CHAPTER IV

SCIENTIFIC & TECHNOLOGICAL DIMENSION

Science & technology have played a pivotal role in shaping the course of human development as well as world history. The Industrial Revolution had accentuated this trend and contributed in no small measure to the creation, growth, and consolidation of colonial empires. "The Industrial Revolution led to a huge increase in global inequality. In 1800, per capita incomes in rich countries were about four times those in poor countries; now they are about 30 times larger."¹ The imperial powers were able to exercise enormous power over colonized subjects precisely because of their exclusive dominance in modern science & technology. Europeans, by the beginning of the modern era, laid claim to superiority over others on the basis of their exclusive dominance in science & technology. They proclaimed, "science and especially technology as the most objective and unassailable measure of their own civilization's past achievement and present worth. In science & technology, their superiority was readily demonstrable, and their advantages over other peoples grew at an ever increasing pace."² Even the contemporary international system continues to exhibit most of these features. The 'digital divide' is only the latest manifestation of the general division that exists between technological haves and have-nots in the world.

It is in this context that this chapter seeks to examine the nature of emerging scientific and technological cooperation between India and the ASEAN members. It will discuss imperatives for, obstacles to, and prospects for further cooperation to face the growing technological challenges effectively. It will also describe the various joint projects currently in operation. It argues that any unilateral effort to tackle technological challenges will prove to be inadequate and hence it is in the enlightened self-interest of India and the ASEAN members to collaborate by pooling their scarce resources rather than to go it alone. It concludes that cooperation in science & technology is a relatively smooth building block for more elaborate forms of cooperation in other sectors.

The modern global economy is a technology-driven one. Technology is of vital importance in creating the economies of scale that are necessary to sustain high economic growth rates. "Today the bases of national strength, wealth and prestige reside less in territory than in science & technology. Wealth comes more from brainpower than from land."³

The developing countries are encountering serious challenges on many fronts in their attempts to make rapid socio-economic progress to improve the living standards of their citizens. The most critical challenge in front of the developing world, according to Mohanned H.A. Hassan, is:

how to bridge the huge gap between the North and the South in the production and utilization of scientific and technological knowledge... What is more disturbing is that the North-South divide in scientific output and technological innovations is constantly widening. On the one hand, the North, with its huge investments in research and

development (R&D), is rapidly advancing the frontier of scientific knowledge. On the other hand, developing countries are spending small proportions of their gross domestic product (GDP)—often less than 1 percent—on R&D... This makes it very difficult for the South to develop their capacity to catch-up.\footnote{Mohamed H.A. Hassan, is the executive director of the Third World Academy of Sciences (TWAS) and also the secretary general of the Third World Network of Scientific Organizations (TWNSO). Mohamed H.A. Hassan, "Challenges, Opportunities and Strategies for South-South Co-operation in Science and Technology in the 21st Century", Paper presented to the High-level Forum on South-South Co-operation in Science and Technology, Seoul, 14-17 February 2000, http://wmy2000.math.jussieu.fr/9_2000_Feb­_KOREA.htm}

The technologically advanced nations obviously occupy the commanding heights of the global economy. They have been maintaining their technological superiority by determining the agenda of the various technological control regimes and patent regimes. They are not keen to transfer technology especially in frontier areas of technology such as information technology and space technology. They regularly deny sophisticated technological products such as super-computers and cryogenic engines to developing countries under the cloak of control of so-called 'dual use' technologies. They have been attempting to thwart not only the transfer of technology but also the indigenous efforts of developing countries to develop high technologies. A case in point was the concerted pressure brought on Russia by USA in 1994 to cancel its contract for supplying cryogenic engines to India. "The deletion of the clauses relating to technology transfer and training in the renegotiated agreement with Russia (were) necessitated by the U. S. efforts to scuttle the earlier contract."\footnote{"The Cryogenic Engine," (editorial), The Hindu, 9 December 1999. Also see, "The Cryogenic Quest," Frontline, 11 May 2001, pp. 14-16.} India, however, has subsequently managed to fabricate cryogenic engine through
indigenous efforts. But we should remember that India’s Geo-stationary Satellite Launch Vehicle (GSLV) programme was delayed by about four years owing to this disturbing episode. It is, thus, evident that developing countries such as India and the ASEAN members are beset with serious technological challenges to their progress.

**Technology: Source of Development and ...Disparity**

The “technology networks are transforming the traditional map of development, expanding people’s horizons, and creating the potential to realise in a decade progress that required generations in the past,” thus declares the Human Development Report 2001 prepared by the United Nations Development Programme (UNDP) in celebrating the new partnership between technology and development. It emphasised the need to harness new growth areas like information and communication technologies and biotechnology for achieving rapid socio-economic development of developing countries. According to the Report, “digital, genetic, and molecular breakthroughs are pushing forward the frontiers of how people can use technology to eradicate poverty. These breakthroughs are creating new possibilities for improving health and nutrition, expanding knowledge, stimulating economic growth and empowering people to participate in their communities."

Technology may not be a panacea for all the ills afflicting the developing world. But the developing countries can ignore the advancements

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7 Ibid, p. 27.
in the technological field at their own peril. Mark M. Brown, the administrator of the UNDP, cautions:

if the development community turns its back on the explosion of technological innovation in food, medicine and information, it risks marginalizing itself and denying developing countries opportunities that, if harnessed effectively, could transform the lives of poor people and offer breakthrough development opportunities to poor countries.  

