SOUTH-SOUTH CO-OPERATION IN SCIENCE AND TECHNOLOGY : A CASE STUDY OF SAARC

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JIBBY THOMAS

DIVISION OF SOUTH ASIAN STUDIES
CENTRE FOR SOUTH, CENTRAL, SOUTHEAST ASIAN
AND SOUTHWEST PACIFIC STUDIES
SCHOOL OF INTERNATIONAL STUDIES
JAWAHARLAL NEHRU UNIVERSITY
NEW DELHI - 110067
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जवाहरलाल नेहरु विश्वविद्यालय
JAWAHARLAL NEHRU UNIVERSITY
NEW DELHI - 110067

Centre for South, Central,
South East Asian and South
West Pacific Studies,
School of International Studies.

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CERTIFICATE

Certified that the dissertation titled SOUTH-SOUTH CO-OPERATION IN SCIENCE AND TECHNOLOGY: A CASE STUDY OF SAARC submitted by Mr. JIBBY THOMAS in partial fulfilment of the requirements for the award of the degree of MASTER OF PHILOSOPHY, has not been previously submitted for any other degree of this or any other university. This is his own work.

We recommend that this dissertation may be placed before the examiners for evaluation.

I. Mukherji

Prof. I.N. MUKHERJI
(Supervisor)

Supervisor
Centre for South, Central Southeast
Asian and South West Pacific Studies
School of International Studies
Jawaharlal Nehru University
New Delhi-110067

Kalim Bahadur

Prof. KALIM BAHADUR
(Chairperson)

Chairperson
Centre for South, Central Southeast
Asian and South West Pacific Studies
School of International Studies
Jawaharlal Nehru University
New Delhi-110067

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JIBBY THOMAS

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CHAPTER I

INTRODUCTION

The South Asian Association for Regional Cooperation (SAARC) comprising Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, is an entity that is now nearing a decade of its existence.

India occupies an unenviable position, being the economic, political and geographic centre of the region.[1] The smaller countries of the region have had conflictual relations with India at any one point of time or the other in the past forty years (with the exception of Bhutan and Maldives). Traditionally countries of the region adopted a bilateral approach to cooperation. Alternatively any multilateral cooperation was conducted only through global institutions. In this situation, it was the concept of SAARC which was for the first time offering a regional cooperation arrangement on the lines of the highly successful Association of South East Asian Nations (ASEAN) and the European Community.

The fact that the region could initiate its own form of

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1 The geographic dimensions of South Asia is still unclear. Some studies have included Afghanistan and Burma in this region. For the purpose of this study, any reference to South Asia will refer to only to the geographic territory of the SAARC member states.

multilateral economic cooperation came as a surprise to most South Asian observers. For forty years, the region did not see a conclave of either its foreign ministers or Heads of State/Government. And within two years of the historic foreign ministers meeting (1983) the SAARC was launched.

In terms of economic characters, each state in the region is a part of what is termed as the South or developing country bloc. They were active participants in the North-South debate during the sixties. A concept that gained currency during the seventies, is what is termed as South-South cooperation. It was intended as an effort by developing countries to pool their resources and achieve collective self-reliance through joint and cooperative development strategies. An important component of this is science and technology. The scientific and technological base of a country, to a large extent determines its economic status. The economic divide in the international economic system can also, in part, be traced to the size and quality of each bloc's science and technology base and its pace of development.

The member states of the region (particularly India) were proponents of the concept of South-South cooperation India had also been a part of several South-South programmes conducted on a global scale. The implementation of South-South cooperation in South Asia had to wait until 1981, when the foreign secretaries of the region met and agreed on launching a programme of cooperation in the region. An important character of this programme was that it involved only economic cooperation. All other forms of cooperation have not been permitted. Science and technology was one of the agreed areas of cooperation, which was launched with a meeting of a study group in 1981. It is now about 13 years since cooperation in science and technology has been initiated. This presents an opportunity to assess the broad directions of cooperation in science and technology, its sustainability and other relevant issues. This work studies the efforts in SAARC to initiate cooperation in science and technology. It analyses this cooperation in the context of South-South cooperation, which includes both recommended patterns of cooperation and the actual nature of this cooperation.

Most research work on SAARC concentrates basically on two components. One is the political undercurrents and its implications for regional cooperation. The second is the potential for increasing trade between SAARC states. It is only country papers presented during the meetings of SAARC and other deliberations under its agesis that tend to deal with the area of technical cooperation. There is a lack of social science research focussing on the issue of cooperation in science and technology. This is manifest through a survey of the literature on SAARC, which is despite the fact that the vital importance of technology and technological cooperation has been recognised in the region.

Similarly the research work also tends to generally work in isolation rather than relating it to the wider Third World context. There has been some work comparing the SAARC to ASEAN and EEC, but this is only in its integration aspects and progress on intra-regional trade. There has been no efforts to analyse SAARC initiatives in the light of potential patterns of cooperation as offered in several studies, that can contribute to the twin objectives of closing the technology gap and aiding the development process. In these two respects this study is an attempt at research into a relatively new dimension of SAARC.

