phototube, photocell, or semiconductor device, which converts light energy to electrical voltage. The output voltage is proportional to the amount of light reaching the photo-sensitive device. Generally, another light source is reflected off a moving mirror in place of the normal pointer in the galvanometer. The reflected image is focussed on the galvanometer scale which is calibrated in optical density or a similar quantity. The reading, of course, indicates the relative light-transmission through the sample, which can be compared with a standard. All modern spectrophotometers are electronic instruments.

Spectrophotometers therefore basically consist of:

(a) A mechanical part and an optical system which are very accurate and complicated to produce;

(b) A photomultiplier, a signal amplifier, an analyser and a standardizing circuit - all of which electronic and electric units do not demand sophisticated production techniques. It should be possible to produce such parts locally, using components from local enterprises with parameters suitable for medical equipment.

Ultrasonic devices

An ultrasonic machine is basically a generator of electrical energy at frequencies about the normal range of hearing, but lower than radio frequencies (about 20,000 cps (cycles per second) with a range to about 1.1 megacycles). The energy is used to cause an applicator that is placed on the patient's skin to vibrate with ultrasonic frequency.

Only ultrasonic energy affects body tissue in three ways simultaneously: thermally, mechanically and chemically.

Thermally, the energy produces heat to a depth of more than 5 centimeters; mechanically, it has a stirring action within the tissue called micro-intercellular or vibratory massage; chemically, it increases cellular permeability and diffusion of ions. It also changes the tensile strength of tendons, permitting greater extension or prolongnation.

There are two basic types of ultrasonic generating units: the continuous output-wave type and the pulsed output-wave type.

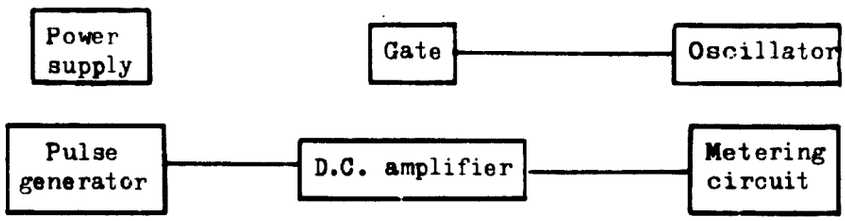

Figure III. Block diagram of a typical ultrasonic unit

Figure III shows the block diagram of a typical ultrasonic unit. The first block is the pulse generator. Its output is fed to a gate which, depending on the setting of the selector switch, either permits the oscillator to operate continuously or makes its action intermittent, producing a pulse-type output-wave.

Implantable instruments

With the advancement of technology, instruments to measure and control human physiological parameters can be made small, reliable and implantable.

Modern implantable instruments have wide spread popularity.

The following are some of the different kinds of implantable instruments:

Name	Function
Heart paoemaker	Adjusts rate automatically and telemeters alarm signals when difficulties develop
Bladder stimulator	Controls bladder pressure by internal and external stimulation and telemeters data regarding the critioal pressure
Blood pressure oontrolling devioe	Applies automatic stimulation to oontrol pressure and telemeters blood pressure data
Pain suppressor	Acts on the spinal cord or peripheral nerve endings
Brain stimulator	Produces sleep or a tranquilising effect and is controlled externally

Name	Function
Sensory stimulator	Stimulates hearing, vision, touch, etc. for prosthesia
Musole stimulator	Analog control of force or displaoement by external command
Gland stimulator	Controls the secretion of hormones
Telemetric measuring devioe	Measures pressure, blood flow, eto., and chemical composition of the body or particular organs
Telemetering devices for electro-physiological signals	Has functions such as those performed by the ECG, EEG, etc.
Implant manipulators	Releases chemicals, produces mechanioal action upon external command, and adjusts the position of implant instruments such as brain electrodes

All these instruments are based on the principles of microelectronios and miniaturization.

Diathermy

Diathermy is the generation of heat in body tissues resulting from the resistance of the tissues to high frequenoy current flow. The use of diathermy equipment in hospitals, physioal therapy departments, doctor's offioes and olinios for muscle treatment is well-known.

Unlike heat applied to the body by hot towels, a heating pad, infrared lamps, etc., the heat from the diathermy maohine is developed within the body without burning the skin.

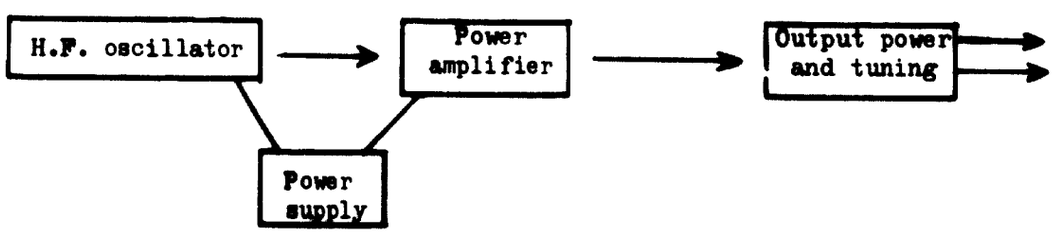

Figure IV. Blook diagram of a typioal diathermy unit

Figure IV is the blook diagram of a typioal diathermy unit. The unit oonsists of an osoillator, amplifier, tuning oontrols, output oirouits and a power supply. The H. F. signal is generated in the oscillator and applied to the amplifier, where it is greatly increased. The amplified signal is fed to the tuning and output circuit, a variable resonant tank.

B. Modern trends in the development of MEE

Modern trends are examined in this section to show the direction of world manufacture and the technical level of MEE on the international market.

The analysis of the progress in MEE reveals the fact that diagnostic equipment advances more speedily than therapeutic ones. It can be explained by the fact that nowadays drugs and chemotherapy are used rather than administration of physical treatment. Thus, the renewal of diagnostic instruments in use takes place usually every 3 to 5 years, while the therapeutic ones are renewed every 6 to 8 years. This can be explained by the essential influence of scientific and technological progress, and particularly by the enormous growth of both electronic and computer technology.

Recently a new tendency has been observed in diagnostic methods. One of the new methods is thermographic examination based on thermal emission from the human body, and involves the use of instruments such as a thermograph and a thermovision set. Tissue undergoing pathological change has a different temperature from healthy tissue. Such differences in temperature between troubled and healthy parts of the human body may be used in the diagnosis of certain diseases. Thermography is a technique of reproduction of thermal pictures to demonstrate the surface temperature distribution of the object under examination. The thermal picture - thermogram - is a product of infrared radiation. The thermogram can be in white and black and in other colours. Thermography is used mainly for the diagnosis of cancer, inflammation and troubles with blood circulation. A medical thermogram is produced by scanning the object with a camera fitted with rotational prisms or mirrors, lenses and a detector. Under a fairly high speed of scanning the picutre can start to move as if on a television screen. To process such thermograms, the microcomputers of special purpose analysers are used.

The main advantage of such a promising method of diagnosis is the absence of the external source of radiation which could be harmful to the health of the patient as well as that of the medical personnel.

Diagnosis by means of X-ray examination still remains one of the leading diagnostic methods. Many firms produce equipment such as tomographs or pantomographs for layer roentgenography as well as for the roentgenocontrast examination of blood vessels, the oesophagus and the stomach. Of wide application is the equipment of radioisotope diagnosis. As a rule the price of such equipment is fairly high.

Considerable progress has been made regarding ultrasonic units for diagnosis in ophtalmology, urology, gastroenterology as well as for cleaning surgical instruments, surgeon's hands, etc.

Recently physiotherapeutic equipment has reached a high degree of perfection. Many firms are engaged in the production of electrotherapeutic equipment, ultra-high frequency (UHF) and microwave therapeutic equipment, and ultrasonic therapeutic equipment. The apparatus "YRAT - IM" made in the Union of Soviet Socialist Republics (USSR) for lithotrity by means of shock hydrowaves is of special interest because no surgical action is required.

The use of laser techniques in medicine has led to improvements in the design of equipment for the treatment of some eye diseases and refinements in surgical techniques for cutting soft tissues and pulp coagulation. It makes possible rapid healing with much less loss of blood and no burned areas, as the operations are performed with an electric knife.

The treatment of malignant tumors is now a complex process: chemotherapy is combined with radiation therapy. For the radiation therapy special roentgen-therapeutic and gammatherapeutic installations are used. They allow for static as well as rotational irradiation. Such equipment is designed to ensure the most accurate identification of the spot to be irradiated in order to ensure the destruction of the malignant tumours only and to avoid any harm to the healthy tissues (dose distribution).

At present the therapy of neoplastic diseases by means of protons, neutrons, mesons and other atom particles is gaining recognition. This method of treatment is very expensive (it requires the construction of special accelerators operated by remote control and the protection of the personnel from irradiation). However, the method is promising, because deep tumours can be reached by a suitable dose distribution through the tissue.

Progress in the development of MEE, and in particular of roentgen equipment, electrocardiographs, electroencephalographs, monitors of different kinds, etc., is generally measured in terms of increased reliability and rapidity in their effects, and greater throughput capacity to save time during the examination process. The examination time cycle is reduced in general because of an acceleration of the data processing cycle. The data are read off the instruments and presented in the form desirable for convenient comparison of real

data with given normal values. The information from any instrument (unit) is presented as a set of data (e.g. tomograms, roentgenograms) on paper, film, magnet, tape, an oscilloscope tube, etc. To process and decode these data the microcomputers are used. Mechanization and automation contribute a great deal to the processing of output data, which helps to increase the throughput capacity of equipment.

The automatization of data processing is mostly effective in a case of mass examination of the population and in large medical organizations such as diagnostic centres with considerable throughput capacity.

Toshiba of Japan makes use of computers for the processing of the picture. Its Gamma apparatus, type GCA-102 or GCA-202 along with the ultrasonic tomograph, type SSL-31A, are connected to the computer which processes the output picture into a readable form, filters them, synthesizes the colour picture, and after staining the areas with different intensity finally produces the picture on a TV screen.

Standard quick-action units are provided by Humetries (United States of America). The mechanized automatic data-processing units are usually provided with a complete set of examination equipment, such as that of Gats (USA); the ultrasonic equipment of the Picker Corporation (USA);[1/] and the equipment for automatic data recording of Siemens (Federal Republic of Germany). The data input of some equipment is so large that it can only be processed by computer. Examples of such equipment are the Gamma apparatus for proton diagnosis and the automatic decoding system for electrocardiograms produced by Siemens (FRG),[2/] and the diagnostic analysis unit, produced by Electronic Processors (USA).[3/]

On the one hand, the incorporation into modern medical equipment of such computer elements as processors, memory units, logic modules, graphics, plotters, tape recorders, etc., leads to price increases, makes the equipment more complex, and also imposes strict requirements as to its operation, servicing and the qualifications of the operators. On the other hand, the incorporation of such elements is economically profitable because of the considerable reduction in

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1/ Biomedical Engineering, vol. IX, No. 2 (1974), p. 65.

2/ Siemens - System der automatischen EKG-Auswertung, 1973.

3/ Biomedical Engineering, vol. IX, No. 2 (1974), p. 64.

the data processing time cycle, thus increasing the throughput capacity. The quality of the equipment ensures correct diagnosis due to semi-automatic and completely automatic modes of operation.

The tendency towards high throughput capacity of the equipment influences the equipment used in traditional methods of examination, such as ECG, measurement of arterial blood pressure, etc.

Beokman (USA), produces, in addition to a number of other types of medical equipment, 8-channel and 16-channel electroencephalographs of module construction using integrated circuits (IC). The standard connectors make possible quick connexion of these units with the oscilloscopes, recorders and the computers.

Medicor of Hungary has produced an interesting piece of equipment, type AVE-- 1 with programmed control intended for arterial blood pressure measurement (Riva-Rocci-Korotkoff principle). Sharp (Japan), produces an electronic sphygmomanometer which makes it possible to avoid the use of a phonendoscope. The sensor of the pulse's sound is built into the collar, and in the scale of the manometer there is a built-in miniature red lamp which starts flashing as soon as the readout is at systolic pressure value (the appearance of Korotkoff's current) and stops flashing at diastolic pressure value. The principle on which the operation of this instrument is based is of interest and can be used for the production of instruments intended for mass examination.

The automatic processing of medical data promotes the production of monitors, devices for controlling the condition of critically ill patients and for generating alarm signals if necessary. On the international market for monitors the Sharp and the Nihon Kohden, both of Japan, have achieved considerable success. They are designed to make and record ECG, plethysmograms, the number of heart impulses, breath frequency and body temperature. All these monitors are of modular design. The new monitor of Devices and Instruments Ltd (United Kingdom of Great Britain and Northern Ireland), is designed to control the functioning of the brain. The monitor compares the normal ECG signal with the patient's signals which are compressed and filtered. Any detected dissmilarity means a pathological impairment. The monitor can be used for the control of such parameters as the speed and depth of the anaesthesia and for the appraisal of the effect of new drugs on the nervous system.[4/] The connexion of the monitor

4/ British Journal of Anaesthesia, vol. 46 (1974), p. 12.

to a computer (Chirana, Czechoslovakia) is effective when it is necessary to record and evaluate vital functions such as the electrical activity of the heart, the hemodynamics of peripheral blood circulation, respiration, temperature and blood pressure. During the last few years there have been a number of cases in which a monitor has been used in connexion with a computer for the detection of arrhythmia (Electronics for Medicine Inc., USA). To check the state of a patient with a coronary disease special equipment (Cambridge Medical Instruments, United Kingdom),[5/] is available for connecting the control unit with four bedside monitors and a central control station for the operator. There is a combination of a monitor and a computer capable of recording 8 parameters of the patients in a ward of 32 beds (Siemens). The preprogrammed computer enables the whole system to put out up to 30 alarm signals. The units of type Kardalarm - S - 1 and Kardalarm - S - 2 may be used alone. They are able to detect bradycardia, tachycardia, asystole, and some forms of extrasystole.

The concept of automation is best exemplified by the clinical analysis equipment with high throughput capacity supplied to large clinics. There are more than 150 firms in 18 countries having such equipment under production. Of considerable interest is a selective biochemical analyser made by Grenier-Electronic (Switzerland). Autoanalyzers of this type are in essence automatic biochemical laboratories. They are able to carry out up to 40 biochemical examinations according to the selected programmes, and are provided with the logic units required for processing the findings. They have the added advantage of simplicity in the programming process.

The aim of modern designs of clinical laboratory examination equipment is to reduce the number of probes. The computerized photometric clinical chemistry analyzer (Ollituote OY, Finland) merits consideration. It can perform 1,000 examinations per hour.[6/] The probes are replaced by photometers and the output equipment is based on the Nova - 1200 (Data General, USA) type of computer.

The understanding of the biophysical nature of human diseases particularly the electrophysiological process of excitation has led to the development of stimulators of different organs. But the major achievements have been in the

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5/ Hospital International, vol. VIII, No. 3/4 (1974), p. 11.

6/ British Journal of Anaesthesia, vol. 46 (1974), p. 12.

field of cardiostimulation. Noteworthy examples are cardiostimulators such as the Stimulator SI-10 of Narcobiosystems Inc (USA), the electrocardiostimulator HCM-2 of V/O, Medexport, USSR, etc.

Medical equipment currently produced incorporates telemetric systems for visual control of the processes taking place within the human organism. Of special interest are visual observations during X-ray examinations and image recording on film. The Video Long-Playing Recorder (VLP) capable of transforming X-ray information directly into visible information at any required location is under production at Philips (Netherlands). It is possible to store 10,000 X-ray images on a record of some 15 in. diameter without loss of information.1/ The 4-channel radiotelemetric system, developed by V/O Maschpribor-Introg (USSR), is designed for the simultaneous transmission and reception of one physiological parameter from four moving persons. The system ensures remote transmission of one of the following parameters: ECG, electromyogram or respiration frequency. The system makes it possible to transmit and receive these parameters when a person is moving freely in space or is carrying out some work. The system units are based on the semi-conductor and use printed circuit wiring. A TV metering system combined with therapeutic and electronic optical transformers has been designed by Medicor, of Hungary. The system transforms a minute image of high brightness into a TV picture. Japanese Telemetric monitors, type ECC. model WEP-6121, are under production at Nihon Kohden. The method of functional models or modular design is now predominant. This trend is common for almost all types of medical equipment. The weight and size of the modules are reduced because of the wide use of printed circuits, transistors, and so on. In practice there are some small-sized instruments, e.g. the miniature electrocardioscope, model MC-3, produced by Medicor (Hungary), the portable single channel electrocardiograph Malysh, made in the USSR, the portable defibrillator unit of Travenol Laboratories (USA), etc.