Technology has no longer remained the preserve of a few affluent individuals. The tremendous potential of technology as an instrument for empowering the underprivileged groups has been realised by policy-makers across the world. Brown highlights the necessity of ensuring that ‘technology is used to empower people, allowing them to harness technology to expand the choices in their daily lives’.

The huge technological inequalities that exist between the advanced and developing countries are graphically described in the report. They are clearly reflected in their respective expenditures on R&D and share of patents. For instance, in 1998 the 29 member countries of the Organisation for Economic Cooperation and Development (OECD) spent more than $500 billion on R&D, which is more than the combined economic output of the 30 poorest countries of the world. The OECD countries, with less than one fifth of the world’s population, also accounted for more than 90% of the 347,000 new patents issued in 1998.

The Report, for the first time, introduces the technology achievement index (TAI) to measure ‘how well a country is creating and diffusing

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8 Ibid, p. iii.
9 Ibid, p. 3.
technology and building a human skill base—reflecting capacity to participate in the technological innovations of the network age.’ The TAI measures only technological achievements and takes into account neither potential nor effort nor inputs. The Report, which prepared the TAI estimates of 72 countries, categorises them as leaders (TAI rank 1-18), potential leaders (19-37), dynamic adopters (38-63), and marginalised (64-72). The Report categorises Singapore as leader, Malaysia as a potential leader, and India, Indonesia, the Philippines, and Thailand as dynamic adopters. Bangalore, Kuala Lumpur, and Singapore figured among the forty-six locations identified as global hubs of technological innovation.

Table 4.1 shows the TAI ranks of selected countries along with their respective ranks in the human development index (HDI) on account of a high level of correlation between TAI and HDI. The world, as Table 4.1 shows, is characterised by steep disparities between the technologically advanced North as represented by the members of the Organisation for Economic Cooperation and Development (OECD) and the developing South including members of the Group of 15 (G-15), the Association of Southeast Asian Nations (ASEAN), and the South Asian Association for Regional Cooperation (SAARC) among others. We can observe from the table 4.1 the relative position of India and ASEAN countries in the global technological order.
<table>
<thead>
<tr>
<th>Country</th>
<th>TAI Rank</th>
<th>HDI Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Finland</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>USA</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Japan</td>
<td>4</td>
<td>9</td>
</tr>
<tr>
<td>South Korea</td>
<td>5</td>
<td>27</td>
</tr>
<tr>
<td>UK</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>Canada</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Australia</td>
<td>9</td>
<td>2</td>
</tr>
<tr>
<td>Singapore</td>
<td>10</td>
<td>26</td>
</tr>
<tr>
<td>Germany</td>
<td>11</td>
<td>17</td>
</tr>
<tr>
<td>New Zealand</td>
<td>15</td>
<td>19</td>
</tr>
<tr>
<td>France</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Israel</td>
<td>18</td>
<td>22</td>
</tr>
<tr>
<td>Italy</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>Malaysia</td>
<td>30</td>
<td>56</td>
</tr>
<tr>
<td>Mexico</td>
<td>32</td>
<td>51</td>
</tr>
<tr>
<td>Argentina</td>
<td>34</td>
<td>34</td>
</tr>
<tr>
<td>Chile</td>
<td>37</td>
<td>39</td>
</tr>
<tr>
<td>Thailand</td>
<td>40</td>
<td>66</td>
</tr>
<tr>
<td>Brazil</td>
<td>43</td>
<td>69</td>
</tr>
<tr>
<td>Philippines</td>
<td>44</td>
<td>70</td>
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<tr>
<td>China</td>
<td>45</td>
<td>87</td>
</tr>
<tr>
<td>Colombia</td>
<td>47</td>
<td>62</td>
</tr>
<tr>
<td>Peru</td>
<td>48</td>
<td>73</td>
</tr>
<tr>
<td>Jamaica</td>
<td>49</td>
<td>78</td>
</tr>
<tr>
<td>Iran</td>
<td>50</td>
<td>90</td>
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<tr>
<td>Egypt</td>
<td>57</td>
<td>105</td>
</tr>
<tr>
<td>Algeria</td>
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<td>100</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>59</td>
<td>117</td>
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<tr>
<td>Indonesia</td>
<td>60</td>
<td>102</td>
</tr>
<tr>
<td>Sri Lanka</td>
<td>62</td>
<td>81</td>
</tr>
<tr>
<td>India</td>
<td>63</td>
<td>115</td>
</tr>
<tr>
<td>Pakistan</td>
<td>65</td>
<td>127</td>
</tr>
<tr>
<td>Senegal</td>
<td>66</td>
<td>145</td>
</tr>
<tr>
<td>Kenya</td>
<td>68</td>
<td>123</td>
</tr>
<tr>
<td>Nepal</td>
<td>69</td>
<td>129</td>
</tr>
</tbody>
</table>

Imperatives for Cooperation

Why is it essential for India and the ASEAN members to collaborate in the field of science and technology? As table 4.1 shows, steep technological disparities exist between them and the advanced countries. It is axiomatic that India and the ASEAN members should initiate steps to bridge the growing technological gap and attempt to catch up with the advanced nations. But are they in a position to accomplish this mammoth task unilaterally? Given the scarcity of financial and human resources at their command, it would not be feasible. Hence both ought to recognise the necessity of pooling their inadequate resources for mutual gain and optimal utilisation.

