Chapter Three

Malaysia's Science and Technology Policy

Introduction

In the previous two chapters the discussion mainly centred on the epistemological background of S&T including the interaction between S&T and society and politics. In this chapter the discussion focuses on the S&T policy in relation to the epistemological roots of S&T. Before undertaking a more detailed discussion of specific issues in Malaysia's S&T policy, it is necessary to look into the apparent factors that has shaped this policy.

As far as the government documents on S&T policy is concerned, no official document dealing with the epistemology of S&T is available neither is there any direct reference of a particular inclination, at the official level, towards the more dominant, the positivistic view of science. However, indirect references and the chosen premises are abound in the many official pronouncements and literatures. Thus, one can clearly see that officially S&T is understood as useful tools for socio-economic development. The government's commitment to S&T, then, stems from the conception of S&T as tools for socio-economic development. This is particularly based on the notion of S&T as the major engine of economic growth.

Nevertheless, despite lack of reference to any scientific tradition, the Malaysian official literatures on the impact of S&T on society recognises moral and spiritual dimension of S&T in society. This seems to be a departure from the mainstream western view. When speaking of development through S&T the spiritual and moral development of the members of the society is given equal importance beside economic development. The emphasis on the spiritual and moral side of human being is I think tacitly accepting the notion of S&T as value laden. This can be described as a distinctive feature of S&T policy in Malaysia.

Expectedly, the official government documents do not engage in any theoretical discussion of S&T. What one can see is that the definition of S&T adopted at the official level characterises S&T as practical tools for sustainable economic growth.[123] Science policy, in Malaysia, then, focuses on using S&T as tools and capacities for socio-economic development based on the model of modern industrial economy.[124] This is reflected in the National Science and Technology Policy (NSTP) which is designed to promote the utilisation of S&T in the socio-development planning.[125]

Malaysia's Science Policy

Malaysia did not have a policy for management of S&T before the independence in 1957. It was only after independence that Malaysia started on

[123] Government of Malaysia, *The Sixth Malaysia Plan 1991-1995*, (Kuala Lumpur: National Printing Unit 1991), p.243.
[124] Government of Malaysia, *The Second Outline Perspective Plan 1991-2000*, (Kuala Lumpur, National Printing Unit), p.5. The main socio-economic planning include the National Development Plan (NDP) and Vision 2020 which were launched together with *Sixth Malaysia Plan 1991-1995*.
[125] Government of Malaysia, *The National Science and Technology Policy*, (Kuala Lumpur: SIRIM, 1986), p.1.

deliberate application of S&T in socio-economic development. Even then, the management of S&T was on the ad hoc basis. It was only in the eighties when Malaysia produced the first document on S&T policy, i.e. the National Science and Technology Policy (NSTP). The focal point of the policy is to promote scientific and technological self-reliance in support of socio-economic activities including plans to upgrade local research and development capabilities as well as improving scientific and educational infrastructure.[126] In addition, the policy also emphasises the improvement of the human physical and spiritual well being, and balanced development of natural resources and the ecology including the preservation of the environment.[127]

The evolution of the utilisation of S&T in socio-economic development after independence could be seen in relation to the structural transformation of the industrialisation process that Malaysia had undergone.

Structural Transformation of the Industrialisation and the Role of S&T

The industrialisation process that covers the period after independence, (since 1957) is a convenient starting point. During the colonial era, the British authorities did not promote industrial development in Malaysia. Any industrial plan was subsumed under the strategy to use Malaysia as major supplier of rubber and tin. This made Malaysia (then Malaya) almost wholly dependent upon rubber and tin for its export earnings by the early twentieth century.

[126] Ibid, pp.1-2.
[127] Ibid,p.1.

This gradually changed after independence. The new independent Government adopted aggressive economic activities to increase export through promotion of new products and economic activities based on palm oil, timber, and petroleum and manufactured goods. These activities transformed the Malaysian economy and industrialisation process through several stages of developmental changes. The changes, which were the result of economic strategies, like import-substitution and export-led manufacturing, resulted into rapid structural transformation of the economy and industry.[128]

Anwar Ali singles out three major phases of this industrialisation transformation.[129] 1) This includes the period from 1958 to 1968. This period starts immediately after independence when the Pioneer Industries Ordinance was introduced which laid emphasis on import-substitution industries that were mainly established to cater for the domestic market. 2) The second phase starts with the introduction of the Investment Incentive act in 1968 up to 1980. During this period, the emphasis was on export-led industrialisation through the introduction of export-related incentives and the establishment of Free Trade Zones (FTZs) in a number of locations.[130] 3) The third phase began in the 1980 which coincides with the implementation of Fourth Malaysia Plan (1981-1985), and the formulation of Industrial Master Plan in 1986. These plans were seen as important

