PRESENT & FUTURE SCIENCE & TECHNOLOGY COOPERATION IN ASEAN

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I INTRODUCTION

It would indeed be amiss if I do not before my address ask you to join me in thanking Dr Maurice Goldsmith for the magnificent manner in which he has organised this conference. I wish to add a special word of welcome to my ASEAN colleagues and also to a most distinguished panel of international experts on Science and Technology Policy. We are indeed grateful to the European Commission for sponsoring the conference.

This conference is not a large one, as we only have some 30 participants from about 15 different countries and international organisations. But I consider that a conference such as this one has a special significance by bringing together top bureaucrats, professionals and international experts to review the state of the art and to provide greater focus and clarification on what can be considered as an increasingly important area of science and technology infrastructure. I refer in particular to science and technology policies, including science and technology indicators and statistics, and techniques in technology forecasting. As most of you are aware, the ASEAN countries do not have explicit science and technology policies. Thus far, national science and technology are basically derivatives of social and economic policies. The topics of the seminar are of particular interest to ASEAN, especially in regard to:

- (a) the development of ASEAN capability and competence in science and technology;
- (b) regional and international cooperation in science and technology; and
- (c) how best to relate them to ASEAN social and economic development and future needs.

My address today will focus on present and future ASEAN cooperation in science and technology. I believe a strong ASEAN support for science and technology must be maintained, for the development and application of science and technology will remain a key factor for a continuing social and economic growth of ASEAN. The views I express here are not necessarily those of the ASEAN Committee on Science and Technology.

II. THE COUNTRIES OF ASEAN

The Association of South-East Asian Nations (ASEAN) is a regional organisation formed by the Governments of Indonesia, Malaysia, the Philippines, Singapore and Thailand, in August 1967, for the purpose of promoting the welfare of the people through economic, scientific and cultural cooperation. Cooperation in science

and technology among the ASEAN nations is based on the principles that regional co-operation does not substitute or replace national programmes. Regional cooperation in point of fact is intended to enhance national capabilities.

ASEAN countries occupy a total land area of 3.637 million square km. ASEAN represents a current market of 270 million, and is projected to be 350 million by 1990 and 450 million by the year 2000.

The Chart (as shown in Figure 1) gives a comparison of some basic data of the ASEAN countries and its dialogue partners, namely Australia, Canada, the EEC, Japan, New Zealand and the USA.

Table 1 shows a comparison of the growth rates between the ASEAN nations, the East Asian newly industrialising countries (NICs) and selected OECD countries:

Table 1

Country	1981			1982		
	Real GNP/GDP	Inflation	Productivity	Real GNP/GDP	Inflation**	Productivity
ASEAN						
Indonesia	7.6	12.2	—	4.5	15.0	—
Malaysia	6.9	9.5	3.9*	3.9	6.5	1.5*
Philippines	4.9	12.4	—	4.0	11.0	—
Thailand	7.6	12.7	4.5*	4.5	10.0	—
Singapore	9.9	8.2	5.4	6.3	4.0	0.9
NICs						
Taiwan	5.5	16.3	3.5*	3.8	5.5	1.2* (Jan— Mar)
Hong Kong	11.0	15.4	2.8*	4.0	12.0	—
South Korea	6.4	23.3	4.5*	6.0	4.2	2.7* (Jan— Jun)
SELECTED OECD COUNTRIES						
US	1.9	10.4	0.8	−1.8	6.0	−1.0
Japan	3.0	4.9	2.1	2.5	2.8	1.5
West Germany	−0.2	5.9	0.6	−1.3	5.0	0.5
France	0.3	13.4	1.0	1.5	11.5	2.0
UK	−2.2	11.9	2.7	0.5	8.5	3.5

Note: * Productivity figures are not published by these countries but derived by employment. The latest employment figures for the other countries however are not available for productivity growth calculation.

** Private consumption deflators are used for OECD countries.

The average annual GDP growth rates in real terms from 1978 to 1982 varies between 4.9% and 8.9%, (Table 2). The growth rates have been generated, in the main, through a combination of expanding industrial operations:

- (a) in mining, manufacturing, construction, and agriculture;
- (b) in electricity, gas, petroleum, and transport services; and
- (c) through high export prices; (except for the present economic recession which had its toll on the primary-producing ASEAN economies which had to suffer the twin effects of low demand and falling commodity prices).

Table 2: Real GNP Growth in ASEAN Countries in 1978–82

	1978–82*	1978	1979	1980	1981	1982[p]
	Percentage Change Over Previous Year					
Indonesia	6.8	6.9	5.3	9.6	7.6	4.5
Malaysia	6.9	6.6	9.2	7.8	6.9	3.9
Philippines	4.9	6.8	6.1	5.4	3.7	2.6
Singapore	8.9	8.6	9.3	10.2	9.9	6.3
Thailand	6.8	10.1	6.1	5.8	7.6	4.5

* Average annual growth rate

Source: *Economic Survey of Singapore, 1982*

p: Preliminary

In terms of world production in 1980, ASEAN countries provide 80% of natural rubber, 63% of palm oil, and 37% of coconuts, (Table 3). All these are renewable resources, and nowhere are the ingredients of soil, air, water and sunshine in more balanced abundance than in this tropical region.