With the emergence of technology as the chief instrument of control of the North over the South, India and the ASEAN members cannot afford to remain hopeful about the transfer of required technology from the North. Both of them were offered technological assistance on favourable terms during the Cold War era from the opposing blocs owing to the prevalence of the ideological compulsions. The end of Cold War has also led to the end of flow of technology on preferential terms of trade. Nowadays the technological powers do not see any reason to continue their favourable treatment and hence the transfer of technology would not be forthcoming easily. Indeed they jealously safeguard their superior technologies and do not normally offer them even for a price. Any offer of technology by them duly comes with strings attached and at an astronomical price.
The effects of the TRIPS Agreement on the transfer of technology are not found to be beneficial much to the chagrin of the developing nations. Since the adoption of the Agreement, the technological gap between the North and the South has continued to widen. "Fears that the enhanced protection given to IPRs will not effectively promote the development process, but limit instead the access to technology, have been voiced by many developing countries."\(^{10}\) Elaborating their concerns, Carlos Correa says: "Several developing countries have questioned ... the continuous use of unilateral pressures and the lack of actual implementation of article 66.2 (incentives for the transfer of technology to Least Developed Countries- LDCs) and of article 67 (technical assistance to developing countries)."

Latecomers, in the context of technology upgradation and adoption, seem to have an inherent advantage. They are, for example, bypassing the older wire-based systems and leapfrogging to the new technology of wireless (digital) telecommunication systems. This is all the more the reason why the new technologies are being jealously guarded by the advanced nations. They can maintain their lead only by denying access to the new technologies.

Most of the technologies are generated to cater to the demands of the market forces. The needs of poor people, who have little purchasing power, are not taken into consideration. "Research and development, personnel and finance are concentrated in rich countries, led by global corporations and following the global market demand dominated by high-income consumers."\(^{11}\)

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\(^{10}\) Carlos Correa, *Review of the TRIPS Agreement: Fostering the Transfer of Technology to Developing Countries*, www.twnside.org.sg/title/foster.htm

\(^{11}\) UNDP, n. 6, p. 3.
In the advanced countries more than 60% of research and development is now carried out by the private sector, with a correspondingly smaller role for public sector research. As a result research neglects opportunities to develop technology for poor people. For instance, of the $70 billion global expenditure on health research in 1998, only $300 million was allocated to develop vaccines for HIV/AIDS and about $100 million to malaria research. Of 1,223 new drugs marketed worldwide between 1975 and 1996, only 13 were developed to treat tropical diseases that occur in developing countries — and only 4 were the direct result of pharmaceutical industry research. The picture is much the same for research on agriculture and energy.

Furthermore, the technologies obtained from the North are not always found to be suitable in the South, as they neither meet the local requirements nor the local conditions. The “technologies designed for the wants and needs of consumers and producers in Europe, Japan or the United States will not necessarily address the needs, conditions and institutional constraints facing consumers and producers in developing countries.”\textsuperscript{12} Indeed, the inappropriateness of the technology is rooted in their differential factor endowments.\textsuperscript{13} On the one hand, most of the developing countries have scarce capital and skills but abundant cheap labour. On the other hand, the advanced countries with the opposite factor endowments have been coming out with technological products and services that are meant for reduction of labour. The technologies of the advanced countries, apart from being

\textsuperscript{12} bid, p. 95.

\textsuperscript{13} alc\textsuperscript{olm} Gillis et al, \textit{Economics of Development}, 4\textsuperscript{th} edn (New York: W. W. Norton & Co., 1996), p. 244.
excessively capital intensive, are designed to be efficient at a higher scale of production than the required or feasible scale in the developing world. Consequently the developing countries have to contend with the transfer of inappropriate as well as uneconomical technology. Moreover, the borrowed technology sometimes remains under-utilised by developing countries owing to dearth of well-trained personnel. So mostly they are forced to be dependent on the expensive foreign technical experts.

The global map of technological achievement in the Human Development Report 2001 shows huge inequalities between countries — not just in terms of innovation and access, but also in the education and skills required to use technology effectively. A large number of professional researchers and trained technicians are required by the developing countries for adapting new technologies for local use. A shortage of skilled personnel can be a serious impediment to a country’s ability to take advantage of latest technologies that can be imported from abroad.\textsuperscript{14} It is, thus, essential for India and the ASEAN members to create and develop indigenous technological capabilities and human skills.

The global technological divide is almost coterminous with the temperate-tropical divide of ecology. Most of the technologies that are beneficial in agriculture, health, and energy vary enormously in temperate and tropical climatic zones owing to the prevalence of different kinds of diseases, pests, soils, and energy resources.\textsuperscript{15} The Harvard University economist, Jeffrey Sachs, asserts that as poor countries are mostly located in

\textsuperscript{14} UNDP, n. 6, p. 4.
\textsuperscript{15} Ibid. p. 95.
ecological zones different from those in the North, they encounter different health and agricultural problems and that those differences account for their continuing poverty. 16

He put forward interesting explanations about how the interaction of physical ecology, social dynamics, and technology trajectories has created the North-South divide that coincides with the temperate-tropical ecological divide. Firstly, technologies that are useful to promote human development, principally in health, agriculture, and energy are ecologically specific as they are determined by soils, pests, diseases, and energy endowments. So they cannot be simply transplanted from one zone to another through tinkering. Secondly, by 1820 the temperate zone technologies attained a higher level of productivity than the tropical zone technologies in these vital areas. Moreover, they were economically integrated in an international market of innovation. But their diffusion was restricted to the temperate zone with little crossover into the tropical zone. Thirdly, technological innovation offers growing returns to scale. As richer populations are concentrated in temperate zone, market demand along with increasing returns has enormously enlarged the gap between temperate and tropical zones in the past two centuries. He exhorts nations to find new ways to harness technology to deal with the challenges of tropical health, agriculture, energy, and environmental management.