[128] Ambrin Buad, ed., *The Malaystan Economy in Transition* , (Kuala Lumpur: National Institute of Public Administration, 1990), p.72.
[129] Anwar Ali, *Malaysia's Industrialisation: The Quest for Technology* , (Singapore: Oxford University Press, 1992),p.6.
[130] This period also saw the introduction of the Industrial Co-ordination Act of 1975 as an instrument to achieve the New Economic Policy (NEP) objectives with regard to Bumiputera equity participation and employment in the manufacturing sector. Ibid.

policy instrument to attract more direct foreign investment into the manufacturing sector.[131]

In the case of the first phase, the import-substitution policy emphasised the promotion of industrial development with foreign investment playing a major role in the process. The foreign companies coming to the country specialised generally on producing consumer products with technologies imported from their parent companies. As result, a dependent relationship between the locals and their technology suppliers were established which, in many ways restricted the capability of domestic enterprises to enhance their learning process and technology acquisition.[132]

The dependence on foreign technology continued in the second phase despite the structural shift from labour-intensive manufacturers to more capital- and technology-intensive products. Followed, in the third phase, with the establishment of heavy industries beginning with the formation of HICOM in 1981.[133] The growth of these industries, however, has not been complemented by the expansion of indigenous technological capability until today.

The lack of indigenous scientific and technological development does not mean that Malaysia has not made substantial progress in the overall field of S&T. Since independence, Malaysia has established a number S&T institutions and

[131] During this period also the first emphasis was given to the second-round import-substitution industries including heavy industries. And the critical need for technology enhancement in domestic industries was recognised. And in line with the objectives of IMP, the Action Plan for Industrial Technology Development was launched in 1990. Ibid, pp.6-7.
[132] Ibid, p.8.
[133] Mohd Saufi Haji Abdullah, "The Role of HICOM in Malaysia's Push Towards Becoming an Industrialised Nation", *Kajian Ekonomi Malaysia*, 23(1), 1986, pp.60-7.

infrastructures at all levels of government and private sectors. This brings us back to our discussion of science policy in Malaysia.

Two types of indicators are to be explored in a study of science policy in Malaysia. They are *institution building*, and *science and technology planning*.[134] The first refers to the way in which a science and technology infrastructure, and its component institutions, are designed and developed. The second considers the way in which policy objectives, resources, and activities may be woven into a coherent plan for the expansion of S&T capacity and for its proper utilisation. Each of these instrument types will have a different impact, but there is complementarity between them.

S&T Infrastructures

S&T infrastructure is a necessary requirement for a countries scientific and technological advancement. The scientifically advanced nations know well - and this is precisely the secret of their technological pre-eminence - that the social and economic benefits derived from applied research depend on the existence and efficiency of what is known as country's 'operational network' of scientific and technological research institutions. It is, however, important to note that, there is no set of criteria for identifying and generating optimal institutional designs, particularly for the scientific and technological system in developing countries. In addition, there is not a standard model of what an efficient S&T infrastructure should be. However, most expect that four different types of activities should be

[134] The STPI model is based on Science and Technology Policy Instrument (STPI) project, a large research effort that examines the design and implementation of science policy in 10 developing countries, like, Argentina, Brazil, and Colombia. Canada, "Science and Technology for Development", *Policy Instruments to build up an Infrastructure for the Generation of Technology*, Module No.5. (Canada: n.p.,1980), p.5.

complemented:[135] 1) Conducting R&D activities in the universities, government institutions (general purpose, devoted to a problem area, mission oriented), industrial research institutes, and industry-level units and laboratories. 2) Supporting activities for R&D, such as information, computing, training, surveys of natural resources, etc. 3) Services for technological needs of the productive and government sectors, such as consulting, engineering, diffusion and technical information, standards, meteorology, quality control, analyses, tests, trouble shooting, etc., as well as technical advice for policymaking, regulation of technology imports, etc. 4) Public S&T services, such as those provided by statistical offices, observatories, geographical and meteorological institutes, etc.

In the study of S&T infrastructure in Malaysia a number of specialised institutions are involved in these activities. Several of them in fact form the backbone of the country's S&T infrastructure.