There is extensive literature on the general analyses of South-South Cooperation in science and technology. Development Cooperation and Third World Development (1984) edited by Pradip K. Ghosh has several papers by UN agencies which study South-South cooperation in science and technology. Bingu Wa Mutharika's paper `Transnational Corporations and Technical Cooperation Among Developing Countries' in Breda Pavlic et al (eds), The Challenge of South-South Cooperation (1983) focusses on the concept of Technical Cooperation among Developing Countries (TCDC), its nature and potential. The implications of monopoly control over technology by Transnational Corporations (TNC) is also studied.

In the report of the South Commission titled The Challenge to the South (1990) one section discusses the strategies to be adopted by the South for the development of science and technology. In Altaf Gauhar (ed.), The Rich and the Poor (1983), Zhang Peiji and Chang Yugwi have assessed the various forms of technical cooperation among developing countries and have outlined four principles that should guide South-South cooperation in their paper `On the Promotion of South-South Cooperation and Its Measures'.

Navin Chandra Joshi's Planning and Technology in Developing Countries (1984) focusses on the role of the international technology order in the development process of the Third World. The compulsion of developing countries to ignore indigenous development of technology in favour of direct imports from the West is discussed. In Aron Segal et al, Learning by Doing: Science and Technology in the Developing World (1987) Segal provides a methodology for assessing existing science and technology capabilities which also include criterion like percentage expenditure of science and technology in the Gross National Product (GNP), national stock of qualified personnel, technology transfer capabilities etc. Ward Morehouse and Brijen Gupta in "India: Success and Failure" assess India's post-independence policy on science and technology, its domestic infrastructure and qualified personnel. It also analyses India's successes and failures in building an indigenous technology base.

On cooperation in the South Asian region and the SAARC, the literature is limited particularly with reference to cooperation in science and technology. The basic primary sources will be the reports of the technical committees of five areas in the IPA, relevant for the study. Each report includes the proposals of member states for cooperation and the deliberations of the Committee on these proposals. It also contains status reports of programmes approved for implementation by SAARC.

The report Proceedings of the SAARC Workshop on Science Policy (1988) is an important source of data on the internal policy of SAARC states regarding science and technology and cooperation in this area. This report contains five country papers that outline the policy and status of science and technology, human resource base and national outlays. M.Anis Alam in his paper `Possible Science and Technology Policy for SAARC Countries' identifies areas where cooperation would be required and the frameworks of national policies that can facilitate this cooperation.

A number of workshops and seminars have been held under the auspices of SAARC. There are reports published for each of these workshops. Reports such as Report of the Workshop on Low Cost Scientific Educational Equipment (1989); Report of the SAARC Seminars on Delivery System of Improved Stoves for Rural Use (1988) and others (see bibliography) contain country papers which outline the programme of member states focussing on the subject of the report. It also provides data on the resources already spent and planned for the future. Besides, it provides information on the extent of cooperation initiated and envisaged for the future in that particular area.

There are some secondary studies on cooperation in SAARC. Most are of a general nature with brief references to the issue of cooperation in science and technology. In Arif A.Waqif (ed.), South Asian Cooperation in Industry, Energy and Technology (1987), there are two papers of relevance to the proposed study. Falguni Sen and V.L.V.S.S. Subba Rao in "Scientific and Technological Cooperation Between South Asian Countries: Some Issues" begin with an analysis of the existing technological order in South Asia and its implications for indigenous development of technology and on the development process as a whole in the region. It also discusses the benefits of cooperation in reducing the extra-regional dependence and the modalities of this cooperation. M. Masihuddin in "Regional Cooperation in Science and Technology" beings with a study of the existing arrangements for cooperation in science and technology and the progress achieved. He then identifies areas that have a potential for cooperation and study's each sector individually.

In a publication of the Research and Information System for the Non-Aligned and other Developing Countries (RIS) by Govind Agarwal et al titled South-South Economic Cooperation: Problems and Prospects (1987), Nagesh Kumar's paper "India's Economic and Technical Cooperation with Co-Developing Countries" begins with a discussion on India's economic and technical assistance to developing countries through bilateral and multilateral channels. The Indian Technical and Economic Cooperation (ITEC) programme and India's contribution to the Colombo plan, Economic Commission for Asia and Pacific, UNCTAD, UNDP et. al., have been studied. The paper also discusses India's official policy regarding scientific and technical assistance.

R.R.Subramanian's paper "A Technological Base for South Asian Regional Cooperation" in Bhabhani Sen Gupta (ed.), Regional Cooperation and Development in South Asia, vol.II (1986), studies the present proposals for technical cooperation. It also discusses on the institutional framework that have been built and the procedural details of technical cooperation in SAARC. It also studies some instances of cooperation and explores potential areas for cooperation.