"The challenge for South-South cooperation, hence, is how to mobilise the best science in the South and elsewhere and direct it towards

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16 Ibid. p. 96.
development problems in the developing world.\footnote{17} Owing to commonality of certain local needs such as preserving traditional knowledge systems and curing of tropical diseases, India and the ASEAN members should jointly create technologies that would suit them and other developing countries with similar needs in a better manner.

Technology provides the best arena for launching a long-term partnership. The linkages established in this field would have mutually beneficial spill over effects in other issue-areas like trade, cooperation in the international forums such as WTO and contribute to overall good will in the relationship. Moreover cooperation in the technological field is not just one-off event, but presents numerous opportunities for continuous interaction to meet the demands of technological up gradation.

The scientists are among the most influential policy-makers in every nation. They command the respect because of their role in the national development and enjoy close rapport with the top leadership. So any international partnership can gain greater depth only by giving them greater role in setting the cooperative agenda.

India and the ASEAN members, being part of the developing world, are faced with a similar set of technological problems. Unilateral attempts on the part of any country to face the growing technological challenges are likely to meet with failure owing to lack of sufficient financial and human resources. So the need of the hour is to launch multilateral and bilateral efforts on a priority basis to tackle challenges.

\footnote{17} Cited in Hassan, n. 4
India, under the visionary leadership of its first Prime Minister Jawaharlal Nehru, has acquired immense expertise in various fields of science & technology with its world-class laboratories and well-trained scientific personnel. Though one-third of its population is still mired in poverty and illiteracy, India is at the cutting edge of the fields such as information technology, space technology, biotechnology, nuclear and missile technology and so on.

India and the ASEAN members, thus, having recognised the imperatives of cooperation, launched initiatives on the bilateral as well as multilateral fronts in the recent period. Many ASEAN members have regularly sought Indian technological expertise as they find it more appropriate and cost-effective. The Malaysian Prime Minister, Dr. Mahathir Mohamad, for instance, addressing the Twelfth Meeting of ASEAN Economic Ministers held in 1982 stated that “in view of the developmental stage of most ASEAN economies where middle-level technology especially, from countries like South Korea and India are of relevance to our present economic programmes.”

India has recognised the ASEAN members as important players on the Asian technological scene. Inaugurating the International Conference on Asia's Technology Future: Transforming Business, the Prime Minister of India, Atal Bihari Vajpayee, mentioned:

> Japan was the first to rupture the citadel of the West’s dominance in the domain of technology, with brilliant inventions ranging from consumer electronics to heavy engineering --- in short, from chip to ship. Asia's technology trail pioneered by Japan has, in subsequent

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years, been blazed by many other countries. South Korea, Taiwan, Malaysia, and in recent years, China have become powerhouses of chip design and fabrication and a wide range of computer and telecom hardware products.\textsuperscript{19}

India and the ASEAN members, thus, recognizing the worth of science & technology for rapid socio-economic development, have entered into agreements in various fields. Cooperation between India and the ASEAN members in science & technology is now operational at two levels-- bilateral and multilateral.

**Multilateral Programmes**

Science & technology has been identified as one of the sectors of partnership during the meeting of ASEAN and Indian Senior Officials on the establishment of Sectoral Dialogue Partnership in March 1993. India suggested that each side offer six post doctoral fellowships for up to six months in the areas of science and technology and the holding of joint workshops to identify themes of common interest for joint projects in the areas of advanced materials, biotechnology, and information technology. Even during the first meeting at the official level between ASEAN and India held in Kuala Lumpur in May 1980, science & technology was highlighted as an area of cooperation.

The first meeting of ASEAN COST-India collaboration in science & technology was held in February 1995. Consequent upon decision of the first meeting of ASEAN-India Joint Cooperation Committee held in November 1996, the ASEAN-India Working Group on Science & Technology (AIWGST)

was established. The TIFAC\textsuperscript{20} on behalf of the Department of Science and Technology and the ASEAN COST (Committee on Science & Technology) are designated as the focal points for all science & technology cooperative activities at the multilateral level. The first and the second meetings of AIWGST were held in Kuala Lumpur in November 1997 and the Singapore in October 1999 respectively. India has also participated in the triennial ASEAN Science & Technology Weeks held in Bangkok in 1995, Hanoi in 1998, and Brunei in 2001. India as a Dialogue Partner provided partial assistance to organize these events. The cooperative activities in science & technology between India and the ASEAN as a group are being funded by the ASEAN-India Fund established in January 1994 to which India has so far contributed more than US $ one million.\textsuperscript{21} Joint workshops are regularly held in India and the ASEAN members to bring together their scientists to identify specific areas of mutual interest. India and a few ASEAN members, after exploratory visits by their scientists to each other's scientific establishments, have started joint research and development projects in the mutually identified areas of advanced materials, information technology, and biotechnology. The progress in each of these fields is reviewed below.

\textbf{A) Advanced Materials}

The Defence Metallurgical Research Centre (DMRC) organised a joint workshop on Advanced Materials in Hyderabad in December 1995 and two joint projects were initiated in this field. One is on the development of raw

\textsuperscript{20} TIFAC (Technology Information, Forecasting, and Assessment Council) brought out India's Technology Vision 2020 document in 1996.

\textsuperscript{21} Personal communication from the ASEAN Secretariat, Jakarta, February 2001.
materials and Neodymium-Iron-Boron (Nd-Fe-B) magnets and application engineering. The other is about the wear resistant and thermal barrier and coatings for automotive and other applications in the field of surface engineering. A joint workshop on Nd-Fe-B Magnets and Rare Earth Materials-Advancements, Achievements and Market Growth was held at Subang Jaya, Malaysia in August 2000.