It is of importance that in these modular designs the standards for modular blocks are observed while designing the layout. The design of electronic equipment such as biopotential recorders, monitors, and medical control systems show much in common.

A distinctive feature of recent MEE design is the attention given to ergonomics requirements. Thorough study of equipment design from the point of view of ergonomics aims at ensuring the most comfortable conditions for both patients and personnel.

1/ Hospital International, vol. VIII, No. 3/4 (1974), p. 11.

II. THE DEVELOPMENT OF MEE IN MALAYSIA

A. Prospects for the development of a MEE industry in Malaysia

This section examines the technical possibilities of the electrotechnical industry of Malaysia to promote the manufacture, maintenance and repair of MEE, and provides some general information about the promotion of MEE.

It should be noted that this study covers only the use of electrical and electronic units for the production of MEE, and does not consider the problems of the use of electromechanical units. These units will have to be the subject of separate studies.

The second five-year plan covering the period 1971-1975 lays considerable emphasis on the industrial development of Malaysia. During the first four years of the second plan the processing industry has developed vigorously.

The Government's policy of stimulating investments in some industrial branches has led to rapid growth in the industrial sector.

Table 1, annex V, shows the changes in industrial production indexes. It is obvious from this table that new industrial branches such as metallurgy, electrotechnics, and transport equipment have a high growth rate.

The electronics industry in Malaysia is very young, and many enterprises were established in 1970-1973. Production is growing from year to year (see table 2, annex V).

Government bodies such as Federal Industrial Development Authority (FIDA) and Malaysian Industrial Development Fund (MIDF) play a considerable role in the development of the country.

In carrying out its mission the survey team visited a number of enterprises and institutions in different parts of the country (see annex IV). During these visits, attention was given to the manufacture and assortment of produots, the technical characteristics of electronic components and units used in the production of MEE, the qualifications of workers and engineers, and so on.

Manufacturing companies produce components such as the following: high and low frequency transistors; transformers, including low frequency transformers for television and radio; resistors; speakers; high light-emitting diodes (LED);

memory stacks for computers; radio communication systems; integrated circuits, capacitors, protective devices for lamps; 9-digit low drive-current LED displays; and, 7-segment numeric displays.

The enterprises are assembly plants which use mainly imported raw materials and initial components for production. The enterprises have no experience in producing electronic components for medical equipment. Only the Swiss firm Kehrli X-ray Sdn. Bhd. produces mechanical parts for X-ray machines and the annual production is about 300 units. If Malaysia could buy the tools and produce its own X-ray tubes, a part of the country's demand for X-ray machines could be met entirely by local production. A number of firms have expressed their readiness to produce the necessary components, units and blocks according to the required MEE specifications. Some of these firms and their main products are the following: Tamura Electronics Sdn. Bhd. (Japan) - transformers for television and radio; Omron Sdn. Bhd. (Japan) - electromagnetic relays and micro-switches; Monsanto Electronics Sdn. Bhd. (USA) - light-emitting diodes; N.S. Electronics (M) Sdn. Bhd. - displays, calculator modules; Motorola Sdn. Bhd. (USA) - different radio communication systems; General Electric Corporation Sdn. Bhd. (United Kingdom) - different television and radio components and devices.

Thus, Malaysia meets all the conditions for the production of medical electronic instruments. Only when the industry can ensure a smooth flow of sufficiently high-quality and reliable products will it be possible to supply them to the different medical centres and hospitals and compete in foreign markets.

Conclusions

1. The components, units and blocks of the Malaysian electronics industry meet the demands of the world's most modern designs.

2. At present Malaysia's local industry is not ready to manufacture MEE, but it is in a position to assemble MEE.

3. The raw materials and components for the manufacture of electronic goods are mostly imported.

4. Malaysia can assemble MEE at competitive prices for the international market.

5. It is possible to organise an experimental assembly shop for MEE.

6. In the case of local production of X-ray tubes it is possible to meet a part of Malaysia needs for X-ray machines by using the mechanical units of X-ray machines which are produced by the Swiss firm Kehrli X-ray Sdn. Bhd.

Recommendations

1. It would be useful to set up an initial group which would assume responsibility for the modernization and assembly of experimental designs of MEE and produce small series of such equipment.

2. During the MEE production process attention should be paid to the following:

(a) The production of MEE should reflect modern developments;

(b) The use of transistorized equipment and integral circuits is preferable;

(c) Block construction of MEE is desirable;

(d) The equipment has to be produced in accordance with established standards;

(e) The product has to meet its specifications fully, in particular those relating to the required parameters and quality level;

(f) Locally manufactured parts and components should be used as much as possible;

(g) The importance of reliability should be borne in mind;

(h) The equipment has to be tropicalized to suit Malaysian climatic conditions.

3. During the progress of work, the following should be done:

(a) Serious efforts should be made to improve designs and promote development;

(b) New ideas should be stimulated;

(c) Progressive production data should be collected and analysed;

(d) Continuous modifications and improvements should take place;

(e) Quality control should be strictly ensured;

(f) Staff should be trained;

(g) Market research should be undertaken.

B. Qualified personnel for the promotion of the MEE industry in Malaysia

This section considers the question of the availability in Malaysia of qualified workers such as electrical and electronics engineers who can be used in the promotion of MEE.

During the period of experimental production it is important to have qualified workers who are experienced in the electronics and electrotechnical industries, and to have engineers trained in MEE technology and who are able to organize and direct the manufacture of MEE in accordance with international standards.

Table 5 (see annex VI) shows that the number of employees in the electrotechnical industry is 21,526. This is approximately 10% of the total number of employees in the manufacturing industry. It shows that the country has a developed electrotechnical industry with a sufficient number of employees. However, the real number of qualified personnel with a knowledge of MEE is very small. There are only a few men in the hospitals of Malaysia who have a thorough knowledge of MEE and who could contribute to the development of the MEE industry.

Visits to manufacturing enterprises have shown that local engineers are available with experience in the production of certain types of electronic components and units. Their knowledge is limited to the technology involved and they have no experience of the full technological cycle. This inexperience restricts promotion of MEE in Malaysia. The above-mentioned engineers could be used for the promotion of MEE if they received special training at the firms which produce MEE.

The hospitals visited have technicians (4 or 5) with a knowledge of certain types of MEE who could supervise the initial groups in the promotion of MEE and during the creation of a technical servicing centre.

An important factor for the production of MEE is the salary of the workers and engineers. At an exchange rate of $US 1 = $M 2.6, the average monthly salary of employees in the electrotechnical industry is approximately $M 224 ($US 86) for workers and from $M 600 to $M 1,000 ($US 230 to $US 384) for engineers, as compared with average monthly salaries in the United States which are approximately $US 350 and from $US 600 to $US 1,000 respectively. Malaysia therefore has inexpensive manpower, which is an advantage in the production of competitive MEE. To sum up, Malaysian workers have no experience in the manufacturing of MEE, but they do have some experience in its maintenance. Serious attention should therefore be given to the training of local engineers in order to meet the needs of hospitals and promote MEE in Malaysia.

Information on the Third Malaysia Development Plan (see New Straits Times of 14 September 1975) suggests that during the period of establishing the new MEE industry, demand for engineers can be met by the University and other institutes if special courses on MEE are included in their programmes.

Conclusions

1. There is a sufficient number of workers qualified for employment in the electronics, electrical and assembly enterprises, and they can be used in the serial assembly of MEE.

2. The manufacturing enterprises which provide the electrotechnical and electronic products have not enough qualified engineers who could be used in the manufacture of MEE.

3. Malaysian hospitals have several qualified engineers who can be used for the maintenance and repair of MEE.

4. The fact that the University and the institutes do not train specialists in MEE creates certain difficulties in organizing the manufacture of MEE.

Recommendations

1. In organizing the experimental production of MEE use should be made of the experience of one or two specialists in the field from United Nations organizations or from foreign firms producing such equipment. No domestic experience is available.

2. Special courses on MEE technology and on the service, maintenance and repair of MEE should be included in the programmes of the University and the institutes of Malaysia in order to meet the demand from hospitals and medical centres for specialists and the needs of manufacturing plants.

3. Foreign specialist should be invited to the University of Malaysia to give lectures in the above-mentioned courses.

4. Local physicists and engineers should be sent to foreign companies for training.

5. Medical personnel should be given the necessary technical training through seminars, symposia, lectures, etc., in order to achieve the maximum benefit from the use of MEE.

C. Health services in Malaysia

This section describes the system of health services in Malaysia, and examines the domestic demand for certain types of medical electronic equipment.

The Government of Malaysia gives serious attention to the improvement of medical services throughout the country, as shown by the sums allocated to such services under the Second Malaysia Development Plan (see table 6, annex VII).

The Ministry of Health report "Our health services in the seventies", issued on 20 May 1975, shows that there is a growing number of in-patients and that the hospital service is being constantly extended (see tables 7 and 9, annex VII). At present there are 65 government and 83 maternity homes and private clinics in peninsular Malaysia.

The distribution of medical centres in each of the states of the country is given in tables 8 and 10, annex VII.

States with a high population such as Perak, Selangor and Johor have special institutes for tuberculosis, leprosy and mental cases, etc. (see table 10, annex VII).

The data in tables 11 and 12 (see annex VII) shows the availability of qualified medical personnel in the medical centres. These tables also show that there are many travelling dispensaries which mainly service rural populations, especially those located far from the big centres.

On the basis of data received as a result of visits to the different medical centres, it was determined that MEE is mainly concentrated in the big medical centres, and that the patients with the most complex diseases are directed to the biggest hospitals: the General Hospital and the University Hospital in Kuala Lumpur, etc.

The biggest hospitals such as the General Hospital, the University Hospital in Kuala Lumpur, Assunta in Petaling Jaya, General Hospital Ipoh, General Hospital Malacca and Penang General Hospital have MEE of all types with which to treat their patients (see table 14, annex VIII).

The data in table 13, annex VII, show that the most widespread diseases among the population of Malaysia are: penumonia, cancer, malaria, pulmonary and other types of tuberculosis, asthma, anaemia, diabetes mellitus, ulcer of the stomach and duodenum, gastritis and duodenitis, schizophrenic disorders.

Thus for the diagnosis and therapy of the above-mentioned diseases it is necessary to have MEE such as: X-ray machines (including mobile ones), analysers for blood, urine, gas, defibrillators, biostimulators, devices for measuring blood pressure, cardiographs, encephalographs, monitors and so on.

Taking into account the number of motor vehicle accidents (see table 13, annex VII), it is necessary to use portable MEE for determining the damaged organs and to give first aid at the scene of an accident.

Conclusion

The growing network of medical centres in Malaysia creates an additional demand for MEE.

III. MAINTENANCE, SERVICE AND REPAIR OF MEE

This chapter considers the types of MEE available in Malaysian hospitals and their maintenance and repair costs, and suggests ways in which the national servicing of MEE in hospitals could be promoted.

It should be noted that a study of the maintenance and repair of MEE was not included in the expert's job description. Nevertheless, maintenance determines the efficiency of the equipment and is therefore very important.

At the present time inefficient servicing is provided in many hospitals of Malaysia, as the visits have shown.

In so far as the hospitals of Malaysia have no technical personnel (with rare exoeptions), they have contracts with firms or trading companies for technical servicing. These contracts cover the maintenance and repair of MEE in the hospitals.

Maintenance work is divided into the following two parts: checking the performance of MEE and cleaning and testing the equipment; and repairing the machines if necessary.

The service contracts include cleaning and checking the performance of the equipment twice a year. If the equipment is out of order the service contract provides for finding the reason for the breakdown, but the hospitals have to purchase the parts of the machines which have to be replaced in order to restore normal functioning.

Table 14 (see annex VIII) shows, inter alia, the availability and estimated servicing costs of MEE in some Malaysian hospitals. This table also shows that MEE is mainly concentrated in the very big regional medical centres such as the General Hospital, University Hospital in Kuala Lumpur, the General Hospitals in Penang, Alor Star, Ipoh, Malacca, Johore Bahru, etc. The average annual service charges of each of these hospitals are estimated to $M 50,000 (see table 14, annex VIII).

The major types of MEE in these centres are the following: X-ray machines, physiotherapy equipment, electrocardiographs, defibrillators, monitors and display units, surgical diathermy equipment, spectrophotometers, pH meters, analytical instruments, blood gas analysers, counters, etc.

The small hospitals lack a wide range of MEE and the annual service charges inourred by each of them are estimated at approximately $M 1,000 (see table 14, annex VIII).

On the basis of the data collected from hospitals in the different regions of Malaysia, and taking into account the number of hospitals, an approximate calculation of annual MEE repair and service charges has been made (see table 16, annex VIII).

Service charges are only approximately $M 470,000, and taking into acoount the additional repair charges of $M 141,000 (counting 30% of the sum for service), the total charges are $M 611,000 per annum.

The total figure shows a substantial expenditure for service and repair. If service and repair were ensured by local workers, and if they were paid a monthly salary of $M 800, the above-mentioned total would be sufficient to employ 65 men. However, a 15-man team should suffice to ensure the service and repair of MEE in Malaysia.

These findings show that the idea of setting up a Malaysian service deserves consideration.

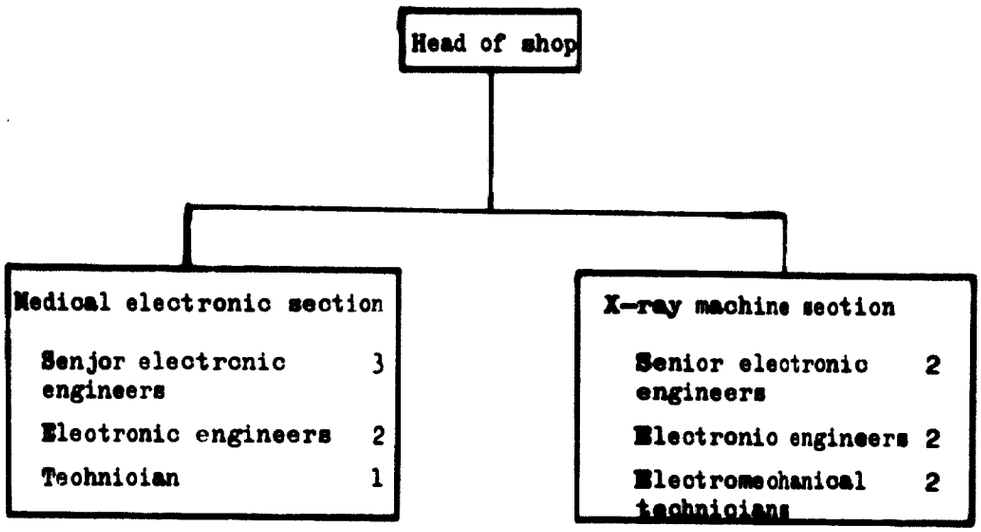
It should be noted that the experimental manufacture of MEE in Malaysia would lead to a reduction in total expenditure for the purchase of parts.

Conclusions

Maintenanoe and repair of MEE in Malaysia are being oarried out by trading oompanies or foreign firms in aocordance with the servioe contracts. A oonsiderable sum is paid by the country for service and repair every year.

Recommendation

Arrangements should be made for the servicing of MEE by a local repair shop, which could be organised as shown in figure V.



Other employees 3

Total 15 people

Figure V. Maintenance and repair shop manning table

IV. MARKET ANALYSIS OF BIOMEDICAL ELECTRONIC EQUIPMENT

A. The Malaysian market

This section surveys the domestic market to determine the volume of demand for MEE.

Table 17, annex IX shows the value of imports of medical equipment into West Malaysia for the period 1970-1973. An analysis will be made of two different groups of equipment.

Electromedical instruments for diagnostic purposes in hospitals

The total expenditure for this type of equipment was $M 337,480, $M 418,736, $M 431,222 and $M 511,468 for 1970, 1971, 1972 and 1973 respectively (see table 17, annex IX). During this period demand therefore grew at rates of approximately 24%, 3% and 18% respectively, which gives an average annual growth rate of 15%.

On the basis of these statistics, it is expected that total imports of this type of equipment will cost approximately $M 676,416 in 1975.

However, the figure approved for the group of government hospitals in 1975 amounts to $M 1,681,029, minus $M 535,350 (for X-ray machines and parts), which gives $M 1,145,679 (see table 15, annex VIII).

This sum does not include the requirements for private hospitals, which can be estimated at 10% of imports for government hospitals.