The mineral industries which are being developed include (as shown in Table 5): gold, copper, chromium, nickel, iron, thorium, tin and tungsten. Copper and chromium are largely located in the Philippines; tin in Malaysia, Thailand and Indonesia; nickel in the Philippines and Indonesia; and iron in Indonesia, Malaysia and Thailand. In 1980 ASEAN produced 63.1% of world tin in concentrates.

Apart from the agro-based and extractive technologies introduced and developed to exploit resources in agriculture, forestry and minerals, ASEAN member states have turned to manufacturing industry to take advantage of the abundance of the natural resources and raw materials. Many of the industries are relatively small scale and labour intensive. The overall objectives are not only to save on foreign exchange by establishing import-substitution industries, but also to increase their export of manufactured goods within the ASEAN region and to the developed countries. Table 6 gives the growth rates in manufacturing and also the contribution to the Gross Domestic Product in each ASEAN country.

Table 3: 1980-ASEAN Crop Production (as % of total world production)*#

Country	Indonesia	Malaysia	Philippines	Thailand	Total % for ASEAN Countries
Crop					
Rice, Paddy	9.69	0.53	1.89 ^a	4.32	16.43
Palm Oil ¹	13.54	49.91 ^b	—	—	63.45
Pineapples ²	2.85	2.01	13.94	18.29	37.09
Cassava	10.98	0.41 ²	—	11.06	22.45
Bananas ²	4.08	1.14	10.00	5.06	20.28
Natural Rubber ¹	26.66	40.57	—	13.09	80.32

based on data from *Statistical Indicators for Asia and the Pacific, Dec 81*

* Figures for Singapore are negligible

¹ based on data from *FAO Commodity Review and Outlook 1981/82*² based on *FAO October 1981 estimates*^a Preliminary as of 31 March 1981^b Figure is for crude palm oil

Except for Singapore, agriculture contributes significantly to the GDP of ASEAN countries, ranging from 23.0% to 33.6% during the period 1977 to 1982. Table 4 gives the annual growth rate of agriculture as well as their contributions to GDP in each ASEAN country.

Table 4: Growth Rates in Agriculture & Contribution to GDP (in 1968 Factor Cost)

Countries	Growth in Agriculture*						Contribution to GDP %					
	1977	1978	1979	1980	1981	1982	1977	1978	1979	1980	1981	1982
Indonesia	1.3	5.1	3.9	5.2	3.5	NA	33.6	32.8	32.0	30.7	29.5	NA
Malaysia	2.4	1.6	8.2	3.1	5.3	1.9	26.4	25.2	24.9	23.8	23.5	23.0
Philippines	4.6	4.4	5.1	4.9	3.8	3.7	26.4	26.0	25.6	25.6	25.6	25.8
Singapore	1.6	-0.8	3.3	1.9	-2.3	-6.3	1.6	1.5	1.4	1.3	1.2	1.0
Thailand	-0.5	10.6	-1.5	1.9	4.7	1.9	27.6	27.8	25.8	24.9	24.2	23.7

* Percentage change over previous year

Source: *Key Indicators of Developing Member Countries of Asian Development Bank, April 1983*

Table 5: ASEAN Mineral Production (Tonnes)#

Mineral Product	Country			
	Indonesia	Malaysia	Philippines	Thailand
Antimony ore	—	—	—	6,910
Bauxite	1,203,200*	757,000*	—	—
Coal	350,400*	—	363,800*	—
Cobalt	—	—	1,240	—
Copper concentrate	188,200*	105,000	1,339,600*	—
Crude petroleum	79,570,000*	12,383,000*	203,000*	2,700*
Iron and concentrate	79,880	530,000*	—	62,500*
Lead ore	—	—	2,030	20,520
Lignite	—	—	—	1,686,000*
Manganese	—	—	5,000	35,320
Nickel ore	1,551,870	—	28,760	—
Tin in concentrates	33,900*	59,900*	—	42,900*
Tungsten concentrate	—	—	—	3,550
Zinc concentrate	—	—	10,760	—

Source: Statistical Indicators for Asia and the Pacific (September 1982) ESCAP and Asian Development Bank – Annual Report 1982

Figures rounded up to nearest 10.