**B) Information Technology**

A joint workshop on Multimedia for Education was held in Chiang Mai, Thailand in May 1996. As part of the ASEAN-India Digital Archive (AIDA) project, a multi-lingual and multi-cultural digital archive was developed through joint efforts of research institutions and universities of India and the ASEAN members.\(^\text{22}\) The Education and Research Network (ERNET), National Centre for Software Technology (Mumbai), Indian Institute of Science (Bangalore), and the five Indian Institutes of Technology collaborated in this venture from the Indian side. It contains text, voice, pictures, and video clippings of common words, phrases and events under categories like customs, food, national flags, and numbers etc. in all the languages of the ASEAN members and in Hindi. Teachers, to make students familiar with the socio-cultural diversity of the region, can use it as an educational kit. The archive is also useful to traders and tourists. The Phase 1 of the project was completed in October 1999 and the Phase 2 is to be started soon.

India offered to establish a hi-tech, state-of-the-art Informatics Training Centre in the ASEAN region. The NIIT, which is already active in

many ASEAN countries, made a presentation on the project to be established in an ASEAN country on a commercially self-sustaining basis. The Government of India will meet some initial establishment costs and provide scholarships to hundred ASEAN students every year for training in this institution. India has also offered further 100 training slots to the ASEAN candidates under the India-ASEAN Human Resource Development Training Courses programme for which training would be provided in 17 courses in 6 designated institutions in India. The NIIT courses were conducted in June-July 2000 to impart IT skills to 100 students from the ASEAN members. The scope for cooperation in this field is vast especially in terms of providing IT training.

C) Biotechnology

A joint workshop on biotechnology was organised in Bangkok in June 1996 and two projects were subsequently launched. One project is on the plant biotechnology for crop improvement and better utilization of natural resources. The other is about the embryo transfer technology (for cattle) in the field of animal biotechnology. A collaborative project for establishing the Bio-informatics Network is to be finalized soon.

D) Space technology

The ASEAN members have recently started taking interest in this vital field. Space technology was proposed as an area of cooperation by India during the second meeting of AIWGST held in Singapore in October 1999. The ASEAN Sub-Committee on Space Technology and Applications (SCOSA) in its first meeting in Manila in May 2000 responded positively to India’s
proposal. ISRO signed agreements with Brunei, Indonesia, and Malaysia for cooperation in the space field.

People of both sides suffer from a host of tropical diseases such as tuberculosis—the disease of poverty. The importance that ASEAN and particularly Indonesia attaches to cooperation in the pharmaceutical sector is underlined by the visit of the President Megawati to Hyderabad, where several leading names in pharmaceutical industry such as Dr Reddy Labs, Ranbaxy, and Bharat Biotech are located.

India and the some of the ASEAN members are also involved in multilateral projects under the auspices of the Commonwealth (Brunei, Malaysia, and Singapore) and the G-15 (Indonesia and Malaysia).

**Bilateral Programmes**

On the bilateral front, India has cooperative arrangements that are administered through the Indian Technical and Economic Cooperation (ITEC) programme of the Ministry of External Affairs (MEA), Department of Science and Technology (DST), and Council of Scientific and Industrial Research (CSIR) with Indonesia, Malaysia, Myanmar, Singapore, Thailand, and Vietnam. Most of the S&T agreements have provisions for joint R&D projects, exploratory visits, and exchange of scientists and training facilities. As Table 4.1 shows, ASEAN countries account for a large number of seats under India’s ITEC programme.

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23 The Indian Technical and Economic Cooperation (ITEC) Programme was initiated in 1964 by the Ministry of External Affairs (MEA) as a bilateral programme of assistance to share India’s technological expertise with other developing countries. India has so far offered technical assistance to 143 developing countries. An amount of Rs. 716 crores was allocated to this programme during 2000-2001 constituting 26% of the budget of the MEA.
Table 4.1: Allocation of Seats to ASEAN members under India’s ITEC Programme

<table>
<thead>
<tr>
<th>Country</th>
<th>Allotted</th>
<th>Utilised</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brunei</td>
<td>10**</td>
<td>-</td>
</tr>
<tr>
<td>Cambodia</td>
<td>20+10**</td>
<td>6</td>
</tr>
<tr>
<td>Indonesia</td>
<td>20+10**+3*</td>
<td>20</td>
</tr>
<tr>
<td>Lao PDR</td>
<td>35+10**</td>
<td>11</td>
</tr>
<tr>
<td>Malaysia</td>
<td>10+10**+3*</td>
<td>4</td>
</tr>
<tr>
<td>Myanmar</td>
<td>40+10**</td>
<td>7</td>
</tr>
<tr>
<td>Philippines</td>
<td>15+10**</td>
<td>8</td>
</tr>
<tr>
<td>Singapore</td>
<td>10**</td>
<td>10</td>
</tr>
<tr>
<td>Thailand</td>
<td>10+10**</td>
<td>10</td>
</tr>
<tr>
<td>Vietnam</td>
<td>70+30(S&amp;T)</td>
<td>64+10**</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>346</td>
<td>150</td>
</tr>
</tbody>
</table>


Note: ** (Additional ten slots are allocated for ASEAN members only)

Note: * (Additional three slots are allocated for a special course for G-15 members only)

**India-Indonesia**

The India-Indonesia Joint Committee on Scientific and Technical Cooperation was established at Jakarta in 1982. During the visit of the Indonesian President, Abdurrahman Wahid to India in February 2000, India has agreed to post an adviser on science and technology to the Indonesian Government. They had signed a Memorandum of Understanding in the field of science and technology at Jakarta during the visit of the Indian Prime Minister Atal Behari Vajpayee in January 2001 and identified the broad areas of information technology, biotechnology, agriculture, marine sciences, medical sciences, renewable energy sources, science policy, and science popularisation.
Under the ITEC Programme for civilian training, India has allocated 10 slots to Indonesia as part of the India-ASEAN S&T cooperation scheme and three slots as part of the G-15 Technical Cooperation programme, in addition to 20 regular slots. The full utilisation of regular slots by Indonesia shows the importance it attaches to the Indian technical assistance programmes.