The total sum for the import of electromedical instruments for diagnostic purposes in 1975 is:

	$M
Government hospitals	1,145,697
Private hospitals (10%)	114,570
	1,260,267

X-ray machines and parts

According to the statistical data (see table 17, annex IX), expenditure was $M 3,014,470, $M 2,053,906 and $M 1,348,025 for 1971, 1972 and 1973 respectively. This shows that imports of equipment in this group fell at an average annual rate of approximately 33% during this period. The approved figure for imports of this type of equipment was $M 966,000 and $M 535,350 in 1974 and 1975 respectively (see table 15, annex VIII). The last figures cover the government hospitals only.

Total imports of this type of equipment amounted to $M 1,062,600 and $M 588,885 in 1974 and 1975. These figures include imports for private hospitals, which are estimated at 10% of those for government hospitals.

Table 15, annex VIII, shows the distribution of MEE in the different regions of Malaysia together with demand and approved purchases for 1974 and 1975. The figures show that demand totalled $M 2,351,800 and $M 2,587,300 in 1974 and 1975 respectively. The number of units were 273 and 361 during those years.

The real expenditure for electromedical instruments and X-ray machines and parts was $M 1,570,064 and $M 1,681,029 in 1974 and 1975 respectively. These figures cover government hospitals only.

The number of approved units were 149 and 272 for those years.

Table 15, annex VIII, also shows the approximate cost of MEE in each group.

Conclusions

1. The internal market in Malaysia is not very big and the total cost of imports for government hospitals amounted to $M 1,570,064 and $M 1,681,029 in 1974 and 1975 respectively. The number of units were 149 and 272 respectively in 1974 and 1975.

2. The biggest demand is for the following: electrocardiographs, analytical instruments, physiotherapy equipment, defibrillators, monitors and display units, spectrophotometers, X-ray units, pH meters, and surgical and diathermy equipment.

3. It is clearly not worth while to manufacture MEE to meet internal demands.

4. The major suppliers of the Malaysian market are Belgium, the Federal Republic of Germany, India, Japan, the Netherlands, the United Kingdom and the United States of America.

B. The international market for MEE

This section analyses the volume of MEE exports from some countries, the types of MEE exported, and the import possibilities to Malaysia's neighbouring countries.

An analysis of the international market for MEE shows that the major countries which supply MEE to the international market are: Austria, Belgium, Canada, Denmark, the Federal Republic of Germany, France, Italy, Japan, the Netherlands, Norway, Sweden, Switzerland, the United Kingdom and the United States of America (see table 18, annex IX).

This table indicates that the volume of the international trade is increasing from year to year. The total cost of MEE exports from the 14 above-mentioned countries was $US 95,159,000 in 1970, as compared to $US 44,655,000 in 1966. It more than doubled during that period. The quantity of MEE (based on an average unit price of $US 1,000) was 95,159 and 44,655 pieces respectively.

Table 19, annex IX, shows the firms manufacturing MEE, the types of MEE imported and exported, and import and export costs (in $US).

It is clear from this table that the most common types of MEE are: central and bedside monitoring systems, inplantable pacemakers, blood analysers, electrocardiographs, phonocardiographs, electroencephalographs, X-ray instruments, spectrophotometers, electronic computers for medical applications, defibrillators, cardioversion systems (consisting of defibrillator, recorder, oscilloscope and amplifier), gas chromatographs, photometers, automated blood counters, cardiac output analysers, radiological equipment, radioactive equipment, laser surgical instruments, computers for planning and sintillation cameras.

Countries and territories neighbouring Malaysia such as Australia, Brunei, Burma, Hong Kong, India, Indonesia, the Philippines, the Republic of Korea, Singapore and Thailand deserve special attention as possible export markets.

Tables 20 to 29, annex IX, show the volume of imports of medical equipment into these countries.

The average annual growth rates of imports of medical equipment into Australia, Brunei, Burma, Hong Kong, the Philippines, Singapore and Thailand were respectively: 9.9% (1971-1974); 105% (1969-1970); 6.5% (1970-1971); 62.7% (1971-1974); -11% (1969-1971); 42.4% (1971-1974) and 28% (1971-1973).

The total estimated import costs of medical equipment into those countries in 1975 were: $M 21,896,000 (Australia); $M 1,000,000 (Brunei); $M 2,292,290 (Burma); $M 13,282,000 (Hong Kong); $M 10,748,000 (India); $M 2,446,000 (Indonesia); $M 581,000 (Philippines); $M 12,665,000 (Republic of Korea); $M 13,134,000 (Singapore); and, $M 15,785,000 (Thailand).

The total import costs of medical equipment into the above-mentioned countries was $M 93,802,000, or $US 36,077,000 ($US 1 = $M 2.60).

Taking into account that the value of the MEE is approximately 60% of total import costs, this gives a figure of $M 56,281,000, or $US 21,646,000.

Conclusions

1. The international market for MEE in Malaysia's neighbouring oountries is quite large.

2. The value of MEE imports to Malaysia's 10 neighbouring countries is estimated to have been $M 56,281,000, or $US 21,646,000, in 1975.

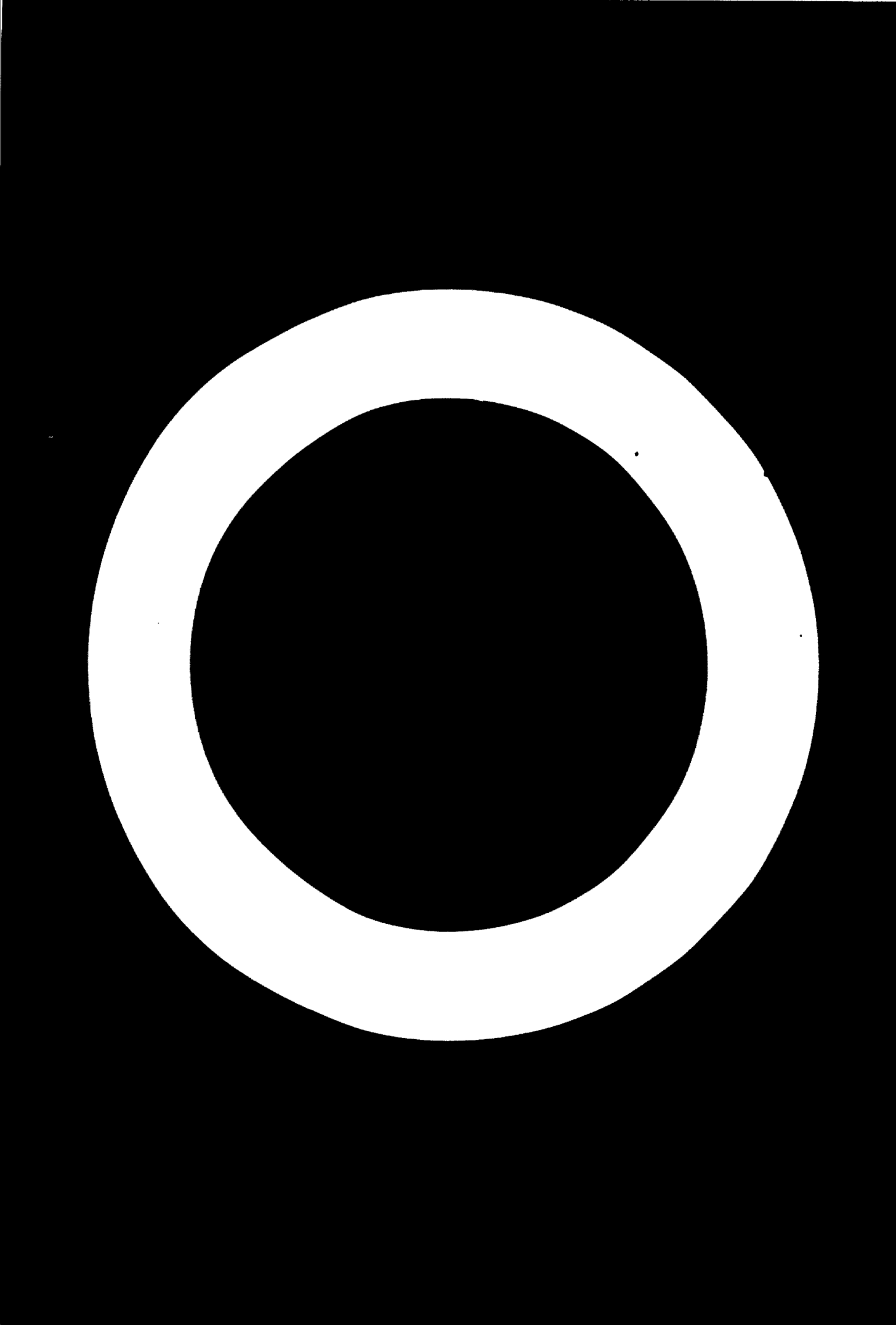
3. With the assistance of foreign firms it is possible to organise the production of MEE in Malaysia for the external market. Table 5, annex VI, shows comparative wages in the MEE Industry.

4. It is estimated that MEE assembled in Malaysia will be competitive on the international market because of inexpensive labour. The cost of transporting the goods to the neighbouring countries would therefore be lower than goods from Europe or America. This makes MEE assembled in Malaysia more competitive.

5. Malaysia is situated in a very good geographic position for international trade with the Asian countries.

Recommendation

An economic analysis of promising types of MEE should be made to determine the feasibility of the proposed production (see annex III for a list of MEE recommended for production).



Annex I

JOB DESCRIPTION FOR THE PROJECT IN MALAYSIA
(DP/MAL/72/001/11-08/12/(01))

POST TITLE	Adviser on Medical Electronic Equipment Projects
DURATION	Four months
DATE REQUIRED	January 1975
DUTY STATION	Kuala Lumpur, with travel within the country as required
PURPOSE OF PROJECT	To advise the government agency FIDA (Federal Industrial Development Authority) on projects to manufacture and/or assemble, medical electronic equipment of all types that could be promoted in Malaysia.
DUTIES	The expert will advise and assist national staff under the over-all direction of the Director of FIDA. He will work with the Head and other officials of (1) the Industrial Studies and Survey Unit and (2) the Special Projects Studies and Special Studies Unit. He will advise and assist other units of FIDA as required. Specifically, the adviser will be expected to: 1. Assist in carrying out an in-depth study of the potential for manufacturing selected items of medical electronic equipment, taking into account the existence of potential suppliers in Malaysia, the availability of labour skills, and the potential demand in export markets; 2. Assist in screening the opportunities thus identified, select the more promising ones and prepare, where appropriate, pre-feasibility or feasibility studies of the projects thus selected; 3. Advise on the best ways and means to promote the implementation of these projects; 4. Evaluate, as and when requested, proposals for the manufacture of medical electronic equipment submitted to FIDA by potential investors.
QUALIFICATIONS	Extensive experience in a company or companies which manufacture such equipment. Candidates should have a sound knowledge of the production process as well as a detailed knowledge of potential international markets and channels of distribution and sufficient experience to advise on how best to enter these markets.
LANGUAGE	English

BACKGROUND INFORMATION

In recent years, FIDA has promoted the establishment in Malaysia of a wide range of plants, manufacturing components, and assemblies for the electronics industry. Although special investment incentives have been available to companies willing to manufacture or assemble medical electronic equipment in Malaysia, few such export-oriented enterprises have been established so far. FIDA recognizes that the establishment of such industries whether for basic manufacture or on an assembly basis, requires technical know-how and expertise. The expert is expected to advise on how to promote this new industry and advise on labour training, and the development of supplier industries that it will require.

Annex II

WORK PROGRAMME

The advisor on the promotion of the medical electronic equipment industry in Malaysia had the following duties:

(a) To study the potential of Malaysia for production and assembly of the separate items of medical electronic equipment:

(i) Sources of necessary data for the promotion of medical electronic equipment:

Treasury report;

Second and Third Malaysia Plans;

Malaysia Yearbooks for 1973, 1974 and 1975;

Directory of the Federation of Malaysian Manufacturers, 1975;

Ministry of Health - reports and plan;

Institute of Medical Research Reports;

FIDA's annual report;

(b) (i) To find out the potential opportunities and capabilities from existing enterprises which can produce the electronic devices, units, blocks and different components for the development of medical electronic equipment by visiting these existing establishments;

(ii) To collect and study the availability of labour skill for the manufacture or assembly of medical electronic equipment locally;

(iii) To find out the types of equipment used by the medical centres and select the possible medical electronic equipment that can be made in Malaysia;

(c) To survey the internal market for medical electronic equipment in Malaysia;

(i) To find out the volume of equipment supplied by trading enterprises to medical centres (hospitals, laboratories, research centres, and medical education centres);

(ii) To ensure the servicing, maintenance and repair of medical electronic equipment;

(iii) To find out the demand from medical centres for medical electronic equipment by visiting such centres and trading enterprises;

(d) To survey the external market for medical electronic equipment. To consider:

(i) Existing and potential suppliers;

(ii) Trends in and prospects for the development of medical electronic equipment in the world;

(iii) Malaysia's potential for becoming an exporter of medical electronic equipment;

(e) To draw up conclusions and recommendations.

Annex III

LIST OF MEE RECOMMENDED FOR PRODUCTION

1. Implantable and nonimplantable stimulators
2. Defibrillators
3. Physiological data transmission systems using the telephone network
4. Lithotomy apparatus
5. Electrocardiographs
6. Dental X-ray apparatus
7. Portable anesthesimeters (for measuring the degree of anesthesia)
8. Electrocardiostimulators (for normalizing the cardiac cycle; emergency and clinical use)
9. Portable UHF therapy apparatus
10. Diathermic coagulation apparatus
11. Portable electric sleep therapy apparatus
12. Computerised systems for medical purposes

Annex IV

ENTERPRISES AND INSTITUTIONS WHICH COULD ASSIST IN THE PROMOTION OF MEE IN MALAYSIA

Chemara Research Station

This research body has two laboratories. One is equipped with an auto-analyser, a Penkin-Elmer atomic absorption spectrophotometer, two flame photometers and one Bausch and Lomb spectronics machine. The other has a Varian liquid gas chromatograph, a Varian ultraviolet spectrophotometer, a Shandon (USA) gas chromatograph, four pH meters (Beckman) and a rheometer 100 (Monsanto).

Communico

This is a local company owned by Malaysian Chinese. They manufacture transformers and ballasts. The products cover a wide range and are made to the customers' demands. This factory imports some of the raw materials. It has a small metal workshop to cut the metal parts from sheets, to do the moulds and some designs. The 50 to 60 employees can produce about 50,000 transformers in one month (maximum). They also produce transformers for the General Electric Corporation to be used in radios and TVs. A list of the transformers with technical specifications is available for reference.

Cycle and Carriage, Kuala Lumpur

This trading enterprise markets medical equipment by Siemens (Federal Republic of Germany), from small ECGs to betatrons. Although not much information is available about this company, it dominates at least 40% of the market for electro-medical equipment.

General Electric Corporation (M) Sdn. Bhd.

This company was established in December 1973. Its produots inolude: ultra-high frequency tuners for colour TV sets; radio intermediate frequency panels; unit audios; preamplifiers; DIN sooket assemblies (oomplete audio sets without the turntable); and, transistor radios.

Many of the raw materials are purchased locally, e.g. transformers, resistors, wires, metal parts, etc, and 90% of the products are for export. About 50% of the materials are used for making the radios and about 10% of the materials for the tuner are obtained locally.

This company employs 450 workers and 6 engineers, of which 3 are Malaysian.

George Kent (M) Sdn. Bhd.

This is a trading company dealing in British-made Cambridge medical instruments. The types of instruments vary from electrocardiographs to intensive care unit monitoring systems. These instruments are both simple in design and inexpensive, which suits the present Malaysian market.

There is an annual demand for about 50 ECG units and from 6 to 10 monitoring systems. The price of one monitoring system varies from $US 5,000 to $US 50,000.

This company circulates newsletters four times a year to keep doctors and specialists informed of advances in the development of new medical instruments.

The company had intended to set up a factory manufacturing pH meters, but has dropped the idea because of the high price of available components. It might revive the project if components are made available at a lower price.

Getz Brothers and Co. Inc.

This company deals in medical and analytical instruments other than industrial equipment. Its cardioscopes and monitors are semi-computerized.

Hewlett Packard (M) Sdn. Bhd.

This factory started in May 1973 as a 100% foreign (USA) company. It produces high-frequency diodes, light-emitting diodes and memory stacks. The products are all exported, while almost all the raw materials are imported. The 735 workers run on 2 shifts. The company will provide technical information regarding the products.