At the Ministry level, there are some Ministries directly or indirectly involved in S&T development and promotion. These include the Ministry of Science, Technology and the Environment (MOSTE), the Ministry of Education (MOE) and the Ministry of Information (MOI) and Ministry of International Trade and Industry (MITI). The Ministry of education and information formulate policies and guidelines, develop and implement S&T curriculum in schools, and disseminate information to enhance S&T awareness among the populace respective.[136] MOSTE is directly involved in S&T development.

[135] Ibid, p.6.
[136] MOSTE, *Annual Report 1989*, p.1.

MOSTE was first established in 1973 as the Ministry of Technology, Research and Local Government. In 1974, the Ministry was renamed the Ministry of Technology, Research and Co-ordination of New Villages until 1976, when it became known as the Ministry of Science, Technology and the Environment (MOSTE). The Ministry is divided into; Management Division, Malaysian Science and Technology Information Centre (MASTIC), S&T Division, Malaysian Centre for Remote Sensing, Technology Park Malaysia and the National Science Centre.[137]

The strategy of the Ministry is to enhance its role and the role of its agencies by contributing towards research, industry, processing and increasing the capability of Malaysians to absorb new technologies as well as and develope indigenous technology. Its other important function is to control pollution and manage activities that would safeguard the environment through better co-ordinated national resource planning to ensure balance between development and the environment.

Some of the achievements of MOSTE include the successful implementation of several projects like the establishment of the National Science Centre, the Malaysian Centre for Remote Sensing (MACRES), Malaysian Science and Technology Information Centre (MASTIC) and the Malaysian Technology Park.[138]

Apart from establishing such institutions, MOSTE has initiated the Report on the Action Plan for Industrial Development. The Action Plan aims to

[137] Ibid,p.3.
[138] Ibid, p.3.

complement the Industrial Master Plan by establishing a framework within which Malaysia can acquire and develop technological capabilities to support its industrialisation goals.[139]

Other relevant bodies directly involved in science policy development. Such as the National Council for Scientific Research and Development (MPKSN). MASTIC and SIRIM. MPKSN established in 1975 co-ordinates and monitors scientific research activities in the government sector. Its main objective is to formulate policy for S&T, and foster R&D activities in both public and private sectors.[140]

Although MOSTE is the main and highest administrative body in the management level, however, the responsibility for formulating S&T policy is delegated to MPSKN. Apart from formulating policy for S&T, MPSKN also acts as an advisory body to a number of government institutions. These include the Cabinet Committee on Science and Technology, and the Minister of Science, Technology and the Environment. MPSKN also advises the Government and the Ministry, on the identification of priority areas for R&D. It also fosters co-ordination among the major sectors of the economy and the implementation and evaluation of S&T activities.[141]

There are also other scientific and technological institutions, apart from MPSKN, co-ordinating with the Ministry and other relevant institutions in S&T related activities. For example, the Standards and Industrial Research Institute of

[139] MOSTE, *The Action Plan for Industrial Development*, (Kuala Lumpur: MOSTE, 1990), P.4.
[140] MPKSN, *Annual Report 1990-1991*, (Kuala Lumpur: MOSTE, 1990), p.4. MPKSN in the Malay language stands for Majlis Penyelidikan kemajuan Sains Negara, in English it is National Council for Scientific Research and Development.
[141] Ibid.

Malaysia (SIRIM) which operates under the MOSTE in developing processes, products and technologies for the industry. The main objective of SIRIM to promote standardisation and quality and to provide technical services, assistance and consultancy to industry.[142]

SIRIM has established the various technology development centres such as; centre for appropriate technology, centre for instrumentation and chemical technology and biotechnology, metals, plastics, ceramics, advance manufacturing, and product design,.[143] Through these centres, SIRIM provides technical services for the industry, including testing, technical information, and patent examination services.

SIRIM is also involved in Technology Diffusion Programme. The programme is designed to create and develop local industries with enhanced manufacturing capabilities by providing services in areas of mechanisation and automation, productivity, product quality and production technology.[144]

The Malaysian Science and Technology Information Centre (MASTIC), established in 1992, is a division under the Ministry of Science, Technology and the Environment. MASTIC provides information for formulating S&T policy and strategy, and plays a supporting role in the formulation of S&T policy.