**India-Malaysia**

Under the ITEC Programme, India has allocated 10 slots to Malaysia as part of the India-ASEAN S&T cooperation scheme and three slots as part of the G-15 Technical Cooperation programme, in addition to 10 regular slots. An agreement was signed between Malaysia and India on cooperation in S&T on 12 September 1998 in Kuala Lumpur where they identified the following areas for cooperation: Patenting of biodiversity in spices; Utilisation of diverse bamboo species for product development; Commercialisation of orchids; Natural plant product chemistry development and screening; Alternate sources of energy and its conservation; Abatement of pollution caused by industries; Reclamation and utilisation of minerals and metals; Innovation in natural rubber technology; Red palm oil and health; Mutual promotion of each others technologies.

As per this agreement, the Malaysia-India Joint Science & Technology Committee was established. During its first meeting held at New Delhi in March 2001, the Malaysian delegation expressed keen interest in learning from India’s experiences in the areas of space science, advanced materials, biotechnology, and ayurvedic/herbal medicine.
Malaysia has of late started taking keen interest in space technology. The delegation sought India's cooperation in satellite technology and remote sensing in the context of establishment of the Malaysian Space Centre and then visited the ISRO, Bangalore. The government-owned company, Astronautic Technology (M) Sdn. Bhd. (ATSB), set up under the Space Science Studies Division (BAKSA) for the purpose of manufacturing TiungSAT-1 has been preparing the design of a constellation of low equatorial orbit satellites. The BAKSA and ATSB have conducted a few training workshops on satellite technology with experts from India.

India and Malaysia signed the following agreements during the visit of the Indian Prime Minister in May 2001. The Antrix Corporation of India\(^2\) and Binariang Satellite Systems Sdn. Bhd. of Malaysia signed a joint venture agreement. It will enable them to create a joint platform that will provide C-band and Ku-band capacity. It covers sales and marketing of the transponder capacity on the joint venture platform, creation of products and services for DTH, data broadcast and multimedia infrastructure, consolidation and optimisation of the orbital slots, joint operation and management of the satellite systems in relation to mutual provision of transponder back-up, development of ground system for satellite monitoring, uplink chains or other satellite infrastructure and so on.

The ATSB of Malaysia signed a MoU with India's Antrix Corporation on 14 May 2001 to launch Malaysian auxiliary payloads on India's Polar Satellite

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\(^2\) The Antrix Corporation, the commercial body of the Indian Space Research Organisation (ISRO) was established in 1993 for tapping the export markets for satellite products and services.
Launch Vehicle (PSLV) and Geo-synchronous Satellite Launch Vehicle (GSLV) launchers depending on their mission requirements. The scope of the MoU covers (a) cooperation between the two companies in regard to use of launch services from Indian launch vehicles such as PSLV or GSLV for the launch of ATSB’s Small Payload Orbit Transport (SPORT) module, or other satellites, in one of its missions as a co-passenger subject to mission compatibility, (b) provision of training of ATSB’s engineers in satellite technology and applications in the facilities of Antrix Corporation and the Indian Department of Space.

IT has emerged as a vital arena for cooperation all over in the recent past. Keeping the huge scope for mutual benefit in mind, the governments of India and Malaysia during the visit of the Prime Minister Vajpayee in May 2001 signed a MoU for cooperating in the field of information technology and services. It is aimed at promoting closer cooperation and exchange of information in the following areas relating to IT: E-commerce and multimedia development; E-government; Information security and cyber crime; Human resource development; Research, design and development; and Exploring third country markets. The areas of strength in IT in India and Malaysia are complementary. While India is a leading global player in software development and IT education, Malaysia is well known for hardware sector.

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25 The first developmental test flight of GSLV was successfully carried out on 18 April 2001 from SHAR Centre, Sriharikota, marking a major milestone in the Indian space programme. With this launch, India has demonstrated its capability to launch communication satellites into geo stationary transfer orbit.

It is remarkable that 14 Indian companies have already started their operations in the famed Multimedia Super Corridor.

India presented a list of technologies available for transfer to Malaysian industries in the field of advanced materials. An expert from SIRIM, Malaysia, visited the International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), Hyderabad.

India is emerging as a major player in the field of biotechnology. Malaysia invited India to participate in the forthcoming ‘Bio-Malaysia 2002’. Bharat Biotech International Ltd. is interested in setting up R&D-cum-production facility of Hepatitis-B and other biotech products in Malaysia in the form of a joint venture. Malaysia is also interested in the training programmes of India in the areas of meteorological services and wildlife management.

**India-Myanmar**

With the revival of contacts, an Indian delegation visited Myanmar to attend the first meeting of the India-Myanmar Joint Working Group for S&T Cooperation held in April 2000. India has taken an initiative to establish India-Myanmar S&T Friendship Library in Yangon. India has offered its expertise to Myanmar in the fields of repair and maintenance of scientific instruments, metrology, standards and quality certification and accreditation. A joint workshop on Oceanography was held in Goa in September 1999 and a number of areas were identified for cooperation. They include oceanographic survey of the Andaman Sea, fisheries surveys, fishery forecast through

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OCEANSAT data, assistance in establishing tidal and weather stations, scholarships in oceanography to students/researchers of Myanmar.