Kehrli X-ray Sdn. Bhd.

This is a Swiss firm with about 60 employees. It produces mechanical and electrical parts for X-ray machines. Annual production is 300 units.

Microsystems

This Canadian company has engaged about 155 employees to produce integrated circuits, capacitors, protective devices, switchboard lamps and bulbs. They would go into the making of polystyrene and Mylar capacitors, fuses, relays and transformers. The engineers are Malaysian. The products are all exported, while the raw materials are mostly imported.

The lamp's characteristics are as follows: 10 V, 35 mA, life, 10,000 h, intensity, 200 fc, and 1 mm Hg vacuum.

For data on the capacitors, refer to the company catalogue.

Monsanto Electronics Sdn. Bhd.

This company produces light-emitting diodes (LED). Technology is brought in from the United States, where the parent company is located, and raw materials are also imported. Its products are used in instruments of various kinds, computers, dash boards, indicators, cameras, testing equipment, etc.

The company can easily supply standard LEDs; special designs would raise difficulties.

Motorola (M) Sdn. Bhd.

This is a United States company which manufactures one-way and two-way radio communication systems. This is not a labour-intensive industry, but it is capital and brain intensive and requires high technology. The factory has about 350 employees running on 3 shifts to ensure maximum utilization of the facilities and equipment. The production capacity is 15,000 units of radio systems a week and the company is capable of producing 1,500 types of radio systems.

The situation in the medical electronic industry is reflected in that of this company, which manufactures sophisticated systems for export as well as local use. The company is also interested in the production of computerised systems.

N. S. Electronics (M) Sdn. Bhd.

This company, which employs 2,600 workers and 30 engineers, produces ordinary and power transistors, light-emitting diodes, single displays, calculator modules, clock modules and displays, lamps and watch modules.

Omron (M) Sdn. Bhd.

This is also a Japanese firm with 220 workers operating in one shift. There are 5 engineers, 3 Japanese and 2 Malaysian.

The products are electromagnetic relays and microswitches. The characteristics of the relays are given in the specification sheets.

In future, they intend to produce other types of relays and also cathode-ray tubes.

Penshin Components Sdn. Bhd.

This is a joint venture company between the Japanese and the Malaysians. It started in 1972 and its production capacity of resistors is about 500,000 pieces a day running on one shift with some overtime. Its carbon flame resistors are from 2.8Ω to 2.2MΩ. The company also makes small speakers for tape recorders and radios. Most of the raw materials are imported and 98% of the products are exported. It has 100 workers.

Philips (M) Sdn. Bhd.

This company trades in all kinds of medical equipment, from ECGs to linear accelerators. They have sold from 20 to 23 ECG units and about 6 intensive care unit monitors in one year.

The price of one battery-operated portable ECG is about $US 4,000, of one dental X-ray machine, from $US 3,000 to $US 4,000, of one Betatron 600, about $US 1.5 million, and of one linear accelerator, approximately $US 1.5 million. This company also sells industrial X-ray equipment, electron microscopes and X-ray diffraction instruments.

Roxy Electric Industries

This is an assembly plant which assembles TVs, refrigerators and rice cookers. The team is interested only in the TV plant.

All the electronic components are imported from the Sharp Company of Japan. The picture tubes are supplied from Taiwan by Phillips. The only local contents are wires, speakers, grills and cabinets.

This company was started by Hong Kong Investor, and now has gone public. It caters for the local market in peninsular Malaysia and also in East Malaysia. Apart from black and white TV, it also assembles colour TVs for Brunei and other markets.

Schmidt Scientific Sdn. Bhd.

This trading company deals with all sorts of medical instruments. In 1975, it sold about 15 ECG units with the brand name of Hellige. Two electroencephelographs (EEG) units were sold (Grass Brand). There are now only about 4 units in the country. Market demand for its products is thought to be increasing.

Siemens Components Sdn. Bhd.

This is a German company employing about 600 workers operating in 3 shifts. It started production in December 1974.

Its products are low-power and medium-power silicon transistors for low frequencies (up to 150 kHz), and low-power Germanium transistors for high frequencies (up to 5 GHz).

The characteristics of these transistors can be found in any electronics book, for they are common types.

The raw materials are all imported.

Standards and Industrial Research Institute of Malaysia (SIRIM)

The Standards and Industrial Research Institute of Malaysia (SIRIM) has a total staff of 250 with approximately 50 professionals (including 5 electronics engineers). The functions of SIRIM are to define standards, provide expert advice and ensure servicing and maintenance. This is a very young organization in its developing stage.

The electronic laboratory does circuitry designs for industries, and ensures the maintenance and repair of instruments. It has been proposed to calibrate all electronic instruments for industries.

The sum of $M 2.8 million has been allocated for equipment purchases in 1976. Some reports from SIRIM were available for information.

Tamura Electronics Sdn. Bhd.

This is a Japanese company which was established in February 1973 and employs about 230 workers in one shift.

Its main products are transformers for TV and radio and, to a very limited extent, for medical electronic equipment. The company produces to the customer's specifications and 96% of the products are exported.

The transformers are the common types for low frequencies (up to 50 cycles/sec) and with a maximum output of 45 VA.

The company has only one Japanese engineer now and is looking for more local engineers. Imports cover 20% of its raw material requirements. It will produce any type of transformers required, but the minimum quantity which may be ordered is 7,000 pieces.

Annex V

RECENT INDUSTRIAL PRODUCTION, GROSS NATIONAL PRODUCT AND TRADE STATISTICS

Table 1. Annual, quarterly and monthly industrial production indexes

Base year: 1968 = 100

Year	Chemical and chemical products	Products of petroleum and coal	Non-metallic mineral products	Basic metal industries	Metal products	Electrical machinery, apparatus, appliances and suppliers	Transport equipment	Other pioneers	Electricity
1968	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1969	111.5	100.1	111.9	143.9	106.7	128.6	210.2	147.2	105.7
1970	118.9	99.5	118.2	139.3	131.4	171.5	272.5	193.9	115.3
1971	121.6	92.0	119.3	188.5	141.3	188.9	281.9	289.4	123.1
1972	144.2	96.6	129.2	192.2	171.7	192.4	268.3	313.6	138.8
1973	185.6	99.1	147.0	225.5	242.8	200.6	393.0	474.5	153.5
1974	199.8	99.9	145.1	237.7	269.3	217.8	504.1	851.3	160.7

Source: Monthly Statistical Bulletin of West Malaysia, December 1974.

Table 2. Value of imports, exports and re-exports by commodity group, 1972 and 1973
($M)

Code	Description	1972			1973		
		Imports	Exports	Re-exports	Imports	Exports	Re-exports
726	Electro-medical apparatus for diagnostic purposes X-ray apparatus Total of group	439,205 2,083,284	4,679 67,349	3,283 46,821	523,554 1,348,030	2,209 6,100	2,200 5,950
729	Filament electric lamps, bulbs, different switches for electrical devices and radio equipment, fluorescent discharge tubular lamps, ultraviolet and infrared lamps, television camera tubes, electrical measuring devices, etc.	46,489,240	7,679,205	756,723	70,886,926	15,811,972	777,790
861	Spectacle lenses unmounted, periscopes, different optical apparatus, cinematographic cameras, different photocopying apparatus instruments for human medicine and surgery	33,703,704	2,107,920	1,188,331	131,844,336	125,950,716	22,219,554

Source: Peninsular Malaysia monthly statistics of external trade, December 1973.

Table 3. Gross national product (GNP) at market prices, 1965-1973
(Million $M)

Item	1965	1967	1969	1971	1973
Private consumption expenditure	5,578	6,221	6,714	7,543	9,500
Public consumption expenditure	1,483	1,704	1,626	2,481	3,358
Total consumption expenditure	7,041	7,925	8,340	10,024	12,858
Private Gross capital formation	781	888	939	1,314	1,600
Public gross formation	630	622	620	852	1,552
Increase in stocks	-	92	12	138	250
Total gross formation	1,411	1,602	1,571	2,304	3,402
Aggregate domestic expenditure	8,452	9,527	10,111	12,328	16,260
Exports of goods and services	4,307	4,222	5,548	5,543	8,010
Imports of Goods and services	4,166	4,097	4,686	5,598	7,636
Net trade on goods and services	+ 141	+ 125	+ 862	- 55	+ 374
Gross national product	8,593	9,652	10,973	12,273	16,634
Mid-year population (thousand)	9,421	10,034	10,600	11,184	11,818
Per capita GNP ($M)	920	961	1,035	1,097	1,408
Gross national savings	1,494	1,585	2,284	2,082	3,391

Source: Bank Negara Malaysia, vol. 7, No. 4 (December 1974).

Table 4. Balance of payments, 1969, 1971 and 1973
(Million $M)

1969	1971	1973	Item
4,986	4,956	7,304	I. GOODS
3,505	4,323	5,803	Exports (f.o.b.)
			Imports (f.o.b.)
+1,481	+ 633	+1,501	Merchandise balance
- 18	- 19	- 2	Non-monetary gold
			II. SERVICES (net)
- 187	- 225	- 340	Freight and insurance
- 11	- 40	- 60	Other transportation
- 96	- 106	- 120	Travel
- 308	- 227	- 498	Investment Income
+ 97	+ 44	+ 14	Government transaction
- 96	- 115	- 115	
- 601	- 669	-1,119	Services balance
+ 862	- 55	+ 380	BALANCE ON GOODS AND SERVICES
			III. TRANSFERS (net)
- 209	- 188	- 205	Private
+ 30	+ 21	+ 20	Federal Government
+ 683	- 222	+ 195	BALANCE ON GOODS, SERVICES AND TRANSFERS
			IV. LONG-TERM CAPITAL MOVEMENTS (net)
+ 299	+ 568	+ 396	Balance on long-term capital
+ 982	+ 346	+ 591	BASIC BALANCE
			V. SHORT-TERM CAPITAL AND UNRECORDED TRANSACTIONS
-	-	-	Short-term capital of Federal Government
- 454	- 221	- 296	Errors & omissions, including other short-term capital (net)
+ 528	+ 125	+ 295	OVERALL BALANCE (surplus +/deficit-)

Source: Bank Negara Malaysia, vol.7, No. 4 (December 1974).

Annex VI

LABOUR FORCE AND WAGES IN THE ELECTRICAL AND ELECTRONICS MANUFACTURING INDUSTRIES

Table 5. Employment and earning statistics

Industries	Paid employees as of 31st December 1974						Total	Salaries and wages per month in ($M)	Average salary per month ($M)
	Malaysian citizens			Non-Malaysians					
	Men	Women	Total	Men	Women	Total			
Electrical appliances	231	281	512	1	-	1	513	85,997	167
Electrical industrial equipment	186	76	232	5	-	5	237	59,649	251
Manufacturing and assembly miscellaneous electrical apparatus	4,649	16,756	21,407	114	5	119	21,526	5,750,159	253

Source: Monthly Statistical Bulletin of West Malaysia, August 1975.

Annex VII

HEALTH SERVICES IN MALAYSIA

Table 6. Expenditures for health services under the Second Malaysia Plan

Services	Peninsular Malaysia		Sabah		Sarawak		Malaysia	
	Million $M	%	Million $M	%	Million $M	%	Million $M	%
Preventive services	38.50	22.51	4.54	18.16	4.04	23.00	47.08	22.04
Curative services	112.63	65.83	15.86	63.44	11.46	65.22	139.95	65.50
Other projects/Programmes	19.85	11.66	4.60	18.40	2.07	11.78	26.62	12.46
Total	171.08	100.00	25.00	100.00	17.57	100.00	213.65	100.00

Table 7. Demand for hospital services, 1955-1974.

YEAR	Total beds available a/	Beds per 1000 population	Total admissions	Average no. of patients treated per available bed	Admissions per 1000 population
1955	12 736	2.10	242 903	19.07	40.1
1960	13 570	1.96	305 801	22.53	44.3
1965	15 056	1.87	417 147	27.71	51.9
1969	17 063	1.93	467 757	27.41	53.0
1971	17 470	1.84	496 535	28.42	52.3
1972	18 186	1.85	545 821	30.01	56.1
1974	18 541	1.81	606 790	32.73	59.2

Source: "Our health services in the seventies", Ministry of Health, Kuala Lumpur (20 May 1975).

a/ General and district hospitals (including special hospitals but excluding institutions).

Table 8. Statewide distribution of the rural health services in peninsular Malaysia as of 1 January 1974

States	Main Health Centres	Health Sub-Centres	Midwives' Clinics
Perlis	1	6	28
Kedah	4	23	156
Pulau Pinang	3	11	56
Perak	11	36	162
Selangor	7	26	128
Negeri Sembilan	2	16	80
Melaka	3	11	64
Johor	10	35	221
Pahang	6	25	161
Trengganu	4	13	75
Kelantan	5	22	105
PENINSULAR [illegible]	56	224	1,236

Table 9. Magnitude of hospital development and redevelopment programme in Malaysia

	PENINSULAR MALAYSIA		[illegible]		[illegible]		Total
	General Hospital	District Hospital	General Hospital	District Hospital	General Hospital	District Hospital	
[illegible] - Completed	•	2	•	•	•	2	4
- Under construction	•	2	•	•	•	•	2
- Proposed	1	19	•	2	•	2	24
[illegible] - Completed	1	1	1	•	•	•	3
HOSPITALS - Under construction	2	•	•	•	•	•	2
- Proposed	3	12	1	1	•	2	19
PHASED DEVELOPMENT PROGRAMME	3	25	•	•	3	•	31
[illegible]	1	4	2	6	•	6	19
TOTAL:	11	65	4	9	3	12	104

Source: "Our health services in the seventies", Ministry of Health, Kuala Lumpur (20 May 1975).

Table 10. Statewide distribution and location of hospitals and institutions in peninsular Malaysia as of 1 January 1975

STATE	Number of beds available			
	General Hospital	District Hospital	Institution	Total
Perlis	377	-	-	377
Kedah	578	731	-	1,309
Pulau Pinang	1,190	617	-	1,807
Perak	932	2,412	4,418	7,762
Selangor	1,975	1,037	3,446	6,450
N. Sembilan	1,072	693	-	1,765
Melaka	909	25	-	934
Johor	1,400	1,724	2,573	5,697
Pahang	366	926	-	1,292
Trengganu	306	202	-	588
Kelantan	914	75	-	989
Total	10,019	8,522	10,437	

Source: "Our health services in the seventies", Ministry of Health, Kuala Lumpur (20 May 1975).

Table 11. Health services: West Malaysia at the end of 1971

State	Estimated population at end 1970	Number of registered doctors	Number of registered dentists		Number of hospitals	Number of hospital beds		Number of dispensaries		Number of rural health centres			Maternity and child health centres
			Div.I	Div.II		Total	Used as Obstetries	Fixed	Travelling	M.C. (a)	S.C. (b)	M. Cl. (c)	
Perlis	126,906	24	2	3	1	299	36	9	2	1	6	28	1
Kedah	1,013,375	84	11	25	5	1,247	131	34	20	3	22	121	4
Penang and Province Wellesley	812,352	215	42	36	6	1,543	192	29	11	3	5	55	3
Perak	1,785,479	264	41	58	11	3,276	337	49	43	9	28	128	4
Selangor	1,565,530	738	96	73	5	2,774	358	45	7	7	24	101	5
Negri Sembilan	556,443	115	14	17	5	2,117	159	23	18	2	15	60	4
Malacca	450,138	78	9	20	2	1,005	134	19	14	2	11	56	3
Johore	1,418,816	215	32	76	9	2,602	429	49	38	5	30	167	6
Pahang	471,860	70	23	13	6	1,185	142	36	25	6	23	132	2
Trengganu	416,900	27	9	12	4	589	61	20	16	4	12	63	2
Kelantan	741,310	51	9	9	2	863	65	23	24	5	18	69	2
West Malaysia	9,359,613	1,881	288	342	61	27,661	2,094	337	223	47	194	988	36

Source: Monthly Statistical Bulletin of West Malaysia, June 1975.