* 1981 figures, if not stated 1979 figures

No mineral production in Singapore

Table 6: Growth Rates in Manufacturing & Contribution to GDP

Countries	Growth in Manufacturing*						Contribution to GDP %					
	1977	1978	1979	1980	1981	1982	1977	1978	1979	1980	1981	1982
Indonesia	13.7	16.8	12.9	22.2	12.0	NA	11.9	12.9	13.7	15.3	15.9	NA
Malaysia	10.6	9.3	9.5	9.0	4.0	3.5	17.9	18.3	18.4	18.6	18.1	18.0
Philippines	11.4	7.7	5.7	4.5	3.4	2.1	25.0	25.4	25.1	25.0	24.9	24.7
Singapore	9.3	11.3	15.0	11.8	9.7	-5.6	21.9	22.4	23.6	23.9	23.9	21.2
Thailand	12.0	9.3	10.1	4.8	8.0	6.2	20.3	20.1	20.9	20.7	20.8	21.2

* Percentage change over previous year

Source: Key Indicators of Developing Member Countries of Asian Development Bank, April 1983

III ASEAN – ORGANISATIONAL STRUCTURE

ASEAN has set about building a framework for ASEAN cooperation since 1967. All the five ASEAN countries concentrate on economic development and construction and have made rapid economic growth. All our economies are market oriented. We encourage free enterprise, and with high levels of external trade flows with the major industrialised countries.

Our progress towards regionalism has been less structured than that of the EC. We have made progress in an Asian manner, not through rules and regulations, but through consensus. The diversity of areas within which the ASEAN partners cooperate, and the levels at which cooperation takes place, ensure the continuing involvement of the citizens of the partner States. These methods are reflected, too, in the organizational arrangements adopted and the procedures which have evolved that enable ASEAN to pursue and achieve its objectives.

It has become ASEAN practice for Ministers and officials of ASEAN governments to maintain close contacts with each other through ASEAN meetings and through informal multilateral visits. At people-to-people level, there is a greater awareness and empathy of each other through the mass media, professional conferencing, academic exchanges, and tourism.

ASEAN works predominantly through Committees, a reflection of the basic need for consensus. There are nine major operational committees, some responsible to the Economic Ministers and others to the ASEAN Standing Committee which comprises the ASEAN Foreign Ministers. The operational committees are:

- (a) Committee on Trade and Tourism (COTT) – Economic Ministers;
- (b) Committee on Finance and Banking (COFAB) – Economic Ministers;
- (c) Committee on Transportation and Communications (COTAC) – Economic Ministers;
- (d) Committee on Industry, Minerals and Energy (COIME) – Economic Ministers;
- (e) Committee on Food, Agriculture and Forests (COFAF) – Economic Ministers;
- (f) Committee on Social Development (COSD) – Standing Committee;
- (g) Committee on Culture and Information (COCI) – Standing Committee;
- (h) Committee on Science and Technology (COST) – Standing Committee;
- (i) Committee on Budget – Standing Committee.

The present pattern of organization dates from 1976/77 following the First Meeting of Heads of Government. Charts depicting the organizational structure of ASEAN and the arrangement of the ASEAN Secretariat are shown in Figures 2 and 3.

The ASEAN Secretariat was established in mid-1976. It consists of three Bureaus – Economics, Science and Technology, and Social and Cultural Affairs – together with a Foreign Trade and Economic Relations Section, an Information Office and Documentation Centre.

Figure 2: Organizational Structure of ASEAN

Figure 3 : Organizational Chart of the regional ASEAN Secretariat

IV ASEAN COMMITTEE ON SCIENCE & TECHNOLOGY

ASEAN regional cooperation in science and technology was initiated when the first ASEAN meeting on science and technology was convened on 27–29 April 1970. Following the rationalisation of ASEAN operations in 1978, the ASEAN Permanent Committee on Science & Technology originally established in 1970 was redesignated the ASEAN Committee on Science & Technology in 1978. Be that as it may, the last 13 years have forged linkages and collaborative efforts among ASEAN scientists, technologists and institutions through many programmes that have been jointly formulated and implemented.

The ASEAN Committee on Science & Technology was established for the promotion of regional cooperation in science and technology within the overall framework of economic growth, social progress and cultural development in the ASEAN region.

The objectives of the regional programmes in science and technology are:

- (a) to initiate and intensify regional cooperation in scientific and technological activities;
- (b) to generate and promote development of scientific and technological expertise and manpower in the ASEAN region;
- (c) to facilitate and accelerate the transfer of scientific development and technologies among ASEAN countries and from the more advanced industrialised countries to the ASEAN region;
- (d) to provide support and assistance in the application of the results of research and development, and in the more effective use of natural resources in the ASEAN region; and
- (e) to provide support towards the implementation of present and future ASEAN programmes.

In pursuance of the above objectives, ASEAN has in recent years been forging the development of many collaborative programmes of interest and relevance to ASEAN development. ASEAN member countries have developed institutional linkages in support of these activities. Among the collaborative programmes are:

- (a) the development of low cost protein-rich foods for infants and lactating mothers;
- (b) the management and utilisation of food waste materials;
- (c) the compilation of an atlas and compendium of climatic statistics;
- (d) environmental management;
- (e) the development of non-conventional energy;
- (f) R & D in food technology; and
- (g) marine sciences and oceanography.

ASEAN COST, in developing a system of implementing the various technical projects, has set up a number of Sub-Committees and Working Groups to help administer them. Presently, there are 2 Sub-Committees and 4 Working Groups, comprising ASEAN experts. They are:

- (a) the Sub-Committee on Climatology;
- (b) the Sub-Committee on Protein;
- (c) the Working Group on Food Waste Materials;
- (d) the Working Group on Food Technology R & D;
- (e) the Working Group on Non-Conventional Energy Research; and
- (f) the Experts Group on the Environment.