India-Singapore

Singapore's National Science & Technology Board (NSTB) has institutional linkages with Indian institutions like CSIR. Cooperation between India and Singapore has been mostly taking place in the field of IT. They decided to set up a task force to identify areas of convergence and cooperation in IT sector. Singapore is involved in many IT projects in the states of Karnataka, Tamil Nadu, and Andhra Pradesh. Singapore's Prime Minister Goh Chok Tong inaugurated the Singapore Technology Park in Bangalore in January 2000. The Government of Karnataka as part of e-governance drive engaged a subsidiary of the Singapore Computer Board to design an integrated Management Information System that would directly link all districts with the State headquarters. The Jurong Town Corporation is preparing a comprehensive development plan for the implementation of the IT corridor in Bangalore. The Electronics Corporation of Tamil Nadu Ltd (ELCOT), the NSTB, and the Trade Development Board (TDB) of Singapore signed a MoU to promote cooperation, trade, and investment in information and communication technologies. Goh Chok Tong suggested that Singapore's NSTB could be involved in the implementation of Tamil Nadu's plan to set up an incubator for IT companies. NIIT is setting up an e-commerce and knowledge management competency center in Singapore to

28 "India, Singapore to set up free trade zone", The Hindu, 20 January 2000.
30 "Further boost to ties with Singapore", The Hindu, 30 June 2000.
31 "ELCOT ties up with Singapore firms", The Hindu, 22 January 2000.
strengthen its software development and content creation activities. It has completed several e-commerce based systems and integration projects in Singapore and attracted many customers like Nanyang Polytechnic.\textsuperscript{33}

**India-Thailand**

A protocol for cooperation was signed between Thailand Institute of Scientific & Technological Research (TISTR) and CSIR in Bangkok in October 1986. TISTR Governor signed a new working programme for two years between CSIR and TISTR during his visit to India in February 1997. The Joint Committee meeting in New Delhi in December 1999 has recommended cooperation in areas of biotechnology, herbal drugs/medicinal plants, food technology, fire research, metrology & standards, glass blowing and eco-toxicity assessment.

**India-Vietnam**

The agreement on cooperation in S&T between India and Vietnam signed in 1976 was renewed in February 1996. During the first meeting of the India-Vietnam Joint Committee on S & T at Hanoi in September 1997, a Programme of Cooperation (POC) was agreed upon. A fresh POC was signed in March 2000. The identified areas of cooperation include advanced materials, biotechnology, IT, electronics and computers, atomic energy, and oceanography. India has provided help to Vietnam in setting up of Rice Research Institute and a Petroleum Centre. The Dept. of Ocean Development and the Survey of India are involved in a project on the establishment of a

\textsuperscript{33} "NIIT's e-commerce center in Singapore", *The Hindu*, 3 April 2000.
Tide Gauge Station at Quinhon.\textsuperscript{34} The National Institute of Oceanography, Goa has a collaboration programme with the Institute of Oceanography, Nha Trang and is involved in a joint project on exploration of non-living resources in the EEZ of South Vietnam.

The atomic energy commissions of India and Vietnam have been cooperating for several years in the peaceful use of nuclear energy.\textsuperscript{35} A team of Vietnamese nuclear scientists visited India in February 1998 and a MoU was signed between the Atomic Energy Commissions of India and Vietnam. Later a delegation from the Indian Atomic Energy Commission visited Vietnam. CSIR has collaboration programmes with National Centre for Science & Technology (NCST) of Vietnam. Under ITEC programme, thirty slots are being allotted to Vietnamese scientists annually for training who are hosted by CSIR.

\textbf{Obstacles to Cooperation}

Are India and the ASEAN members encountering any difficulties to cooperate? Notwithstanding the presence of several imperatives for cooperation between India and the ASEAN members, one finds certain impediments to cooperative efforts. Firstly, the lack of funds is responsible for the low level of cooperation. The governments of both India and the ASEAN members are hard pressed to allocate more resources to science & technology in view of the more pressing concerns. This is clearly evident in the inability of the governments to provide better facilities to scientists.


Moreover owing to the 1997 economic crisis, the ASEAN members can muster only limited resources now. Secondly, the cooperation has so far remained a mere inter-governmental affair. The lack of initiative, except in the IT sector, on the part of the private sector accounts for the absence of any serious cooperation on these issues of vital importance to the well being of both societies. Thirdly, the commercialisation of jointly developed technologies is proving to be problematic due to non-involvement of the private sector at the preparatory and implementation stages of joint R&D projects and marketing difficulties. Fourthly, the utilization of jointly obtained research results in the context of intellectual property rights (IPRs) is a tricky issue.

No follow up action is initiated promptly on the numerous MoUs signed. Many Meetings are known for bold declarations that launch high hopes that are later dashed by a combination of a failure to follow-up and the obstacles and inertia that seem to be built into the policy formulation and implementation agencies.

There is hardly any awareness about each other's scientific establishments. There is no adequate media coverage of each other's technological achievements, however modest they may be compared to those of the advanced countries.