Table 12. Health Services: West Malaysia at the end of 1972

State	Estimated population at end 1971	Number of registered doctors	Number of registered dentists		Number of hospitals	Number of hospital beds		Number of dispensaries		Number of rural health centres			Maternity and child health centres
			Div.I	Div.II		Total	Used as obstetries	Fixed	Travelling	M.C. (a)	S.C. (b)	M.Cl. (c)	
Perlis	128,135		2	3	1	299	36	9	2	1	6	28	1
Kedah	1,028,466		14	25	5	1,245	131	34	20	3	22	145	4
Penang and Province Wellesley	820,948		34	36	5	1,466	192	30	11	3	9	55	3
Perak	1,807,985		40	56	11	3,277	307	57	48	9	30	147	3
Selangor	1,587,730		101	72	5	3,045	336	52	14	7	24	114	4
Negri Sembilan	562,810		13	17	5	2,228	180	24	18	2	15	75	4
Malacca	455,785		14	20	2	911	134	2[illegible]	13	3	11	57	2
Johore	1,437,567		2[illegible]	7[illegible]	[illegible]	2,94[illegible]	512	55	43	8	30	192	6
Pahang	479,456		22	12	6	1,242	178	37	28	6	23	149	3
Trengganu	424,317		10	9	4	60[illegible]	62	20	16	4	12	68	2
Kelantan	753,305		11	11	2	364	6[illegible]	24	27	5	18	77	2
West Malaysia	9,487,510	...	289	339	60	28,554	2,213	36[illegible]	240	51	200	1,107	34

Source: Monthly Statistical Bulletin of West Malaysia, June 1975.

Table 13. Treatment given at government hospitals in West Malaysia, 1968-1974

Item		1968	1970	1972	1974
Number of government hospitals		60	59	57	59
Special medical institutions		6	5	5	5
In-patients					
Admissions		492,326	489,532	551,888	606,790
Deaths		16,861	16,509	16,921	17,990
Total cases treated		509,141	506,599	572,897	627,462
Out-patients (new cases)					
Fixed dispensaries		4,328,484	4,040,457	4,546,225	4,647,540
Travelling dispensaries		940,223	712,244	778,499	698,630
Selected diseases of in-patients (excluding special medical institutions)					
Pulmonary tuberculosis:	Treated	10,668	9,919	9,329	8,655
	Deaths	1,137	943	721	764
Other tuberculosis:	Treated	742	514	415	302
	Deaths	45	28	17	30
Cancer :	Treated	7,595	8,764	8,282	10,558
	Deaths	1,162	1,191	1,218	1,257
Veneral diseases :	Treated	224	237	212	220
	Deaths	12	14	4	19
Typhoid fever :	Treated	1,039	1,186	1,260	887
	Deaths	42	43	18	15

Table 13 (continued)

Item		1968	1970	1972	1974
Typhus:	Treated	89	103	36	155
	Deaths	-	2	-	1
Dysentery:	Treated	1,712	1,528	1,284	852
	Deaths	73	26	27	20
Diarrhoea and enteritis	Treated	196	385	309	282
(Infants):	Deaths	36	118	51	46
Diphtheria:	Treated	823	506	407	223
	Treated	91	59	62	39
Leprosy:	Treated	303	284	284	214
	Deaths	72	84	1	3
Tetanus:	Treated	460	395	351	286
	Deaths	211	152	129	115
Acute poliomyelitis:	Treated	296	60	1,017	20
	Deaths	6	2	34	-
Malaria:	Treated	20,973	22,538	16,475	9,303
	Deaths	160	135	117	55

Table 13 (continued)

Item		1968	1970	1972	1974
Diabetes mellitus:	Treated	4,888	5,222	6,403	6,306
	Deaths	160	170	189	211
Malnutrition:	Treated	1,003	1,077	1,844	2,935
	Deaths	145	150	123	102
Anaemias:	Treated	5,456	7,133	9,752	8,618
	Deaths	235	236	178	150
Asthma:	Treated	6,861	7,340	8,652	9,560
	Deaths	79	104	97	100
Mental deficiency:	Treated	2,598	2,341	2,146	1,577
	Deaths	5	5	2	1
Schizophrenic disorders:	Treated	2,456	4,820	3,902	4,892
	Deaths	6	38	2	-
Other mental psychoneurotic and personality disorders:	Treated	1,330	1,924	1,996	1,259
	Deaths	2	1	1	-
Acute tonsillitis:	Treated	3,194	2,991	3,053	4,297
	Deaths	2	1	2	1

Table 13 (continued)

Item		1968	1970	1972	1974
Influenza:	Treated	1,141	536	448	415
	Deaths	3	1	-	-
Pneumonia:	Treated	7,500	7,715	9,286	10,721
	Deaths	1,271	1,159	1,034	1,252
Ulcer of the stomach and duodenum:	Treated	5,020	6,207	5,842	6,598
	Deaths	183	151	158	150
Gastritis and duodenitis:	Treated	4,705	4,289	5,583	6,261
	Deaths	24	22	12	13
Abortion	Treated	11,951	12,800	14,796	15,524
	Deaths	24	22	12	13
Motor vehicle accidents:	Treated	7,161	8,213	9,313	12,208
	Deaths	319	313	281	469
Suicide:	Treated	196	230	229	401
	Deaths	44	44	36	38
Assault:	Treated	2,012	1,482	1,584	1,451
	Deaths	24	10	12	20

Source: Monthly Statistical Bulletin of West Malaysia, August 1975.

Annex VIII

DATA CONCERNING MEDICAL ELECTRONIC EQUIPMENT USED IN HOSPITALS

Table 14. Medical electronic equipment available in hospitals

No. (1)	Name & Location of Hospital/ Clinic (2)	Region (3)	Population under supervision (4)	Types of MEE being used in Practice (5)	Number of units (6)	Approximate price per unit ($M) (7)	Year of Purchase (8)	Manufactured (9)	Who takes care of the maintenance & repair (10)	Expenses in maintenance ($K) (11)	Difficulties and Restrictions (12)	Probable purchase and financing (13)	Suppliers of MEE (14)	Availability of sufficient skilled personnel (15)	Doctors opinions on Rel. to production of MEE (16)
1.	General Hospital, Aber Star	I	1.1 million	ECG, defibrilator, laboratory equipment.					Local staff and companies.	Estimated 2,000	Distance finance	Funds of Ministry of Health	Philips, Sony E.T., Siemens Companies		
2.	Hospital Emerah, Kalit Palam.	I		Electrocardiograph calorimeter Incubator	1 1 1	1,000 1,000 3,000	1975 1975 1974	Siemens Swana, England Atom INC Japan.		Estimated 500					
3.	Hospital Emerah, Butterworth.	I	180,000	X-rays, Electrocardiograph, automatic suction pumps.					Yearly contracts are being given to private firms	3,000.00	No	Depends on the availability of specialist being posted here in future.	Private firms [illegible] the Ministry of Health.	No	Good
4.	Hospital Emerah, Lapat.	II		X-ray machine 300 MA, 125KV ECG Machine Philips Shimeru Cambridge Ames Analyser Blood	1 1 1	46,000 3,900 3,900 3,900 2,000	1969 1974 1971 1973 1970	by USA by Holland by Japan by England by U.S.A.		Estimated 2,000					
5.	Hospital Emerah, Batu Pahat.	V		ECG (cardiopan 531) Bedside ECG Monitor with Rate meter Central consoles with six channel Cardioscope Defibrilator with ECF Monitor Pressure Monitor Type 01C58 X-ray (Diagnostic, media 30) Holland 300 MA, 125KV	1 4 1 1 1 1 1	1,800 60,000	1973 1975 1975 1975 1975 1975 1973	Philips Philips Cambridge Cambridge Cambridge Cambridge Philips, installed 1975		Estimated 3,000					

Table 14 (continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
6.	District Hospital Dungun, Kuar.	IV		Cardiopan (ECG) Monitor Defibrilator Bed side monitor Diathermy machine X-ray 500MA 150KV Siemen's Portable 20 MA, 90KV Watson 300MA, 125KV Watson 15MA, 90KV	4 1 2 1 1 1 1 1	1,800 1,800 16,000 10,000 14,000 100,000 8,000 60,000 12,000	1972 1974 1975. 1975 1965 1975 1972 1962	Philips Harcher Corp. 1972, 1975. George Kent, U.K. George Kent, U.K. Electro Medical Supply Greenham Ltd., London Philips Siemens Watson Watson		3,500					
7.	Hospital Dungun, Jelebu.	IV		ECG machine calorimeter	1		1975	German		200					
8.	District Hospital, Kemaman, Trengganu.	VI	56,000	ECG X-ray	1	3,000 50,000			Contracts	1,000 X-ray +	Poor servicing	ECB calorimeter, Flame photometer	Ministry of Health.	Nil	Good
9.	Hospital Besar, Ipoh, Perak	II	1,800,000	1. Spectrophotometer model 6/35 2. Defibrillator Pacemaker (SD) 3. Cardiostat 4. " 5. " 6. Cardiopan ECG Type 531 7. Ultra-Mini Electrocargiograph 8. ECG 9. ECG Preamplifier 10. Micro Ophthalmic Surgical Unit model G. 10562 11. Major Electro-Surgical Unit model MDS. 38 12. Amoils Cyco Cataract Unit Complete 81574 M 13. Duel Light Insufflator (Fibre Optic) 14. ACMI Fibre Source Projector. 15. Radiotome Model 617 16. Endotron Electric Surgical Unit. 17. Diathermy Endotherm 18. Surgical Electro-Apparatus (combined with Diathermy & Sucker)	1 1 2 2 2 2 2 2 1 1 2 1 2 1 1 1 1	2,800 3,000 4,500x2 4,500x2 4,500x2 4,800x2 3,500 3,700 5,000 6,000 3,000 15,000 15,000 6,000 9,000	1975 1967 1972 1974 1975 1969 1970 1971 1966 1974 1971 1975 1975 1972 1975 1960 1966	Coleman Instrument Maywood, USA Phillips Siemens Siemens Siemens Phillips Shimatsu, Japan Cambridge, England. Sanborn, USA Keelers Hamlin Keelers Medical Technology International Inc. American Cystoscope Maker Inc. Siemens Electro Med. Supplies Ltd. Electro Med. Supplies Ltd. Allan and Hanbury		Estimated 100.00 100.00 250.00 250.00 200.00 100.00 200.00 150.00 100.00 100.00 100.00 100.00 1,000.00 50.00 50.00 100.00 100.00 100.00				Nil	Doctors still prefer product from well established manufacturers

Table 14 (continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
				19. Cardiopan Electro-Cardiograph Model 5M	1		1969	Phillips		50.00					
				20. Smalley Portable Defibrilator Mod.	1		1966	Spectro-Aviomic Ltd.		100.00					
				21. Mesuroton 510	2	3,650x2	1962	Siemens		250.00					
				22. Oscilloflux 500	1	1,650	1955	Phillips		150.00					
				23. Stimulator	1	850	1965	Stanley Cos. Med. Equipment.		50.00					
				24. Megason XII Ultrasonics (for Ultrasonic therapy)	1	1,627	1965	Birtcher Corporation		140.00					
				25. Selective Treatment Unit (Current Stimulator Machine)	1	1,500	1966	Stanley Com. Med. Equip.		100.00					
				26. Triodyne Super (Current stimulator machine)	1	1,500	1966	Electro Med. Supplies		100.00					
				27. Ultratherm 608	2	5,000x2	1972	Siemens		200.00					
				28. Radiotherm Microwave Diathermy	1	4,000	1974	Siemens		150.00					
				29. Mesuroton 627	1	4,000	1975	Siemens		150.00					
				30. X-ray Unit Mobile "D"	1		1950	Phillips		3,780.00					
				31. Dental X-ray Unit (Practia)	1		1953	Phillips		)					
				32. Phillips Tomograph Unit Standard	1		1953	Phillips		)					
				33. X-ray (Portable)	1		1953	Phillips		)					
				34. Muller for (Diagnostic)	1		1964	Phillips		)					
				35. Philip Medio	1	29,930	1964	Phillips		)16,000.00					
				36. Elimos 90/40 Mobile	1		1970	Elim		)					
				37. Watson Roentgen V	1	33,885	1971			)					
				38. Phillips "Practia" 90/20	1		1972	Phillips		)					
				39. X-ray, Phillips Mobile Condenser Discharge	2		1974	Phillips		)					
				Total						19,780.00					
				Total estimated expenses						25,000.00					
10.	District Hospital, Port Dunlop	II		NIL	-	-	-	-	-	-	-	-	-	-	-
11.	Hospital, Bukuh Road, Pusung.	I	480,000	Surgical Diathermy Medical Diathermy Cardiac monitors Walkie-talkies Bedside communicatives.		Estimated		Hagemeyer Borneo Cor. Behemeyer		Estimated 1,000	Frequent breakdown, lack of service facilities	Cardiac monitors Electronic pocket paging system		No	

Table 14 (continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
12.	Hospital University.	III		Sembarn 45680 8 channel recorder						400					
				Teletronic Type 567 storage Oscilloscope S/N 012983						300					
				Heart Rate/Pulse Monitor	6										
				Temperature/Respirator Monitors	6										
				Visco-Scope	8										
				Temperature/ Venous Pressure Monitor	3										
				Systolic/Dystolic Pressure Monitor	5										
				Signal Display	1										
				Visco-Monitor Recorder	1										
				Patient Selector	1										
				Numerical Display	1										
				Four channel Scope	1										
				Two Channel Recorder	1										
				ECG/Heart Rate/ Meter	2										
				Sembarn Electronic Monitoring Equipment						3,100					
				Phillips X-ray Equipment and Miscellaneous						27,741					
				Minograf, 8-channel recorder	1					920 per annum					
				6-channel Telco scope	1					240					
				Large screen Telco scope	1					260					
				Siemens Cardiomat TS single channel ECG machine	5					500					
				Minograf 34 4-channel recorder	1					500					
				Kips and Zemen oximeter	2					140 x 2					
				Physiotherapy equipment						2,700					
				Siemens Shortwave thermotherapy unit	4					560					

(continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
				Siemens Microwave therapy machine Radiotherm 305	2					280					
				Siemens Ultrasonic therapy unit Sonostat 631 with treatment head						200					
				Siemens Stimulator current therapy Neurotron 601	5					500					
				Simens Stimulator current diagnostic & stimulator current therapy unit	1					160					
				Operation Theatre						1,500					
				Mingograf 8-channel recorder with transducer, 47cm scope 1-channel preamplifier, Elemescope, retometer	1					1,140					
				Mimograf 4 channel recorder	1					500					
				Siemens Siromobile Image Intensifier (X-ray tube No. 16824) with monitor	1					870					
				Siemens diathermy Radiotors 612	13					1,700					
				Radiology equipment Mingograf 6-channel recorder	1					280 940					
				Total estimated expenses						38,551.00 50,000.00					
13.	Chinese Maternity Selangor.	III	1,000,000	Dopler heart monitor, ECG Cardiac monitor.							Nil	No			
14.	Melinic & Rumah Perawatan Jentera	III	50,000	Electro-diathermy set	1	7,000			contracts	1,200		Cardio-trace Defibri-llators 300MA X-ray	No		
				Electrocardiograph		3,000									
				X-ray, Bucotome		11,000									
				Sacrometer		3,000									
						3,000									

Table 14 (continued)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
15.	Assunta Hospital	III		Baratron 600											
				X-ray Phillips	1		1962								
				X-ray Phillips	1		1970								
				Portable X-ray Phillips	1										
				X-ray Siemens	1		1962			15,000					
				Monitors	1		1971								
				Defibrilator Heat	1		1971								
				Diathermy machine	1		1965								
				Sport wave Diathermy	1										
				Microwave Siemens											
				Somostat Siemens	1										
				Electronic Treatment unit	1										
				Neurotem 626 Siemens			1975								
				ECG Cardiopan 531 Phillips											
				Communication system	1		1970								
16.	Penang General Hospital	I	1 million	Scanner (Scintillator)	1	120,000	1975						Siemens		
				Machine for nuclear medical diagnosis ECG	4	3,500									
				X-ray 750MA	1	90,000	1965						Phillips		
				X-ray 500MA	2		1973			more than 50,000			Phillips		
				X-ray 300MA	1								Siemens		
				X-ray 500MA with T.V. unit	1		1945						Phillips		
				Monitor	7		1973								
				Defibrilator ECG											
				Ultratherm	1								Siemens		
				Somostat 633 (ultrasave)	1								Siemens		
				Diathermy machines ECG	6								Siemens Bovis Mac Barn.		
17.	General Hospital, Kuala Lumpur.	III		See appendices to Report (Hospitals)						more than 75,000					

Table 15.