A number of ad hoc working groups under COST have also been set up to help formulate specific programmes with a view of promoting new areas of cooperation in science and technology.

Formulation, planning and coordination of COST's programmes are done through biennial meetings of COST, meetings of its Sub-Committees and Working Groups, and through reports and correspondence.

V COOPERATION IN SCIENCE & TECHNOLOGY

In broad terms, ASEAN nations are dependent on consensus of all partners in the Association. This is important where the nature of technology or phenomena transcend national boundaries such as satellite communications, remote sensing, weather monitoring, submarine cable system, and so on. This cooperative principle is significant in that it has enabled ASEAN nations to make advances towards their overall objectives.

To illustrate the cooperative efforts promoted by ASEAN, I shall now highlight some of the major projects that are being implemented.

- (a) The Basic Agreement on the ASEAN Industrial Projects: Under this agreement, five large scale industrial projects are located in each ASEAN country; urea to Indonesia and Malaysia, superphosphates to the Philippines, diesel engines to Singapore, and soda ash to Thailand. The objectives of such a package deal were to "utilise the available raw materials in the member states, contribute to the increase of food production, increase foreign exchange earnings or save foreign exchange, and create employment".
- (b) The Basic Agreement on ASEAN Industrial Complementation: The framework of this agreement, formalised in 1981, is based on private sector initiatives with government providing the legal framework. Steps are taken to implement the first complementation package automotive products. Such products are granted a 50% margin of preference under the ASEAN Preferential Trading Arrangements and other non-tariff preferences negotiated bilaterally.
- (c) An ASEAN Food Security Reserve Agreement: This scheme provides for a 50,000 metric ton emergency rice reserve. Studies are presently being undertaken on the supply and demand of food and other strategic products in ASEAN and on expanding the scope of the Food Security Reserve;
- (d) Operation of the ASEAN Submarine Cable System: Started in 1978, the ASEAN submarine cable network will be completed in 1983; and it will be linked with other submarine cable systems in order to enhance the quality and reliability of communication not only within ASEAN but also between ASEAN and the rest of the world.

Apart from what I have just mentioned, numerous other programmes in science and technology have also been formulated through a decentralised network of committees and working groups it has established in the fields of:

- (a) transport and communications,
- (b) food, agriculture and forestry,
- (c) industry, minerals and energy, and
- (d) science and technology.

In this way, ASEAN encourages a wide range of participation and involvement of professionals and institutions in ASEAN development.

VI REGIONAL R & D ACTIVITIES

The ASEAN Committee on Science and Technology was assigned the responsibility of promoting research and development in the ASEAN countries. Cooperation in R & D activities is a new and effective way of developing the competence of ASEAN scientists and technologists, and to increase the technological capacity of the ASEAN countries. The Committee has addressed itself to a number of basic issues confronting development.

Protein Foods

One of these relates to the development of low cost protein-rich foods in order to combat malnutrition in the ASEAN countries among the vulnerable groups, mainly infants and lactating mothers. Malnutrition is often accompanied by deficiencies in vitamins and minerals, in particular vitamin A and iron. The responsibility in administering the protein project rests with the Sub-Committee on Protein. Soya beans have undoubtedly emerged as an important source of raw materials, as they have the highest protein content with the best amino acid balance of all plant products. This has been recognised in Asia for generations because soya beans have been accepted as a basic food substance. Another crop of immense potential for ASEAN is that on high-protein winged beans (*psophocarpus tetragonolubus*). Development work based on soya beans have produced a number of formulations for infant foods. Highly nutritional snack foods and soya milk have also been developed. The development of these products takes cognizance of the food-eating habits of the ASEAN people; and several of these products are at the stage of commercialisation.

Food Waste Materials

Food waste materials constitutes one of the major sources of pollution, having an adverse effect on the environment. The deterioration of the environment and the likely effects these would have on food production and supply have brought into sharp focus the morality of science and technology. I am of the view that this is in part due to the evolution of a scientific and technological attitude which craves after problems of synthesis (may they be new processes or products) more than after problems of wastes and degradation. Consequently human kind has neglected to take into account the deleterious effects of its innovation, leaving it to the carrying capacity of nature to deal with. So pollution today, may it be that of air, land or water, reflects the failure of science to achieve an understanding of the natural world. It also reflects until recent times the failure of modern science and technology to remedy the situation. However,

the collective steps taken by ASEAN to combat pollution due to food waste are reflected in the ASEAN's projects on the management and utilisation of food waste materials. They are designed to recycle food waste materials and convert them into useful products such as food, fuel and chemicals. These research efforts will at the same time help remove major sources of pollution, particularly water pollution.