Project proposals are taking a long time to fructify into viable joint projects, especially multilateral ones. The scientific personnel have to route their proposals through a circuitous path involving several agencies that lead to cost overruns.
Prospects for Cooperation

The above stated obstacles to cooperation may appear to be insurmountable. However, with India becoming a full dialogue partner of the ASEAN in 1995, the prospects for cooperation have brightened up. The annual ASEAN--PMC (Post-Ministerial Conferences) provides an important forum to jointly address these common problems by India and the ASEAN members at the ministerial level. The cooperative mechanisms that are already in place at various levels can provide guidelines to enhance science & technology cooperation between India and the ASEAN members.

From the above discussion, it is clear that technological challenges need to be tackled effectively on an urgent basis. There are no 'quick-fix' solutions as these challenges are everlasting and India and the ASEAN members have to devise cooperative mechanisms keeping a long-term perspective in mind.

The falling cost of communications has made networking inexpensive in the recent past. So the personnel in the scientific and technological establishments in both countries can now easily communicate in order to launch collaborative research projects. They can assist each other in building the capacity to innovate and adapt technology to suit their local needs. They can offer the expertise in their respective areas of strength.

So what India and the ASEAN members should do to enhance cooperation?

The following policy suggestions may be considered in this regard. Most important of all, public awareness has to be created about the growing
technological challenges that could, indeed should, lead to allocation of more intellectual and material resources to tackle them. Secondly, governments of India and the ASEAN members should pool their limited resources as science & technology is a capital-intensive enterprise to achieve better results.

Thirdly, governments of India and the ASEAN members should initiate steps to enable the private sector to participate actively and effectively in the policy formulation process and in the programme implementation. Mentioning about the role that can be played by the private foundations in developing countries, the HDR 2001 says that the “developing countries could introduce tax incentives to encourage their billionaires to set up foundations. Rich individuals from Brazil to Saudi Arabia to India to Malaysia could help fund regionally relevant research.”36

Fourthly, governments of India and the ASEAN members should create enough awareness about the available opportunities and give publicity to science & technology events such as science congresses, exhibitions, workshops, conferences and so on and thus pave the way to identify specific areas of cooperation. Fifthly, as there are clear limits to what governments can do, private sector and media have a vital role to play in this regard. They should not only highlight these challenges, but also contribute in effectively dealing with them. For example, media can highlight the science & technology achievements of India and the ASEAN members. Sixthly, India should make efforts to get incorporated into the existing cooperative mechanisms in the

36 UNDP, n. 6, pp. 6-7.
ASEAN region. Bilateral and multi-lateral agreements may also be reached on
the need to exchange information.

Seventhly, traditional medicine is an emerging area of interest in the
wake of rising prominence of acquisition of intellectual property rights in the
field of traditional knowledge. India and the ASEAN members can share their
expertise about the tropical plants. For instance, the scientists of the Tropical
Botanic Garden and Research Institute (TBGRI) located in the State of Kerala,
India developed an herbal medicine, named *Jeevani*, by utilising the
traditional medicinal knowledge of the local Kani tribe. It is developed from
*arogyapaacha* plant (*trichopus zeylanicus*) - a small rhizomatous, perennial
herb found in India, Malaysia, and Sri Lanka.\(^{37}\)

Eighthly, India and the Malay-speaking ASEAN members can cooperate
to develop the Malay language content to popularise the use of the
Simputer\(^{38}\) and also to jointly market it in countries like Brunei, Indonesia,
southern Thailand and southern Philippines where Malay is spoken.

Ninthly, the Indian Embassies in Germany, Japan, Russia and the USA
maintain science and technology wings to strengthen bilateral, inter-agency
and inter-institutional cooperation. They facilitate the identification and
implementation of joint S&T programmes of mutual benefit and also the visits
of the Indian scientists/technologists to R&D Institutions in these countries as


\(^{38}\) The academics at the Indian Institute of Science and engineers at the design company Encore Software in Bangalore, to provide affordable computers, designed a handheld Internet appliance called 'Simputer' for less than $200. It currently provides Internet and email access in local languages, with touch-screen functions and micro-banking applications. Later versions promise speech recognition and text-to-speech software for illiterate users.
well as the visits of scientists/technologists from these countries to the Indian R&D Institutions. Similarly India and the ASEAN members should open science and technology wings in their respective missions to ensure quick and smooth implementation of various cooperative ventures. Tenthly, the ASEAN members may invite well-known Indian scientists and technologists such as Dr. Kasturi Rangan and Azim Premji, under the India-ASEAN Eminent Persons Lecture Series. It takes two hands to clap. So both should be equally interested in the partnership to make the best out of it and both should capitalise on the gains made thus far.

**Conclusion**

India and the ASEAN members should not remain mere recipients of technology but strive to become its creators. India and the ASEAN members have managed to weave a web of contacts among their scientific establishments and scientists in the recent period. This will go a long way in boosting their indigenous efforts to acquire technological capabilities and their attempts to attain technological autonomy, if not technological independence, from the technological control of the advanced countries. They should also negotiate together for attaining their common interests in international technological regimes.

India and the ASEAN members are beset with serious technological challenges to their progress. Any unilateral effort to tackle them will prove to be inadequate and hence ineffective. It is in the enlightened self-interest of India and the ASEAN members to collaborate rather than to go it alone. Hence the immediate need of the hour is to pool their scarce resources and
jointly tackle them and also attempt to narrow down the huge technological gap between them and the advanced nations.

Cooperation in science & technology is useful in expanding the scope of linkages between India and the ASEAN members. Such an arrangement will be a relatively smooth building bloc for more elaborate forms of cooperation in other sectors. Indeed, the technological challenges provide both of them with excellent opportunities to contribute to each other's socio-economic development in a constructive manner.