EQUIPMENT \ REGIONS	PENANG				GENERAL HOSPITAL, KUALA LUMPUR				PERAK				PAHANG				KELANTAN				MALACCA			
	1974		1975		1974		1975		1974		1975		1974		1975		1974		1975		1974		1975	
	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$
1. Electrocardiograph			3	14,000	-	-	-	-	10	22,000	2	5,000	31	95,000	15	90,000	1	2,000	-	-	3	17,500	6	18,000
2. Cardio-Pacing (Defib, Monitor, etc.)			-	-	1	1,000	-	-	1	15,000	2	2,000	1	10,000	-	-	-	-	-	-	-	-	1	1,000
3. Defibrillators			1	1,000	1	11,500	1	5,000	4	62,000	1	11,000	2	22,000	3	33,000	-	-	-	-	2	20,000	1	10,000
4. Surgical Equipment-Stationary			2	7,000	3	31,000	2	30,000	9	60,000	2	12,000	2	16,000	1	8,000	-	-	-	-	1	6,000	1	6,000
5. Physiotherapy Equipment			-	-	3	18,000	8	45,000	3	11,000	3	18,000	1	6,000	-	-	1	8,000	-	-	-	-	2	10,000
6. Stereotaxy			9	23,000	3	4,600	-	-	3	19,000	4	12,000	3	10,000	26	90,000	-	-	2	15,000	-	-	1	3,000
7. Electromyograph Machine			-	-	1	44,000	-	-	-	-	-	-	-	-	-	-	3	10,000	-	-	-	-	-	-
8. Electroencephalograph Machine			-	-	1	8,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
9. Fibre Detectors			2	13,000	2	2,000	-	-	2	2,700	-	-	10	20,000	1	3,000	-	-	-	-	-	-	-	-
10. Stimulators			-	-	2	3,500	2	3,500	-	-	-	-	1	1,000	1	2,000	-	-	-	-	-	-	-	-
11. X-ray Equipment/parts			-	-	-	115,000	-	31,000	-	52,000	-	-	-	-	-	90,000	-	-	-	-	-	90,000	-	90,000
12. X-ray Units			4	108,000	-	-	-	-	2	101,000	6	400,000	4	180,500	2	90,000	-	-	-	100,000	2	180,000	1	70,000
13. pH Meters			-	-	-	-	-	-	1	4,000	1	2,000	6	6,000	2	2,000	-	-	1	12,000	-	-	-	-
14. Spectrophotometers			2	4,000	-	-	2	15,000	1	2,500	-	-	1	3,000	2	6,000	-	-	-	-	-	-	-	-
15. Other Analytical Instruments			6	9,000	-	-	7	40,000	1	9,000	6	9,000	10	21,000	1	30,000	-	-	-	-	2	8,000	5	12,000
16. Blood Gas Analyser			1	3,000	-	-	-	-	-	-	1	3,000	1	3,000	-	-	1	1,000	4	13,000	-	-	1	10,000
17. Examinoscopes			-	-	1	1,000	1	2,000	1	2,000	1	2,000	-	-	1	2,000	-	-	1	20,000	-	-	-	-
18. Monitors & Display Units			3	9,000	1	100,000	-	-	-	-	4	6,000	3	60,000	1	5,000	-	-	-	-	-	-	1	5,000
19. Other Electronic Instruments			-	-	3	10,000	1	40,000	1	11,000	-	-	2	6,000	2	3,000	1	1,000	-	-	1	2,000	-	-
20. Scanners/Scintillators			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
21. Cystoscopes			1	1,000	-	-	-	-	-	-	2	2,000	-	-	1	2,000	-	-	-	-	1	1,500	1	1,500
22. Respirators			1	10,000	-	-	-	-	-	-	-	-	1	26,000	-	-	-	-	-	-	-	-	-	-
23. Coulter Counters			-	-	-	-	1	10,000	-	-	-	-	-	-	1	25,000	-	-	-	-	-	-	1	25,000
24. Anaesthetic Machines			-	-	1	15,000	-	-	-	-	-	-	12	84,000	-	-	-	-	-	-	-	-	-	-
TOTAL:		382,000				361,000		221,500		373,000		420,000		387,700		373,000		22,000		161,000		275,000		214,500

Table 15. Medical electronic equipment used in government hospitals

KELANTAN				MALACCA				PENANG				JOHORE			
1974		1975		1974		1975		1974		1975		1974		1975	
No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$
	2,000	-	-	3	17,500	6	18,000	6	15,000	3	12,000	3	8,000	15	35,000
	-	-	-	-	-	1	1,000	-	-	-	-	-	-	-	-
	-	-	-	2	20,000	1	10,000	1	12,000	-	-	-	-	5	50,000
	-	-		1	6,000	1	6,000	1	6,000	1	6,000	-	-	1	6,000
	8,000	-		-	-	2	10,000	1	8,000	-	-	-	-	7	42,000
	-	2	[illegible]	-	-	1	3,000	4	7,000	8	13,000	8	4,000	9	24,500
	10,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	1	20,000	-	-	-	-	-	-
	-	-	-	-	-	-	-	1	2,000	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	1	3,000	-	-	-	-
	-	-		-	40,000	-	40,000	-	-	-	-	-	-	1	70,000
	-	-	[illegible]	2	180,000	1	70,000	-	-	4	80,000	1	70,000	-	-
	-	1	[illegible]	-	-	-	-	1	1,000	-	-	-	-	8	9,000
	-	-	-	-	-	-	-	1	2,000	-	-	-	-	8	18,000
	-	-	-	2	8,000	5	15,000	4	30,000	1	1,500	1	1,000	8	6,000
	[illegible]	4	[illegible]	-	-	1	10,000	1	10,000	-	-	-	-	1	40,000
	-	1	[illegible]	-	-	-	-	-	-	-	-	-	-	-	-
	-	-	-	-	-	1	5,000	-	-	-	-	1	5,000	-	-
	1,000	-	-	1	2,000	-	-	-	-	1	2,000	1	2,000	1	16,000
	-	-	-	-	-	-	-	2	130,000	-	-	-	-	-	-
	-	-	-	1	1,500	1	1,500	1	2,800	2	4,000	-	-	-	-
	-	-	-	-	-	-	-	-	-	2	10,000	1	2,000	1	10,000
	-	-	-	-	-	1	25,000	-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	22,000		[illegible]		275,000		214,900		239,800		131,000		98,000		306,300

NEGERI SEMBILAN				KEDAH				PERLIS				[illegible]	
1974		1975		1974		1975		1974		1975		1974	
No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$
5	12,500	6	15,000	4	10,000	5	16,000	1	[illegible]	-	-	8	[illegible]
3	3,000	4	5,000	-	-	-	-	-	-	-	-	-	-
1	10,000	1	10,000	-	-	1	6,500	1	11,000	1	11,000	-	-
4	12,000	5	15,000	1	2,000	1	6,000	-	-	-	-	1	[illegible]
-	-	3	15,000	-	-	2	11,000	-	-	2	[illegible]	1	[illegible]
2	9,000	4	12,000	-	-	1	1,000	1	[illegible]	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	1	30,000	1	30,000	-	-	-	-	-	-
-	-	1	2,000	-	-	1	2,000	-		1	2,000	-	-
-	-	-	-	1	1,600	-	-	-	-	-	-	-	-
-	-	-	10,000	-	-	-	9,000	-	-	-	-	-	-
-	-	2	20,000	2	112,000	-	-	1	[illegible]	-	-	1	[illegible]
1	2,000	1	2,000	-	-	1	1,000	-	-	-	-	5	[illegible]
2	4,000	2	4,000	-	-	-	-	-	-	-	-	1	[illegible]
8	7,000	8	7,000	-	-	2	5,000	-	-	1	1,500	-	-
-	-	-	-	-	-	-	-	1	10,000	-	-	-	-
-	-	1	2,000	-	-	1	2,000	-	-	-	-	1	[illegible]
-	-	2	8,000	-	-	3	116,000	-	-	1	3,000	-	-
-	-	-	-	-	-	1	6,000	-	-	-	-	1	[illegible]
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	1	1,000	-	-	-	-	-	-	-	-
-	-	-	-	-	-	1	14,000	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-	-	-	-	-	-	-
	59,300		127,000		156,600		225,000		33,600		25,500		[illegible]

Data collected in Malaysia

spitals

LEBAK				PUBLIC				TERMINAL				INDUSTRIES				TOTAL REQUEST						APPROVED					
1974		1975		1974		1975		1974		1975		1974		1975		1974			1975			1974			1975		
No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total Cost in M$	No. of Units	Total M$	Approximate price/unit	No. of Units	Total M$	Approximate price/unit	No. of Units	% from request	Total M$	No. of Units	% of request	Total M$
4	10,000	5	16,000	1	2,100	-	-	8	9,000	2	4,000	6	27,000	1	2,000	72	213,100	2,959	82	161,000	2,598	41	56.9	121,319	36	56.8	58,264
-	-	-	-	-	-	-	-	-	-	1	1,000	-	-	-	-	6	27,000	4,500	8	9,000	[illegible]	-			10	125	11,250
-	-	1	6,500	1	11,000	1	11,300	-	-	-	-	-	-	-	-	12	148,500	12,375	15	139,500	9,300	1	8.3	12,375	11	73.3	10,230
-	2,000	1	6,000	-	-	-	-	1	2,000	-	-	-	-	-	-	23	144,000	6,266	14	98,000	6,857	10	43.3	62,866	11	78.6	75,425
-	-	2	11,000	-	-	1	8,000	1	2,000	-	-	-	-	-	-	9	45,300	4,777	29	162,000	5,585	5	55.6	25,089	14	48.3	78,190
-	-	1	1,000	1	1,500	-	-	-	-	4	12,000	-	-	-	-	21	65,100	3,100	66	190,800	2,878	-			26	39.4	79,826
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	44,000	44,000	-	-	-	1	100	44,000	-	-	
-	3,000	1	50,000	-	-	-	-	-	-	-	-	-	-	-	-	3	50,000	16,333	1	50,000	5,000	1	33.3	16,333	-	-	
-	-	1	4,000	-	-	1	4,000	-	-	1	4,000	-	-	-	-	15	49,700	3,780	7	28,000	3,428	5	33.3	8,000	11	151.1	41,308
-	1,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4	8,500	1,375	4	8,500	2,125	-			5	125	10,625
-	-	-	9,000	-	-	-	-	-	-	-	-	-	6,000	-	-	-	111,000		-	390,000			*60	126,000		*80	210,000
-	112,000	-	-	1	9,000	-	-	1	30,000	-	-	-	-	-	-	13	682,500	52,500	20	725,000	36,250	16	12.3	396,000	5	45	325,150
-	-	1	1,000	-	-	-	-	3	3,000	1	1,000	-	-	-	-	12	16,000	1,333	14	17,000	1,214	14	116.7	18,862	11	78.6	13,394
-	-	-	-	-	-	-	-	1	3,000	1	3,000	2	5,000	2	5,000	8	15,300	1,912	18	55,000	2,896	3	37.5	7,725	15	78.9	43,860
-	-	2	5,000	-	-	1	1,530	4	7,500	1	1,500	2	46,000	4	36,000	31	149,500	4,048	56	179,500	[illegible]	27	87.1	109,295	64	116.5	209,700
-	-	-	-	1	10,000	-	-	-	-	-	-	-	-	-	-	3	23,000	7,666	5	76,000	15,200	2	66.7	15,332	5	100	76,000
-	-	1	2,000	-	-	-	-	1	1,000	-	-	-	-	-	-	3	4,000	1,333	5	10,000	2,000	3	100	3,999	4	80	8,000
-	-	3	116,000	-	-	1	3,000	-	-	-	-	-	-	-	-	6	166,000	27,666	15	156,000	10,133	4	66.7	110,664	13	86.7	133,729
-	-	1	6,000	-	-	-	-	1	1,500	1	3,000	-	-	-	-	9	34,500	3,611	7	70,000	10,000	4	44.4	14,444	11	157.1	110,000
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2	130,000	65,000	-	-	-	-			2	-	
1	1,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3	3,830	1,766	7	10,500	1,500	11	366.7	15,435	5	71.4	7,500
-	-	1	14,000	-	-	-	-	-	-	-	-	1	5,000	-	-	3	37,000	12,333	5	44,000	8,800	1	33.3	12,333	6	120	52,800
-	-	-	-	-	-	-	-	-	-	1	25,000	1	[illegible],000	-	-	1	25,000	25,000	4	85,000	21,250	-	-		5	125	106,250
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13	99,000	7,615	-	-		-	-		-	-	
	134,000		285,000		33,600		25,500		55,000		54,500		118,000		43,000	273	2,351,800		381	2,587,500		149		1,370,884	272		1,671,029

Table 16. Expenses of hospitals for service, maintenance and repair of MEE in Malaysia

State	Population (1971)	Types & No. of Hospitals			Estimated expenses a year ($M)			
		Government	Nursing Homes & Private Clinics	Total	Service	Repair	Parts	Total
I. Kedah & Penang	1,849,414	12	12	24	73,000	21,900	estimated 800,000	94,900
II. Perak	1,807,981	12	21	33	82,000	24,600		106,600
III. Selangor	1,587,738	12	29	41	129,000	38,700		167,700
IV. Malaka	455,785	10	2	12	61,000	18,300		79,300
V. Johor	1,437,565	7	18	25	74,000	22,200		96,200
VI. Pahang	479,456	6	1	7	26,000	7,800		33,800
VII. Kelantan	753,805	6	-	6	25,000	7,500		32,500
Sabah	628,269							10,000
Sarawak	1,007,502							10,000
Total		65	83	148	470,000	141,000		631,000

Source: Data provided by hospitals.

Annex IX

INTERNATIONAL TRADE IN MEE

Table 17. Imports of medical equipment into West Malaysia

Country and Commodity	Code	1970	1971	1972	1973
		Value $M c.i.f.			
ELECTRO-MEDICAL APPARATUS FOR DIAGNOSTIC PURPOSES	7261000				
Australia		21243	5261	-	271
Austria		2750	-		701
Canada incl. Newfoundland		805	-	-	-
China		454	-	-	3115
Belgium		-	-	-	147030
Denmark excl. Greenland		12897	10660	-	1185
France incl. Monaco		-	660	600	2015
Federal Republic of Germany		132736	185195	159997	188492
Hungary				18503	-
Hong Kong		305	-	-	-
India		-	225	-	3111
Italy incl. San Marino		37	450	-	-
Japan		30505	63383	88980	63688
Netherlands		5148	786	104	5544
Other Asia		-	62457	-	
Singapore		685	5152	2973	23801
Sweden		10396	48	3844	29157
Switzerland		-	3140		
Norway		-	-	-	582
United Kingdom -		56014	54519	89150	22835
United States		63505	26800	67071	19941
TOTAL		337480	418736	431222	511468
X-RAY APPARATUS	72620000				
Australia		10963	10447	14328	17589
Austria		47442	9466	673	-
China		3000	-	-	-
Denmark excl. Greenland		35602	2793	10631	-
Belgium		-	-	16578	9024
France incl. Monaco		952	70442	5784	-
Federal Republic of Germany		298226	1335296		
India		51180	13963	582159	230319
Italy incl. San Marino		3954	46557	-	228
Hong Kong		-	-	-	1140
Japan		17065	34445	327226	316913
Netherlands		189172	797167	563444	416553

Table 17 (continued)

Description of Commodity	Code	1970	1971	1972	1973
		Value $M c.i.f.			
Sabah		-	3003	-	-
Singapore		3020	-	378	13451
India		-	-	14818	43353
Sweden		33454	126507	2672	5078
Switzerland		9530	27069	35342	41651
United Kingdom		182038	208073	149634	190903
United States		56174	329242	330239	61818
TOTAL		941772	3014470	2053906	1348025
INSTRUMENTS FOR HUMAN MEDICINE & SURGERY	86171100				
TOTAL		897584	1547123	1547125	1840415
DENTAL-INSTRUMENTS & APPARATUS	86171200				
TOTAL		1109983	2378077	2318077	1447886
OTHER MEDICAL, DENTAL, SURGICAL & VETERINARY INSTRUMENTS N.E.S.	86171900				
TOTAL		1259265	1687706	1687706	1380571
TOTAL		4546084	9046112	8038036	6528365

Source: Annual statistics of external trade, 1970-1973.