Food Technology

ASEAN has opened up a third line of cooperation in the area of food. The programme entails collaborative R & D work on food processing and technology. Except for Singapore, agriculture contributes significantly to the GDP of the ASEAN countries. Post-harvest food losses in this tropical region with relatively high humidity and temperature present perennial problems to farmers. This new collaborative research programme, aims to develop improved methods of processing, packaging and distribution. The programmes will further the efforts of ASEAN institutions in the training of personnel and in the application of post-harvest technologies and in developing a more effective system of transport and distribution of food.

Food deterioration and wastage in the humid tropics can then be checked.

Non-Conventional Energy

Increasing emphasis have been placed by ASEAN COST on non-conventional sources of energy. Several projects have been identified. Australia and the US in continuing and expanding cooperation with ASEAN COST, have provided funds for a number of non-conventional energy projects on:

- * biomass for heat and power;
- * energy conservation technologies;
- * coal technologies; and
- * solar pumping.

New Zealand and Canada have expressed interests to extend their cooperation in the field of non-conventional energy. New Zealand has as a first step sent a technical mission to the ASEAN region in December 1982 to study the prospects for ASEAN-New Zealand cooperation on non-conventional energy.

The objectives of the mission were to match New Zealand's expertise, technologies and hardware in non-conventional energy with the real needs in the ASEAN countries. Areas that are of particular interest to New Zealand include energy planning, inventory assessment and technology transfer.

At the recent ASEAN-Canada JCC Meeting on 26-27 Apr 83, Canada has expressed interests in support of the projects of biogas technology and wind energy and solar energy utilisation.

Environment

The problems concerning the degradation and pollution of the environment are complex problems. For environmental problems are inextricably linked to problems of population growth, urbanisation and industrialisation whether it be manufacturing industry or agricultural industry. There are no quick solutions to the environmental problems. Insofar as environmental problems are complex, so are the solutions complex, costly and long term. The priorities that are established for environmental problems differ from country to country. They must of necessity be considered not only within the

context of protecting the physical environment, but also within the framework of a country's social and economic priorities and infrastructure. The ASEAN cooperative projects on the environment under the purview of COST are administered by the ASEAN Experts Group on the Environment. The United Nations Environmental Programme (UNEP) and the United Nations Development Programme (UNDP) have contributed funds in support of ASEAN seminars and workshops. UNDP has expressed its intention to support ASEAN projects on:

- * organo-industrial pollution monitoring; and
- * anti-pollution technologies.

The EC also provided fellowships and expert assistance to ASEAN COST on environment matters.

Marine Science

Two areas of marine science of interest to ASEAN are:

- * Studies on Tides and Tidal Phenomena; and
- * Studies on Oceanography related to the management of living resources.

Both projects will take the form of collaborative regional studies, manpower development, exchange of expertise and information, and joint seminars. Canada has at the 1st Meeting of the ASEAN-Canada JCC, Ottawa, 26–27 Apr 83, agreed to support 2 ASEAN projects on oceanography, namely: resource development and management and pollution monitoring studies.

Training, Expert Assistance, Seminars and Studies

Under the ASEAN-EC Cooperation on Science and Technology, the EC has provided fellowships, expert assistance, seminars and studies to COST in the fields of energy, environmental control and manpower development for the first 2 years.

ASEAN COST and EC are presently formulating the next 3-year programme.

VII INTERNATIONAL RELATIONS IN SCIENCE & TECHNOLOGY

Regional and international cooperation is of vital importance to ASEAN scientific and technological development.

In view of the international character of science and technology, ASEAN COST has established links and positive relationships with its counterparts in developed countries and international organisations. Such an approach is important in generating a continuing support in human resource development and in the judicious application of science and technology for ASEAN development.

COST therefore undertakes its projects on a cooperative basis. Most of them are based on bilateral or multilateral assistance. In its dialogues with third countries and international organisations, ASEAN COST has adopted the following guidelines:

- (a) cooperation within ASEAN as a group should not be at the expense of assistance given to individual countries on a bilateral basis;
- (b) cooperation should be for projects which should be of benefit to all ASEAN countries;
- (c) cooperation should be for projects conceived by ASEAN and which are regional in character; and
- (d) cooperation should supplement but not supplant ASEAN capability.

In all our cooperation, ASEAN has developed a pragmatic way of making decisions through consensus. Our success is manifested in the fact that most developed countries and international organisations have now established official relations with us.

To-date, ASEAN has established formal dialogues with Australia, Canada, the European Community, Japan, New Zealand, the United States, the UN organisations and the EEC. Acting collectively, ASEAN has been able to gain increasing support for many of its development programmes, among which are those dealing with science and technology.

ASEAN countries have established on a bilateral basis several joint research and development projects with Japan under what is known as the Institute for the Transfer of Industrial Technology (ITIT) Projects. The projects under this scheme have been selected in accordance with the following guidelines:

- (a) R & D projects should meet the requirements of the level of economic and social development of counterpart countries.
- (b) R & D activities should be carried out both in Japan and counterpart countries on equal basis.
- (c) R & D activities should be carried out in close consultation between Japan and counterpart countries.

Following these guidelines, the research and development projects, as a first step, are selected with consideration of the potentialities and priorities of both parties. Next, the planning, programming and managing of the joint research and development projects involve mutual and close consultation between the two parties concerned. The joint research and development projects endeavour to create new technology appropriate for counterpart countries or to improve already existing technology to suit local conditions.