As an information resource centre, MASTIC specialises in providing S&T management information, including R&D statistics and S&T indicators. This also includes as an information channel for all S&T related activities in the country. Its

[142] SIRIM, *SIRIM: a friend and partner of industry*, (Kuala Lumpur: SIRIM, n.d.), pp.3-4.
[143] Ibid, pp.7-14.
[144] Ibid, pp.15-21.

services range from providing S&T information for the planning of S&T education, and to provide access on R&D information between public and private sectors. In addition, MASTIC offers specialised information and analytical services to the industry status.[145]

MASTIC is divided into four functional groups. (1) Information Services. (2) Indicators and Forecasting, and (3) Library and Publications.[146] In order to efficiently co-ordinate the activities of these functional groups and disseminate the information collected effectively MASTIC has formulated an operational strategy based on the Information Collection Policy, which conducts wide coverage of S&T management information. It does that by dividing the institution into three divisions, they are; (1) *S&T information for policy development and Management,* (2) *S&T information in support of the national science infrastructure, and* (3) *S&T information for industry and commerce.*[147]

The first division, the S&T information for policy development and management services, provides factual information on the structure and organisation of S&T in Malaysia. The information includes research performers, research councils, the government initiatives and the strengths of technology development.[148] The information comes in the forms of data-sets, and quantitative indicators. The latter include indicators of innovation and level of technological development.

It is important here to point out that MASTIC also gather information on

[145] MOSTE, *MOSTE Annual Report 1995*, (Kuala Lumpur: MOSTE, 1996), p.22.
[146] MASTIC, *Malaysian Scientific and Technological Information Centre*, (Kuala Lumpur: MASTIC), n.d., p.7.
[147] Ibid, pp.8-9
[148] Ibid, p.8.

economic, industrial and social issues, affective the course of S&T policy development. These include economic and statistics indicators, industry policy and incentives, industry trends and forecasts, innovation and competition theory, and International comparisons of social and economic development.[149]

In addition to factual and quantitative information, MASTIC also distributes information on the methodologies involved in the development, collection and analysis of quantitative indicators. The methodologies here refers to the methods of International comparisons of R&D and S&T, including differences in national priorities for R&D, level of and trends in R&D expenditure, and definition and classifications of R&D.[150]

The second division, the S&T information in support of the national sciences infrastructure division is in charge of assisting the researchers and technology developers in Malaysia. It provides detailed information on the capacity and skills of S&T in Malaysia. It also provides information on activites and current projects such as, scientific capacity of research institutions, scientific capacity of companies and groups, and forecasts of the need for scientists, engineers, and other skilled staff in particular industries.[151]

Finally, the third division, S&T information for industry & commerce, uses the information, collected by the other two divisions, and gives them to companies and commercial industries. However, dissemination of the information is based on the specific needs of the companies and commercial enterprises.[152] This includes specific forms of information like information on specific

[149] Ibid.
[150] Ibid.

technologies, information on government incentives for R&D and information on priorities under IRPA.[153]

MASTIC recently has introduced a new project: Technology Mapping.[154] This is a systematic collection of information on the S&T situation in the country. Unlike the existing system, which can only provide the data on the past, and to some extent on the present situation. Technology Mapping gievs information on the future directions of S&T. However, this proposal is still in its initial stages, as of now, and the detailed guidelines and methodologies are yet to be developed.

So far we have discussed the major roles agencies in S&T planning and development. We also discussed in some detail the information bases of S&T as seen in the role of MASTIC in S&T development and planning. In the following discussion I would like to illustrate on one more important issue directly related to science policy; i.e. technology transfer.

Technology Transfer in Malaysia

Technology transfer involves the transmission of the complex of knowledge, materials, and methods pertinent to all activities associated with the production and use or operation of the techniques or technical systems in question.[155] Technology transfer also includes transfer of knowledge, like feasibility studies, machinery installation, selecting and setting industrial

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[151] Ibid, p.9.
[152] Ibid.
[153] Ibid. example of these are the, the survey, on the 'Science and Technology Awareness Among Secondary School Students', ' A Study on the level of Awareness, Perception and Acceptance of Science and Technology Among Malaysians', and the 1992 and 1994 'National Survey of Research and development'.
[154] *The Seventh Malaysia Plan 1996-2000*, p. 321.
[155] Tom Ganiatsos, "Transfer of technology: Theory and Policy," Krishna Ahooja-Petal, Anne Goedon Drabeck, and Marc Nerfin, eds., *World Economy in Transition*, (New York: Pergamon Press, 1986),p.237.

processes, operation of production facilities, maintenance, training of personnel, and marketing.[156] In addition, transfer of technology also involves the domestic capacity to alter, modify, and adapt in a thousand different ways.[157]

In Malaysia, the transfer of technology takes place in the forms of information exchange, purchase and licensing arrangement. Supplemented by efforts to procedure technology by various means, such as training and joint venture agreements with foreign companies.[158] Very often, technology transfer takes place in the form of a package with foreign technical expertise and capital equipment, hence leading to hidden costs and making it more difficult to evaluate the price of the technological component. The lack of technical, and other expertise required for technology assessment and for the acquisition of information about the technology, means some form of technology transfer may have the undesirable effect of retarding indigenous technological development. The problem often encountered is that expatriates often

[156] Ibid.