Table [illegible]. Trade flows between some countries
([illegible] and US dollars)

Years	Total exports from 14 countries	Intra-group trade: exports from the following countries							
		USA	FRG	Sweden	United Kingdom	France	Japan	Switzerland	Italy
1	2	3	4	5	6	7	8	9	10
1966	44,695	16,697	9,201	6,243	1,585	1,558	1,229	1,135	1,037
1967	53,029	20,984	10,355	7,629	1,940	1,838	1,423	1,485	1,273
1968	62,569	24,733	13,152	7,324	1,552	1,888	2,479	1,764	2,578
1969	72,894	28,664	15,841	7,668	2,257	2,624	2,286	2,185	2,084
1970	95,159	33,277	20,988	9,821	5,259	4,302	3,216	2,963	2,567
Into the following countries:			I m p o r t s						
Canada:									
1966	4,476	4,237	122	26	31	3	5	25	0
1967	5,232	4,799	183	80	24	15	18	32	-
1968	6,075	5,309	326	54	19	14	16	19	0
1969	7,454	6,569	399	155	32	101	30	36	1
1970	9,931	8,696	607	229	50	191	24	35	13
FRG:									
1966	4,043	1,692	-	1,469	49	73	13	379	80
1967	5,542	2,405	-	2,078	33	70	32	307	105
1968	4,771	1,860	-	1,613	68	36	21	330	128
1969	5,185	1,890	-	1,629	104	141	30	393	138
1970	7,083	1,891	-	2,611	446	261	42	721	344
Netherlands									
1966	2,208	604	1,047	278	59	3	25	42	49
1967	2,776	896	1,166	327	68	13	36	85	67
1968	3,897	1,835	1,227	292	121	61	45	127	94
1969	5,077	2,386	1,633	349	107	7	53	176	107
1970	6,426	2,659	2,357	455	357	20	72	197	106
United Kingdom									
1966	1,997	1,093	224	430	-	42	17	50	38
1967	2,404	1,381	200	495	-	43	21	70	36
1968	2,254	1,060	209	527	-	24	41	71	124
1969	2,618	1,258	245	636	-	17	29	94	94
1970	4,823	2,849	560	660	-	22	82	198	64
USA:									
1966	1,088	-	531	104	188	28	120	22	14
1967	2,252	-	964	610	208	22	308	24	23
1968	2,389	-	1,131	549	192	23	330	74	21
1969	2,976	-	1,426	542	303	2	340	107	52
1970	4,488	-	1,303	845	963	64	802	184	55
Italy:									
1966	2,060	713	700	151	97	239	31	64	-
1967	2,321	938	761	135	42	147	18	151	-
1968	2,928	1,231	942	149	105	260	18	119	-
1969	3,149	1,101	1,182	197	119	179	21	188	-
1970	4,454	1,066	1,500	314	500	431	55	434	-
France:									
1966	2,303	1,018	604	239	123	-	30	128	71
1967	3,771	1,872	888	504	99	-	47	166	66
1968	4,060	1,903	1,210	270	58	-	42	292	112
1969	4,946	1,989	1,570	242	240	-	66	385	232
1970	4,377	963	1,874	308	187	-	64	353	258
Belgium:									
1966	1,282	340	391	185	48	177	13	58	16
1967	1,710	389	487	267	61	310	51	90	24
1968	2,137	626	728	236	109	210	37	82	51
1969	2,114	503	733	274	111	212	28	76	93
1970	3,572	955	825	346	349	411	46	144	289

1	2	3	4	5	6	7	8	9	10
Switzerland:									
1966	1,646	783	563	94	14	33	6	-	24
1967	1,580	669	569	166	10	47	16	-	16
1968	1,898	765	876	59	15	41	16	-	19
1969	2,357	806	1,129	102	41	62	27	-	46
1970	3,087	1,006	1,527	152	60	55	12	-	83
Sweden:									
1966	1,139	262	364	-	19	4	11	34	5
1967	1,156	299	393	-	27	2	40	34	31
1968	1,802	694	494	-	32	16	71	19	13
1969	1,872	429	533	-	37	10	44	43	16
1970	2,373	413	731	-	148	9	96	45	33
Brazil:									
1966	684	413	136	14	4	5	9	23	-
1967	961	387	200	33	1	159	40	22	1
1968	1,467	554	263	119	17	214	88	54	7
1969	1,513	776	266	75	0	140	119	55	20
1970	2,345	1,120	533	76	31	67	235	66	22
Spain:									
1966	1,057	291	370	119	8	145	46	17	21
1967	1,154	404	264	97	48	209	10	5	36
1968	1,291	429	307	233	31	122	68	18	19
1969	2,034	611	636	240	65	211	63	31	97
1970	2,132	486	720	225	108	270	84	33	97
Czechoslovakia:									
1966	372	7	94	136	-	17	-	-	76
1967	524	24	112	131	-	34	-	2	142
1968	733	5	190	282	-	42	0	1	224
1969	1,235	23	560	196	7	166	11	-	222
1970	1,982	33	1,068	199	11	243	2	2	249
Mexico:									
1966	510	294	100	23	10	64	5	1	5
1967	919	619	113	38	20	82	16	11	10
1968	867	576	107	72	5	34	27	16	20
1969	974	568	234	37	5	40	41	37	10
1970	1,878	903	412	132	20	267	23	117	8
Denmark:									
1966	904	162	364	304	10	1	1	15	1
1967	959	167	317	360	23	-	1	32	3
1968	1,765	941	387	341	27	3	8	17	6
1969	1,440	318	417	493	32	2	58	17	32
1970	1,675	148	899	386	168	-	26	49	31
Japan:									
1966	871	687	125	50	5	-	-	2	-
1967	845	721	55	49	1	-	-	1	14
1968	1,214	1,097	37	24	0	3	-	5	11
1969	1,501	1,285	127	27	34	9	-	6	10
1970	1,579	1,236	107	130	51	4	-	6	1
Austria:									
1966	835	41	628	107	1	1	4	40	3
1967	974	48	650	221	1	5	-	25	0
1968	1,453	94	931	336	9	11	0	45	2
1969	1,229	87	838	171	15	25	1	54	5
1970	1,476	153	991	194	14	6	4	70	13
Egypt:									
1966	483	238	93	23	68	2	4	22	17
1967	609	327	97	31	66	7	12	20	37
1968	762	404	145	28	90	14	14	17	23
1969	1,043	589	195	4	107	11	26	11	89
1970	1,447	866	262	54	128	1	22	54	49
Argentina:									
1966	694	386	95	142	1	7	8	2	5
1967	693	520	35	50	3	2	14	1	39
1968	836	385	69	67	1	7	19	1	49
1969	1,231	792	184	101	1	-	37	15	61
1970	1,427	975	86	62	40	21	173	4	31

Table 18 (continued)

1	2	3	4	5	6	7	8	9	10
Yugoslavia:									
1966	197	20	130	23	3	3	1	2	12
1967	362	26	296	10	4	11	5	3	23
1968	400	48	217	28	-	11	-	3	82
1969	833	31	508	57	4	27	-	4	199
1970	1,257	41	676	76	19	49	-	9	233
Australia:									
1966	788	475	82	87	101	5	16	7	1
1967	608	348	62	87	41	0	37	10	4
1968	614	299	69	61	53	1	54	50	7
1969	1,004	590	130	76	84	1	73	30	2
1970	1,220	645	125	37	163	2	120	78	11
Chile:									
1966	184	105	38	25	-	14	1	1	0
1967	233	178	13	28	4	1	1	-	5
1968	240	172	32	15	1	17	3	-	-
1969	706	208	45	1	0	426	25	0	0
1970	1,178	429	99	-	9	624	16	0	0
Finland:									
1966	803	150	258	330	6	1	2	18	1
1967	728	141	177	300	8	1	3	33	6
1968	780	180	195	273	9	3	19	13	1
1969	922	254	243	238	41	19	6	49	11
1970	984	207	283	284	44	19	20	22	38
Venezuela:									
1966	414	258	46	56	5	13	16	0	9
1967	379	255	38	28	7	4	14	0	3
1968	426	302	50	41	2	6	12	1	7
1969	666	467	60	50	1	3	49	1	12
1970	548	376	76	34	2	0	33	0	6
Iran:									
1966	157	24	65	3	45	8	4	8	1
1967	250	54	81	24	45	19	4	16	11
1968	312	163	86	2	13	33	1	7	4
1969	438	163	159	6	51	10	30	12	3
1970	504	277	124	3	16	33	32	0	4
India:									
1966	350	124	64	31	38	-	12	8	71
1967	312	141	70	14	46	-	21	5	10
1968	281	258	33	1	19	-	33	4	24
1969	269	137	45	17	30	-	10	7	23
1970	476	268	81	23	36	-	13	1	38

Source: Report of the Ministry of Trade, USA, 1971.

a/ Austria, Belgium, Canada, Denmark, Federal Republic of Germany, France, Italy, Japan, Netherlands, Norway, Sweden, Switzerland, United Kingdom and United States of America.

Table 14. Export-import market for MBE in some countries

	General firms, producing MBE in each of countries	The main Type of MBE	
		Export	Import
1	2	3	4
1. Austria	Elin-Union (filial FRG one) - roentgenological equipment (X-ray) "Reichert Optische Werke" (Filial USA company "American Optici Co") Microscopes etc. "Otto Sauer" - local company - biomedical MBE and x-ray apparatus and other MBE. "Kreis-technik" (electro encephalographs)	X-ray apparatus and biomedical research MBE	From FRG "Siemens" Phonocardiographs, ahoencephalographs, diagnostic X-ray apparatus. "Zeiss" Spectrophotometers electromyography "Mela" Central and bedside monitoring systems. From Denmark Analysers of blood, electromyographs, electrocardiographs From Denmark Analysers of blood, electromyographs, electrocardiographs. From USA Implantable pacemakers, central and bedside monitoring systems, laboratory equipments.
2. Australia	25 domestic and foreign owned firms, which produced patient monitoring systems particularly for the cardiac function, x-ray equipment especially of the standard type for small hospitals and local radiologists. The main firm is "Astronics Australasia Pty. Ltd." - produces electrocardiographs, phonocardiographs, blood pressure recording units and patient monitoring systems. Of the remaining domestic suppliers a few specialise in single product categories, for example, heart monitors, patient monitoring equipment.	Principal MBE is exported by Australia primary markets for Australian export products are New Zealand, Papua New Guinea, and USA (monitor systems x-ray equipment for small hospitals etc.)	From USA X-ray and other equipment utilizing Cadioactive substances, analitical instruments for biomedical applications, electronic computers for medical applications, defibrillators, electro-cardiographs, infracardiac catheters, cardioversion systems, consisting of defibrilator, recorder, oscilloscope and amplifier; electro-encephalographs, gas chrometographs, photometers automated blood cell counters lazers etc. From other countries; England and Japan
3. Belgium	Only 4 domestic firms:"F. Demblon" manufactures electromyographs, stimulators and diatermy units;"N.V. Gerard Flenger S.A." - products for layer curomatography and electronmore 16 foreign-owned companies - radiology equipment broad line of nuclear medicine instrument. The absence of a well developed electronics industry, which would normally supply basic components has limited the scope of biomedical equipment manufacturing in Belgium.	Medical, dental surgical and veterinary instruments, medical x-ray and other equipment utilizing radioactive substances. Analytical instruments for medical applications.	From USA Cardiac output analyzers, computers, defibrillators, implantable pacemakers, central station monitoring system and bedside monitoring systems, electrocardiographs, phonocardiographs, computers programs for electrocardiograph analysis, nuclear equipment, etc. From FRG "Siemens" - X-ray apparatus, electrocardiographs, phono-cardiographs, electromyography systems. "Zeiss" - ophthalmological instruments.

Table 19 (continued)

1	2	3	4
			From the Netherlands "Philips" - electroencephalographs, gas absorbers, radiological equipment.
4. Denmark	25 firms manufacture MEE. 24 of these are Danish - owned. Most of the production consist of cardiology, neurology and laboratory equipment. "Radiometer A/S" - blood gas systems, pH - meters. "Siemens-Eli Moll GmbH" A/S" - patient monitoring devices, lung function test equipment, resuscitators. "Disa Elektronik" - neurological equipment, radio-meter line and etc.	Equipment of cardiology respiratory, neurological equipment, anesthesia equipment, nuclear instrumentation, radio-meter lines.	(Of of import from Germany (FRG) and (Swedish) "Siemens-Elonomic" - X-ray apparatus and radio-active equipment. "Elsa" - (FRG) - spectrophotometers From USA and the United Kingdom - analytical instruments, flame photometers, atomic absorption spectrophotometers, gas chromatographs From USA Cardiac output monitor/counter, implantable pacemaker, defibrillator, recorder, oscilloscopes and amplifiers, computer systems for ECG computer theory for ECG analysis.
5. Finland	"Vallak" (filial Swedish firm Laboratoriumproducter)" radioisotopical analyzers. "Olli-type" defibrillators, monitoring systems, blood analyzers. "Roentgen - Lyno" - elements for X-ray apparatus of "Phillips". "Hykis" computers for medical purposes.	Radioisotopic analyzers, defibrillators, computerised photometric clinical chemical analyzers, blood analyzers.	90% all use import from other countries, from FRG "Siemens" - and other firms" - cardiological measuring equipment, ophtalmoscopes, implants, pacemakers, electrosurgical instruments. From Sweden electrocardiographs, defibrillators pacemakers positive pressure breathing apparatus with nuclear elements. From the United Kingdom anaesthesia equipment, pacemaker, chromatographers.
6. FRG	"Siemens AG", "Gmbh Müller" "AEG Telefunken," and Picker roentgen - radiological equipment. "Hebert Bosh Electronik GmbH" "Erbe electromedizin KG and "Fritz Hüttinger Elektronik GmbH" - anesthesia apparatus, diathermy microwave and short-wave equipment.	Radiological equipment, nuclear medicine equipment, different cardiological equipment, tomographs and other equipment.	From USA Cardiac output analyzers implantable pacemakers, central station intensive care systems, defibrillators, recorders, oscilloscopes, amplifiers, bedside monitoring systems, computer systems for ECG analysis. positive pressure breathing apparatus, lesser surgical instruments, computers for planning radiotherapy treatment. From Denmark and the Netherlands Cardiological equipment, electromyographs. From the United Kingdom analyzers, laboratory instruments and etc.

Table 19 (continued)

1	2	3	4
7. United Kingdom	"Vickers," "British Oxygen" anesthesia equipment and positive pressure breathing apparatus, "I.K.L., Devis Instruments", "Droys Lebl, Bun - Uniken" (filial Phillips)" Cook and Tucker", "Evans Electroselenium" - laboratory equipment.	automatic analysers for clinical research, anesthesia equipment and breathing apparatus, computers for medical devices, cardiomyographs, electrostimulators, laboratory equipments.	From FRG Radiological equipment electrocardiographs, electronic microscopes. From the Netherlands Radiologic l equipment monitoring systems, laboratory equipment. From Sweden Breathing apparatus, cardiographs. From Switzerland monitoring systems and etc.
8. Switzerland	About 2 [illegible] manufacturers. "Wild Heerbrugg" - microscopes. "Mettler Instruments" - analytical balances. "Haag-Streit" - opthalmological equipment, "Amditron" - diatermy equipment "Carba and [illegible]" - anesthesia equipment, thin layer [illegible] gas and electrophoresis [illegible]. "Fred Diedrich" together with "Philips" (Dutch) - [illegible] cardiographs. "Dr. F. Bosch [illegible]" - plethysmographs "Comet" - X-ray tubes, medical electron and other equipment.	[illegible] pulmonary equipment, ophthalmological and diatermy equipment, thin layer [illegible] gas, electrocardiographs.	FRG Radiological equipment, patient monitoring systems, cardiological equipment. From France Radiology equipment volume - controlled breathing apparatus. From Sweden Respiratory equipment. From Holland Radiology neurology and patient monitoring equipment. From the United Kingdom Anesthesia equipment, laboratory instruments. From USA Implantable pacemakers, bedside monitoring systems for electrocardiogram record keeping, gamma scintillation cameras, ultra-violat spectrometers, automated blood cell counters, automated clinical chemistry systems.
9. Venezuela	does not produce any [illegible]	-	All MES is imported from other countries. From USA Cardiac output analyzers, computers, defibrillators and cardioversion systems, implantable pacemakers, central and bedside monitoring systems, electrocardiographs, telemetr system for transmitting electrocardiograms, computer systems for CCU and etc. From FRG X-ray equipment and accessories From Japan Electrical measuring and controlling apparatus for medical applications. Other countries include the United Kingdom, France and Sweden.

Source: Export Market Digest, United States Department of Commerce, 1974.