The joint research efforts on new technology aim to meet the needs of developing countries with innovative technologies useful both to counterpart and to Japanese researchers. Each research endeavour includes domestic laboratory work as well as that in Japan; in principle, a Japanese researcher is dispatched to the counterpart laboratory while the counterpart researchers are invited each year to Japan.

Table 7 is a summary of joint research projects on new technology that are currently undertaken by ASEAN institutes together with the counterpart research institute in Japan on a bilateral basis.

Table 7: Joint Research on New Technology

Name of Research Project	Japanese Research Institute	ASEAN Research Institute	Country	Duration
1. Research on the potential utilization of local non-woody fibres and woods for pulp and paper making (Paper Making)	Government Industrial Research Institute, Shikoku	Thailand Institute of Scientific and Technological Research	Thailand	1978-1982
2. Research on the development and application of natural sorbents for oil spill clean-up (Oil Sorbents)	Government Industrial Research Institute, Osaka	Institute for Research and Development of Textile Industries	Indonesia	1979-1982
3. Basic studies for geothermal energy development in Northern Thailand (Geothermal Development)	Geological Survey of Japan	Department of Mineral Resources	Thailand	1980-1983
4. Research on pyrolysis of industrial and urban wastes into usable products (Industrial and Urban Waste Utilization)	Government Industrial Development Laboratory, Hokkaido	National Institute of Science and Technology N.S.T.A.	Philippines	1980-1984
5. Research on utilization of Malaysian natural resources for building materials (Lightweight building materials)	Government Industrial Research Institute, Kyushu	Standards and Industrial Research Institute of Malaysia	Malaysia	1980-1982
6. Research on improvement and development of pottery product quality in Indonesia (Pottery Product Quality)	Government Industrial Research Institute, Nagoya	Ceramic Research and Development Institute	Indonesia	1980-1984
7. Research on the utilization of unutilized plant material (unutilized Plant Material)	Industrial Products Research Institute	Institute for Research and Development of Cellulose Industries	Indonesia	1981-1983
8. Research and development on the Indonesia complex sulphide ores processing (Sulphide Ores Processing)	Government Industrial Research Institute, Tohoku	Mineral Technology Development Center	Indonesia	1981-1984
9. Research on multi-variate colour fastness in low latitudes (Colour Fastness)	Research Institute for Polymers and Textiles	Institute for Research and Development of Textile Industries	Indonesia	1981-1983
10. Effective utilization of oils and fats produced in tropical plants (Utilization of Vegetable Oils)	National Chemical Laboratory	Palm Oil Research Institute of Malaysia	Malaysia	1982-1984

VIII ASEAN HUMAN RESOURCES DEVELOPMENT

Government to government agreement has been reached between Japan and the respective ASEAN countries for the establishment of a human resource development centre in each of the ASEAN member countries.

A total of US\$100 million has been earmarked for the whole project. The technical cooperation package includes dispatch of Japanese experts, acceptance of trainees and supply of equipment. In addition, the buildings or facilities will be built through grant aid cooperation.

The 5 ASEAN Human Resources Centres and their activities can be summarised as follows:

Indonesia: Centre for Vocational and Extension Service Training — trains young people as vocational and small scale industrial instructors.

Malaysia: Centre for Instructor and Advanced Skilled Training — provides skill improvement and advanced training to secure skilled technical workers.

The Philippines: Human Resources Development Centre — develops agro-industrial livelihood activities in conjunction with the Philippine Movement for Improving Agricultural Village Livelihood.

Singapore: The Productivity Development Project — aims at training administrators and supervisors in various occupational levels to achieve improvement in productivity.

Thailand: Primary Health Care Training Centre Project — offers expert training in Primary health care methods and extend health care services at community level.

Another Centre will be established in Okinawa to function as a training centre and liaison office for the ASEAN Centres.

IX TECHNOLOGY TRANSFER

Many factors can be attributed to the gap in development and living standards between the rich advanced countries and the independent developing countries. The most overwhelming factor — with immediate, physical and real manifestations — is the difference in the levels of the application of science and technology. The process of developing scientific and technological capabilities is not a simple matter of transfer of technology from Country A to Country B. The problem is much more complex entailing the broader issues of social and economic structure of society, political stability, levels of literacy and education, economic planning, foreign investments, and the development of the necessary infrastructure to make the best use of modern science and technology.

All ASEAN countries are working for a steady continuing economic growth through the application of modern science and technology. But the means adopted by each country to achieve this goal and the obstacles encountered in the implementation differ from country to country. The national circumstances in each country are different, and the approach may not necessarily be the same. Some countries proceed towards modernisation by placing greater emphasis on self-reliance and the mobilization of their indigenous capital resources. Others rely on foreign investments and technology.

However, the spread of science and technology will vary according to political, social and religious factors on the one hand, and institutional forces and group pressures resisting modernisation on the other.