[157] Nathan Rosenberg, *Inside the Black Box: Technology and Economics* , (New York: Cambridge, 1082),p.275. In this context Rosenberg quotes the experience of the Japanese who emphasised indigenous capabilities from the outset. He argues that the lesson of their success 'seems to have been a government strategy for introducing foreign technologies in ways that emphasised their local linkages and the emergence of an indigenous technological capacity.' Ibid, p.275

[158] *The National Science and Technology Policy* , 1986, p.10.

carry out the tasks, which could be performed by locals.

One of the most significant conduits of technology transfer is the usage of capital equipment of the developed countries. In this respect, manufacturing firms in Malaysia are deliberately encouraged to use modern and new equipment.[159] This aspect of technology transfer, as Anwar Ali argues, has lead to technological dependence, given the industrial structure of the Malaysian economy. Because importing capital equipment from developed countries limits the technological choices of the country, by the technical specifications of imported equipment. And the possibility of opting for relatively more labour-intensive techniques is therefore reduced as most of these equipment are relatively labour-saving.[160]

Moreover, the existing, technological dependence results from heavy import of technology from the developed countries. In view of this dependence, it is argued, Malaysia is much more likely to get its technology in poor terms.[161] As the heavy costs of importing technology, which includes foreign exchange costs and indirect costs such as restrictions on sources of input and access to export outlets, are in large part due to its situation of technological dependence. The latter is primarily responsible for the very weak bargaining position of developing countries like Malaysia vis-à-vis technology suppliers, and consequently the poor terms exacted.[162]

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[159] Government of Malaysia, *Investment in Malaysia: Policies and Procedures*, 2nd eds., (Kuala Lumpur: Federal Industrial Development Authority , 1971), pp.25-26.
[160] Anwar Ali, "The Transfer Of Technology And Its Impact On The Development Process In Malaysia", p.169.
[161] Ibid,p.170.
[162] Ibid.

There are several reasons for the poor state of technology transfer in Malaysia, but the most important of them belong to the role of government and the private sectors. In the industrialised countries, like the US and Japan, technology development is usually generated by the private sector, while the state is more concerned with projects which involve large capital outlays and long gestation periods or which possess numerous economic externalities. For example, most of the basic research in the areas of defence, atomic power, outer space, oceans, the environment, and national health come under the purview of the state.[163]

In Malaysia, the situation tends to be the reverse. Unlike the industrialised countries, the private sector plays the minimum role in technology development and technology acquisition. The state, then, in Malaysia is the sole contributor to the technological development. The impact of this on technology transfer is that, the government on its own is unable to provide enough funds for purchasing technologies to cater also for the private sectors. In addition, as will be discussed in the chapter on R&D, the private sector's participation in R&D activities are minimum which has created slow progress towards indigenous technology development and has increased technology import from abroad.[164]

The Role of the Government

Government intervention concerning technology management takes two different forms:[165] (1) *R&D financing* (2) *Steering technological development*. By financing R&D conducted by firms, the government helps firms reinforce their

[163] UNESCO, *Science and Technology Policy Outlook*, (Paris: UNESCO, 1985), pp.56-8.
[164] Anwar Ali, pp.99-100.

technological potential. In addition, by conducting part of the R&D in government research centres, it develops technologies that firms can latter use. *Steering technological development.* Through government contracts, the state provides a market for the technologies developed, and by favouring certain suppliers, it guides the technological specialisation of firms. [166]

The role of the government if based on the notion that government has a role in factor creation and government policies can influence the improvement of factors such as human resources, scientific knowledge, economic information and infrastructure. This in turn is believed to strengthen the national S&T enterprise. The government moreover, justifies its role by arguing that it is more concerned about the social impact of S&T then the profit-driven private sector.[167]