Table 20. Imports of medical equipment into Australia, 1970-1974

Description of Commodity	Code No.	1970 - 1971		1971 - 1972		1972 - 1973		1973 - 1974	
		Quantity (No.)	Value ($A)	Quantity (No.)	Value ($A)	Quantity (No.)	Value ($A)	Quantity (No.)	Value ($A)
Electromedical Apparatus	726.10.00	-	4,221,720	-	5,067,360	-	4,448,520	-	6,489,720
X-Ray Tubes, Complete	726.20.01	685	885,080	765	1,370,520	539	968,760	844	1,613,520
Parts for X-Ray Tubes	726.20.04	-	155,520	-	149,040	-	116,640	-	142,560
X-Ray Generators Complete	726.20.05	49	200,880	89	379,080	98	408,240	80	667,440
Parts for X-Ray Generators	726.20.08	-	12,960	-	6,480	-	25,920	-	12,960
Nucleotest X-Ray Equipment	726.20.13	-	-	-	-	-	-	-	32,400
X-Ray Apparatus, Accessories	726.20.19	-	11,411,280	-	10,889,640	-	10,436,040	-	12,707,280
Total			16,887,744		17,862,120		16,404,120		21,665,880

Source: Overseas trade, Commonwealth Bureau of Census and Statistics.

Table 21. Imports of medical equipment into Brunei

Description of Commodity	Code No.	1969		1970	
		Quantity	Value Brunei dollars	Quantity	Value Brunei dollars
Electrical Medical Apparatus not X-Ray	726100	-	6,532	-	3,393
X-Ray including Radiography and Radio-theraphy apparatus	726200	-	7,917	-	133,444
Other medical instruments and appliances not elect.	861710	-	77,776	-	89,680
Mechano therapy appliances massage and other breathing apparatus	861720	-	34,759	-	34,746
Total			126,984		261,263

Source: Statistics of external trade.

Table 22. Import of medical electronic equipment into Burma

Country or territory and commodity	Commodity Code	1970	1971
Electro-Medical Apparatus	7261000		
USA		5,622	22,339
AUSTRIA		-	1,085
DENMARK		-	15,085
GERMANY, FEDERAL REPUBLIC OF		3,643	19,474
NETHERLANDS		-	1,866
UNITED KINGDOM		113,275	84,683
USSR		3,652	-
JAPAN		311	69,228
		35,752	1,269
TOTAL kyats		161,255	155,029
TOTAL $M		60,628	77,515
X-Ray Apparatus	7262001		
USSR		14,591	-
USA		-	12,210
AUSTRIA		19,945	-
DENMARK		-	387
GERMANY, FEDERAL REPUBLIC OF		119,408	98,435
NETHERLANDS		28,893	27[illegible]7
UNITED KINGDOM		51,382	13,[illegible]3
INDIA		-	-
JAPAN		-	22,625
[illegible]		-	2,842
TOTAL kyats		210,219	417,159
TOTAL $M		105,110	208,580
Radiography & Radiotherapy Apparatus	7262002		
USA		-	-
SWITZERLAND		-	-
UNITED KINGDOM		1,643	155
FINDLAND		-	4,519
JAPAN		1,311	1,451
AUSTRALIA		-	318
TOTAL kyats		2,954	6,423
TOTAL $M		1,477	3,212
Surgical & Medical Supplies	8617101		
USA		15,463	12,111
DENMARK		237,660	180,783
GERMANY, FEDERAL REPUBLIC OF		-	98,467
UNITED KINGDOM		60,854	144,733
INDIA		8,842	123,742
JAPAN		15,419	-
PHILIPPINES		-	100
TOTAL kyats		338,238	559,936
TOTAL $M		169,119	279,968

Table 22 (continued)

Country or territory and commodity	Commodity Code	1970	1971
Dental Supplies	8617102		
GERMANY, FEDERAL REPUBLIC of		11,213	-
UNITED KINGDOM		213,518	164,479
JAPAN		-	-
TOTAL kyats		224,731	164,479
TOTAL $M		112,366	82,240
Dental Apparatus Appliances and Accessories	8617104		
AUSTRIA		-	-
GERMANY, FEDERAL REPUBLIC of		-	-
UNITED KINGDOM		17,649	56,724
JAPAN		-	20,158
TOTAL kyats		17,649	76,882
TOTAL $M		8,825	38,441
Medical & Surgical Apparatus Appliances & Accessories	8617199		
USA		69,148	50,220
MEXICO		-	-
DENMARK		129,458	154,678
GERMANY, FEDERAL REPUBLIC of		74,410	207,282
SWEDEN		-	5,315
UNITED KINGDOM		241,695	363,906
ITALY		-	-
INDIA		3,199	4,319
CHINA		151	-
JAPAN		225,358	355,936
AUSTRALIA		28,116	5,957
TOTAL kyats		771,535	1,146,713
TOTAL $M		385,768	573,357
Scientific Surgical & Optical Apparatus Accessories	8617201		
CANADA		-	4,942
USA		346,403	173,565
AUSTRIA		1,855	298
DENMARK		62,223	2,152
FRANCE		106,098	43,142
GERMANY, FEDERAL REPUBLIC of		440,303	203,188
NETHERLANDS		-	8,307
SWEDEN		5,938	41,129
SWITZERLAND		767	-
UNITED KINGDOM		252,182	221,178
ITALY		-	908
CHINA		-	-
CZECHOSLOVAKIA		1,461	948
GERMANY, DEMOCRATIC REPUBLIC		91,843	-
FINLAND		-	26,790
USSR		717	298
HONG KONG		-	170
INDIA		3,377	11,100
JAPAN		315,064	188,095
AUSTRALIA		72,786	21,276
TOTAL kyats		1,701,017	947,576
TOTAL $M		850,509	473,788

Table 22 (continued)

Country or territory and commodity	Commodity Code	1970	1971
Radiological Apparatus Appliances and Accessories Medical	8617202		
GERMANY, FED. REP. of		-	-
UNITED KINGDOM		-	1,217
TOTAL kyats		-	1,217
TOTAL $M		-	609
Instruments other than Medical for physical or chemical analysis	8619800		
USA		-	8,409
SWITZERLAND		-	-
SWEDEN		-	252
UNITED KINGDOM		-	20,244
JAPAN		-	144,722
AUSTRALIA		-	1,00
TOTAL kyats		-	174,272
TOTAL $M		-	87,364
TOTAL (all items)$M		1,713,799	1,825,074

Source: Bulletin of Export Trade, Government of the Socialist Republic of the Union of Burma.

Table 23. Imports of medical equipment into Hong Kong, 1971-1974

Description of Commodity	Code No	1971		Jan - Jun 1972		1973		1974	
		Quantity	Value ($M)	Quantity	Value ($M)	Quantity	Value ($M)	Quantity	Value ($M)
Electromedical Apparatus	726100	-	1,178,586	-	775,489	-	1,591,742	-	1,587,594
X-Ray Apparatus	726200	-	1,026,837	-	488,492	-	2,522,526	-	1,540,852
Medical Dental Instruments Apparatus	861700	-	4,923,821	-	2,210,612	-	7,163,850	-	9,804,397
Total			7,129,254		3,474,593		11,278,118		12,932,843

Source: Hong Kong Trade Statistics, Census and Statistics Department, Hong Kong.

Table 24. Imports of medical equipment into India, 1970

Commodity	Code No.	Quantity	Value ($)
Defibrillator and Heart Pacers	7261001	(No.) 3	2,926
Electrocardiograph and Electroencephalograph	7261002	(No.) 8	1,756
Hypothermia Machine	7261003	(No.) 2	9,803
Ultraviolet and Infrared lamp with Stand	7261004	(No.) 1934	7,930
Other Elec. Apparatus for Medical Purposes	7261009	(No.) 654	964,339
Parts	7261011	(Kg) 5111	693,513
X-Ray Generator, etc.	7262001	(No.) 26	209,076
X-Ray Tube and Valve	7262002	(No.) 417	287,564
X-Ray Apparatus Parts	7262009	(Kg) 101263	2,499,647
Total			4,676,554

Source: Monthly statistics of the foreign trade of India.

Table 25. Imports of medical equipment into Indonesia, 1972

Commodity	Code No.	Quantity (kg)	Value ($US c.i.f.)
Electromedical and radiological apparatus and appliances	10030	12,408	$US 758,617 $M 1,942,099

Source: Foreign trade statistics, Biro Pusat Statistik.

Table 26. Imports of medical equipment into the Republic of Korea, 1971

Commodity	Code No.	Quantity (No.)	Value ($M)
Electric medical, dental, surgical and veterinary instruments and appliances.	7261900	3221	2,418,060
Parts of Electro-medical apparatus	726990	914	37,562
Apparatus based on the use of X-Ray for dental use	7262110	246	129,310
Apparatus based on the use of X-Ray for medical use	7262120	266	2,769,057
Apparatus based on the use of X-Ray for industrial laboratory use	7262160	15	300,288
Apparatus based on the use of X-Ray: other use	7262180	4	126,597
X-Ray tubes	7262191	158	59,312
X-Ray generators	7262192	5	47,196
X-Ray screens	7262193	111	6,156
X-Ray high tension generators	7262194	2	80,896
Apparatus based on the use of X-Ray: Parts	7262199	454	105,902
Apparatus based on the use of the radiotions from radioactive substances: For medical use	7262211	9	46,210
Apparstus based on the use of the radiotions from radioactive substances: Other use	7262239	367	98,391
Apparatus based on the use of radiotions from radio-active substances: Parts	7262290	21	13,478
X-Ray Parts and accessories	7262999	87	10,565
Total			6,208,980

Source: Statistical Yearbook of Foreign Trade

Table 27. Imports of medical equipment into the Philippines, 1969-1971

Description of Commodity	Code No.	1969		1970		1971	
		Quantity	($K)	Quantity	($K)	Quantity	($K)
Radiological Apparatus, including X-ray Apparatus, X-Ray Tubes and Screens	721.11.01	53,951(kg)	1,126,909	82,202(kg)	1,758,786	35,745(kg)	785,082
Electromedical Apparatus (Medical, Dental, Surgical, Veterinary or Ophthalmic Instruments) including Infrared and Ultraviolet Ray Apparatus and the like	721.11.02	6,852(No.)	705,576	5,077(No.)	534,807	3,583(No.)	425,658
Total			1,832,485		2,293,593		1,210,740

Source: Foreign trade statistics of the Philippines.

Table 28. Imports of medical equipment into Singapore, 1971-1974

Description of Commodity	Code No.	1971		1972		1973		1974	
		Quantity	Value ($S)	Quantity	Value ($S)	Quantity	Value ($S)	Quantity	Value ($S)
Electrical Medical Apparatus Not X-ray	726100	-	414,720	-	1,129,560	-	756,192	-	1,476,233
X-Ray incl. Radiography and Radiotherapy Apparatus	726200	-	678,680	-	1,277,067	-	1,771,625	-	1,914,115
Other Medical Instruments and nonelectric appliances	861710	-	2,474,177	-	2,661,853	-	3,165,198	-	7,134,866
Mechanotherapy Appliances Massage and Other Breathing Apparatus	861720	-	1,266,153	-	1,290,498	-	1,133,492	-	2,328,209
Total			4,833,730		6,358,978		6,826,507		12,853,423

Source: Singapore external trade statistics.

Table 29. Imports of medical equipment into Thailand, 1971-1973

Description of Commodity	Code	1971		1972		1973	
		Number	Value c.i.f. (Baht)	Number	Value c.i.f. (Baht)	Value c.i.f. (Baht)	Number
Electro medical apparatus	991,701		775,566	21	332,943	13,818	1
Dental instruments appliances	901,703		6,916,265	170,748	4,573,366	8,930,220	
Surgical instruments and appliances	901,704		2,583,389		2,622,195	5,282,402	
Medical instruments and appliances	901,705 901,710		32,491,549		18,376,828 13,812,963	37,080,608 22,398,784	
Veterinary instruments and appliances	901,707		156,504		197,184	592,106	
X-ray apparatus	902,011	85	6,888,597	270	9,450,676	6,919,122	89
Radio therapy apparatus	902,012	1	7,280	1	357,498	147,359	2
X-ray tubes	902,014	42	587,481	25	258,810	271,655	17
X-ray screens	902,015	600	184,952	232	76,391	89,175	207
X-ray exam or treatment tables	902,016	7	62,681			56,616	
Other parts & accessories of X-ray & radio therapy apparatus medical use.	902,019	1,387	486,938	2,222	653,706	1,079,278	
Other X-ray apparatus	902,021	71	3,423,662	381	2,488,134	124,137	
Radiological apparatus	902,022	1	83,261				
Other X-ray generators	902,023	21	5,175	4	680,357	192,540	
Other X-ray tubes	902,024	5	42,562	1	51,773	119,592	
Other parts & accessories of other X-ray & radiological apparatus	902,029	1,648	965,600		692,814	247,148	
Total Baht			55,561,478		50,494,638	83,569,560	
Total $M			6,978,331		6,341,954	10,496,051	

Source: Foreign trade statistics of Thailand, December 1973.

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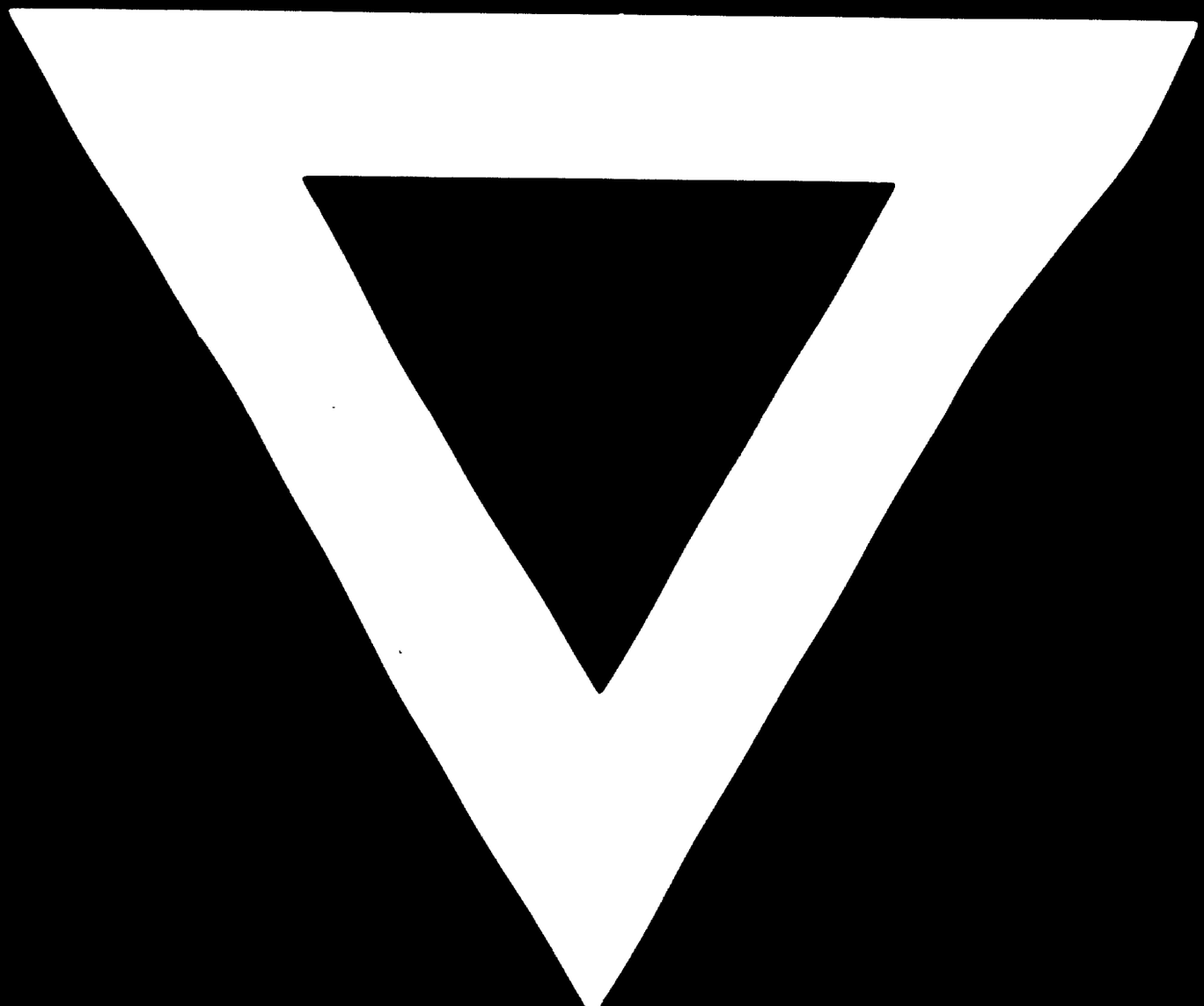

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