There are several areas in which the potential for regional cooperation can be exploited to the advantage of the member countries. Firstly, there is a need for each ASEAN country to establish its national centre for the transfer and development of technology in order to help in the selection and import of technology from the industrialised countries. It can develop capabilities in packaging and adapting technologies to national needs and resource endowments. It can also provide channels for information exchange, give training, and help in the negotiation of terms and conditions. The centre could also provide information on availability of technology, expertise, capital goods and so on.

Secondly, there is also a need for ASEAN to look into the development and harmonisation of patent systems in the ASEAN countries. These will help generate a climate for promoting foreign investments of higher technology from the industrialised countries and greater ASEAN intellectual activities in industrial innovation.

Institutes of excellence in areas such as post-harvest technology, fisheries, forest based products, nuclear energy, metals and minerals, engineering, transportation, communications, low-cost housing, and so on could be considered for regional responsibilities. Each institute should be provided facilities and manpower at an internationally comparable level of excellence. The facilities of such an institute could be made available for the participating ASEAN member countries. An example of such an institution is the International Rice Research Institute in Manila which undertakes research on cropping patterns, control and management of pests, irrigation and water management, post-production technology, development of farming machinery, and so on.

Insofar that a climate of cooperation for mutual benefits has been generated by the Governments of the ASEAN member nations, the role of the private sectors especially the international firms like the Transnational Corporations (TNCs) will add new dimensions to the transfer of technology and the development of endogenous science and technology. For international firms have the capacity to accelerate these processes, as they collectively account for the greatest flow not only of technology but also of manpower and expertise from the advanced countries to the ASEAN region. Therefore the establishment of cooperative programmes between international firms and the ASEAN nations will help strengthen ASEAN capabilities in the application of technology and in response to evolving technology, as technology by its very nature is dynamic. Let me propose one or two ways in which such programmes can be initiated. These are not novel as they have been proposed from time to time even by the international firms. What is needed is constructive determination so that mutual benefits can be derived by partners whose economies are so interdependent.

A key social factor that is inextricably linked to the application and development of science and technology is the type and level of education and training. Apart from the need to improve the level of expertise for understanding, choosing, assimilating, implementing and adapting, evolving technology to individual needs, relevant managerial and entrepreneurial training are required. In this regard, the TNCs have a definitive role:

- (a) by setting up training facilities so as to enlarge the host nation's pool of trained manpower more rapidly than would otherwise be the case;

- (b) by hiring and training specified graduates from local tertiary institutions and offering them career opportunities to advance through the whole of the corporate technical organisations; and
- (c) by establishing professional links between the corporate community and local university so as to bring the reality of the market place to academic institutions. A two way system can be promoted: one way is to arrange and retain members of the science and technology faculty of local universities as consultants to firms; and the second way is to make available corporate technical personnel for university teaching and service on research advisory boards.

There is a need for affiliates of TNCs to initiate local research, development and engineering (or R, D and E) activities. For TNCs have the tradition, expertise and experience in constructively developing and strengthening their affiliates' positions in ASEAN countries to initiate R, D and E activities. By establishing strong links with tertiary institutions, international firms can play a significant role in the training of R, D and E personnel, and in helping to formulate suitable programmes relevant to the present and future market needs. Steps are being taken in a number of ASEAN countries to provide the basic infrastructure. In this regard, Indonesia is presently setting up a Science City. Singapore has launched the Singapore Science Park whose tenants will be R & D firms and institutions. The National University of Singapore located next to the Park will help generate greater interaction among researchers thereby providing the climate for innovative activities.

A number of ASEAN countries have established a scheme with Japan known as joint research for technology transfer on an institutional basis. The scheme seeks to improve and adapt technology already existing in Japan. The joint project includes research to be undertaken in both Japan and its counterpart ASEAN institute, as well as an exchange of researchers.

Joint research for technology transfer seeks to improve and adapt technology already existing in Japan for local conditions. In this case each research project also includes laboratory work locally as well as in Japan with similar researcher exchange schemes.

Table 8 is a summary of joint research projects for technology transfer currently undertaken between ASEAN institutes together with the counterpart institutes in Japan.

Table 8: Joint Research for Technology Transfer

Name of Research Project	Japanese Research Institute	ASEAN Research Institute	Country	Duration
1. Research on the establishment of metrological standards (Length and Temperature Standard)	National Research Laboratory of Metrology	National Institute of Science and Technology (NSTA)	Philippines	1982–1983
2. Research on the electric and photometric standards system (Electric Standards)	Electrotechnical Laboratory	Thailand Institute of Scientific and Technological Research	Thailand	1980–1982
3. Research on reliability of measuring instruments in the tropics (Standards Instruments)	National Research Laboratory of Metrology	Directorate of Metrology	Indonesia	1980–1983

X THE FUTURE

The success of science and technology is attributed to the success of the analytic character of the scientific methods that enable new knowledge and concepts to be produced. It is also due to the success of technology which applies this knowledge in new ways of doing things useful to society. Thus science and technology form a single composite system whose role in a country's future and well-being is indispensable.