An important point to include in this discussion is that, the role of the government is evolving and changing based on the scientific and technological trends of the time. For example, The Fifth Plan proposed centralised planning system. This was based on the view that it will co-ordinated and achieve higher productivity in R&D. Towards this end, a comprehensive review of the science policy organisation as well as the legal and institutional arrangements in S&T was undertaken. The MPKNS as the major science policy agency, will be strengthened

[165] Pierre Dussauge, Sturt Hart and Bernard Ramanantsoa, *Strategic Technology Management*, (Paris: McGraw-Hill, 1987), p.122.
[166] Ibid
[167] Omar Abdul Rahman, "Achieving the Industrial Targets of Vision 2020 - The Science and Technology Perspective", unpublished, Paper presented at the Conference 'Towards a Developed and industrial Society: Understanding the Concepts, Implications and Challenges of Vision 2020', Kuala Lumpur, 1987, p.15.

to provide effective intersectional jurisdiction in planning and management, while an independent mechanism will be provided for evaluation and assessment."[168]

This type of planning, particularly centralised planning in Malaysia could be justified given the lack of participation by the private sector in industrial technology development. There is extensive reliance by the private sector on foreign sources of technology. Domestic adaptations and modifications of imported technologies in the form of new and improved products and processes are not substantial either.[169]

Despite the absence of the private sector, the government is promoting its relationship with the private sector as that of co-operation and co-ordination. This relation is defined 'as a system of co-operation between the government and the private sector towards the creation of Malaysian Company to achieve progress and where the profits accruing will be shared by all. The government is a shareholder in this company, and if the company progress and makes profit, a portion will accrue to the government and subsequently to the people as a whole.

This is in the concept of 'Malaysia Incorporated' which is a system of co-operation between the Government and the private sector towards the creation of Malaysian Company to achieve progress and where the profits accruing will be shared by all. The government is a shareholder in this company, and if the

[168] Ibid, p.16.
[169] *The Sixth Malaysia Plan*, p.192. This situation is the result of earlier import-substitution and export-led industrialisation policies were dependent on direct foreign investment, and thus technologies and technical expertise were imported. Since it responds to market signals and its planning horizon is relatively short, the private sector, in fulfilling its corporate interests, does not have the incentive to undertake projects in industrial technology development whose returns may not be immediate. The market, therefore, fails to work as an adequate mechanism for allocating resources to technology development or R&D activities because decision-making at the firm level is based principally on the profit motive. Anwar Ali, p.102.

company progresses and makes profit, a portion will accrue to the government and subsequently to the people as a whole.[170]

The relationship between the public and the private sector envisaged, then, represents an ethos within a society, which transcends the dichotomies, distinguishing the domains of the public and private sectors. In its ideal state, the polarities between the public and the private sectors should not exist. There is synergy between these two sectors, which not only reinforces their respective roles but is also mutually supportive.[171]

Conclusion

Despite being a late comer in industrialisation and scientific and technological development, Malaysia has made some achievements. However there remain some important issues that need to be addressed which are crucial to the long term S&T policy

In the management of S&T, in Malaysia, technology receives much of the attention. In Malaysia's industrial development vision, technology is a strategic commodity. It is the engine of growth. Although, S&T both have been recognised as vital for the country's socio-economic advancement,[172] in reality and in practice technology gets most of the attention. This is clear from the priority

accorded to economic growth and applied research.

[170] Abdullah Abdul Rahman, "The Malaysian Incorporated Concept: A Key Strategy in Achieving Vision 2020", Presented at the Conference 'Towards a Developed and industrial Society: Understanding the Concepts, Implications and Challenges of Vision 2020', Genting Highlands, 5-7 December, 1991, p.2.
[171] Ibid, p.2.
[172] *The Fifth Malaysia Plan 1986-1990*, p.187.

For instance, under the Intensification of Research in Priority Areas (IRPA), applied research (manufacturing-oriented research) receives most of the fund of S&T development. The level of manufacturing-oriented research supported under IRPA is one-third higher than otherwise indicated under the present five sector classification system. Research oriented towards *new and emerging technologies* accounts for 11% of total IRPA grant allocations, and of this amount two-thirds was allocated to biotechnology-related areas.[173]

In the long term, this situation is a cause for concern. Because, pure science, which is given lower priority, is essential for indigenous scientific and technological development. The investment in pure science is actually the way to increase the stock of scientific knowledge vital for technological development which will remove the existing dependency on foreign imported technologies and scientific knowledge.

[173] MPSKN, *Annual Report 1993*, p.19. More on IRPA and the five sectors classification will be discussed in the chapter on R&D.