Being the society's source of innovation and dynamism, science and technology manifest themselves as potent agents of "change". They are rejuvenating and renewable resources. Countries big and small, developed and developing, richly and poorly endowed must continue to look to science and technology as invaluable assets since scientific and technological skills are so crucial for a continuing national and regional development.

Science has no limits. Each major breakthrough generates its own stream of technological innovations. They have their origin in the advanced countries, in particular the USA, UK, France, Japan and Germany. In the free enterprise system they will continue to be in the forefront of technological innovations. Together, they account for the highest number of R & D scientists and engineers in the world. ASEAN will continue to look to them for advanced technologies and techniques. Even advanced nations like Australia, Canada and New Zealand also look to them, since they are net importers of technologies. Science and technology must therefore provide the basis for present and future ASEAN social and cultural development and economic growth.

ASEAN Plan of Action

The future plan of ASEAN cooperation in science and technology is embodied in the ASEAN Plan of Action on Science & Technology that was approved by both ASEAN COST and the ASEAN Standing Committee in 1980. The Plan of Action provides a comprehensive outlook and direction on future ASEAN programmes in science and technology. Major programme areas have been identified to strengthen scientific and technological capabilities and infra-structure of ASEAN at both national and regional levels. The programme areas cover:

- (a) Food and Agricultural Development;
- (b) Energy and Natural Resource Development;
- (c) Manufacturing, Industries, Transportation and Communications Development;
- (d) Health and Social Development; and
- (e) Science and Technology Infrastructural Development.

ASEAN Science & Technology Fund

Within the framework of the ASEAN Plan of Action, an ASEAN Trust Fund is presently being set up by ASEAN COST to provide for a continuing funding support for future regional programmes. The establishment of the Trust Fund is based on contributions from third parties. Japan has been approached to give an anchor support of US\$50 million.

ASEAN Science & Technology Week

The Science and Technology Week has been established by ASEAN COST to reappraise global development of science and technology and to give future directions to ASEAN co-operation in science and technology.

It will be held on a rotational basis among ASEAN countries every two to three years. It would focus on areas of importance to the future development of ASEAN as embodied in the ASEAN Plan of Action such as micro-processors, biotechnology, medical sciences, energy, science and technology data bank and science and technology policy. At this point of time, ASEAN needs to address itself to frontier technologies, for the world is witnessing the start of a new industrial revolution in microprocessors, and perhaps yet another revolution in biotechnology in the 1990s. But development in science and technology is undoubtedly a costly venture. If science and technology are well chosen and prudently applied, they will be a boon and a rich heritage to ASEAN's progress and development.

International Cooperation

Science and technology are international in character. International scientific and technological cooperation is therefore important as it opens up a way of achieving ASEAN's objectives more rapidly and economically. The increasing importance of science and technology to ASEAN and the growing interdependence of all nations, have combined to generate an increase of cooperation agreements in science and technology entered into by ASEAN on the one hand and its dialogue partners and third parties on the other. The agreements are directed at human resource development, applied research, and development of science and technology infrastructure.

As we look to the future, it becomes evident that advances in science and technology and their increased application call for a substantial increase in international activities. This development can be seen in many different areas — environment alleviation, ocean resources, space applications, natural resources depletion, food, scientific and technological advances, energy and so forth.

International Response

The response to ASEAN COST's programmes on science and technology has been positive, notably from Australia, Canada, the European Commission and the USA. The UN organisations like UNDP, WMO, UNESCO, UNEP and other international organisations like CIDA and IDRC have also given support. But these have been on a selective basis and on areas such as agriculture, food, environment and energy.

The response from Japan to ASEAN COST's document on science and technology can be taken as a positive and comprehensive one. The response is primarily due to strong political support given to science and technology by the ASEAN Governments and Japan. Prime Minister Nakasone in his recent visit to the ASEAN countries from 30 April to 10 May 1983, has extended a hand of cooperation to ASEAN in fields such as agricultural science, engineering, medical sciences, basic sciences, electronics, communication, information sciences, and biotechnology. Many of these topics constitute what can be called frontier technologies.

Ministerial Meetings

The meetings of ASEAN Ministers on Science and Technology, Energy and Environment are important as they give direction and support, and lay down the foundation for a continuing ASEAN cooperation in science and technology. Prime Minister Nakasone's proposal for an ASEAN-Japan ministerial conference on science and technology opens up a new outlook for future ASEAN scientific and technological cooperation. ASEAN

would need a more comprehensive approach on science and technology, especially in its relations to third parties on the one hand and to developmental, economic and science and technology policies on the other hand. That cooperation in science and technology has received participation at the highest levels of Governments augers well for greater regional cooperation and for a faster rate of development and application of science and technology in the ASEAN region.

IX CONCLUSION

In conclusion, I believe ASEAN needs a comprehensive ASEAN cooperation policy in science and technology, especially in regard to:

- (a) development of an ASEAN science & technology infrastructure;
- (b) transfer of technology not only from the advanced countries to the ASEAN countries but also within the ASEAN region; and
- (c) human resource development.

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