Another study by RIS titled Economic Cooperation in the SAARC Region: Potential, Constraints and Policies (1990) by V.R. Panchmukhi and others has a section on Indian Joint Ventures (JVs) operating abroad, Indian turnkey projects and technology transfer agreements in South Asia. It also gives a detailed account of each instance of such transfer of technology from India. Similarly it has identified areas of technology which India can transfer to other SAARC countries.

The primary limitation of the above studies on SAARC is that they have not assessed the SAARC programmes initiated or under consideration. They do not refer to or study any SAARC documents. The only exception is Yvonne Schokman's article, "Proposals for Cooperation in Science and Technology in South Asia". This study is partially based on the reports of the Technical Committee (the main SAARC institution for science and technology cooperation). The period covered by this article is 1988. There are no studies covering the period after 1988. This study is also sketchy since it only provides an overview of the activities in science and technology cooperation rather than an indepth analysis.

The other studies are exploratory in nature, with the focus on identifying potential areas of technology transfer.

Despite the fact that it is a decade now since the inception of SAARC, there have been no studies based on primary documents from SAARC. This work attempts to bridge this lacunae in the available SAARC literature.

The focus of this study is on the activities conducted under the Technical Committee on science and technology cooperation. The activities conducted under the other Technical Committees are also studied when they have a significant science and technology component.

The study has adopted a multi-dimensional approach regarding methodology. By and large a descriptive analytical approach is envisaged in this study. A part of the study will be of a comparative analytical nature. Content analyses of primary documents is also conducted. Statistical analysis too is used where relevant.

The study will follow with four parts:

The second chapter studies the concept of technology, its categories and relationship to development. It discusses the theoretical background of technology as a factor for economic development and the patterns of cooperation recommended in the South-South Programme. It also studies actual instances of such cooperation.

Chapter III begins with an assessment of the human resource and knowledge base with reference to science and technology. It then studies national policies regarding indigenous development of science and technology and cooperation in this sector. It also carries a brief comparison of the similarities and dissimilarities among member states vis-a-vis the scientific infrastructure and human resource base.

Chapter IV begins with the discussion on the concept and inception of SAARC. It then studies the relevance for science and technology. On the basis of secondary literature this chapter studies proposed modes of cooperation. It also identifies potential areas for cooperation. Lastly it studies the constraints arising from within the region and from SAARC as a whole, and its implication for science and technology cooperation.

Chapter V is the core chapter of this work. It begins with a study of the institutional frameworks and modalities in SAARC with reference to cooperation in science and technology. This is followed by a detailed study of the nature of initiatives taken under the agesis of the Technical Committee on Science and Technology. It also briefly studies initiatives undertaken in other sectors of cooperation which involve science and technology.

Chapter VI is the concluding chapter of this study. An assessment of SAARC activities is carried in this chapter. This assessment is carried out at two levels. Firstly the SAARC initiatives are analysed in comparison with the theories and patterns of cooperation recommended for developing countries. Secondly these initiatives are analysed as a response to the needs of the region. The chapter also discusses the prospects for future cooperation in science and technology in the region.

CHAPTER II

SCIENCE AND TECHNOLOGY CO-OPERATION IN THE THIRD WORLD

This chapter essentially seeks to build the background to the analysis of SAARC in the South-South context. It will discuss the main issues in South-South co-operation in science and technology. Section one is a brief introduction to the concept of Third World and its characteristics. Section two discusses the concept and dimensions of science and technology and its role in the development process of the Third World. Section three discusses various issues in science and technology in the existing scenario, which are of vital concern to the Third World. This covers both domestic and external dimensions. Section four discusses the role of science and technology in the South-South programmes. It examines several issues regarding science and technology in South-South co-operation. Section five discusses the limitations that hinder the implementation of science and technology in the South-South programme. It also examines solutions put forward to overcome these limitations. Section six studies actual instances of South-South co-operation in science and technology. It also includes theoretical input from various sources on the mode of South-South co-operation in science and technology. Section seven concludes this chapter.

1. THE CONCEPT OF SOUTH

An understanding of economic development in the international context requires, first, an awareness of the economic classifications applicable in the international economic system. This is more particularly so in the context of this work, since the attempt is in analysing co-operation in science and technology in South Asia within a specific economic classification termed as South-South co-operation.

Based on several indicators, both social and economic, the community of states in the international system can be divided into two groups. (Here the Socialist bloc comprising of East Europe and the former Soviet Union are removed since they constitute a different economic ideology and political system.) These are the developed (alternatively termed as North and First World) and the developing countries (termed as South and Third World). This categorisation is based on economic growth, level of industrialization, national and per capita income, scientific and technological base etc.

Developing countries account for 75 per cent of the world's population, and 60 per cent of agricultural output. But its shares in foreign trade, industrial output and Gross National Produce (GNP) are much lower. In science and technology, the Third World accounts for only two per cent of the world expenditure on research and development and their nationals account for not more than one per cent of the world's grants of patent rights.[1]

All the countries of the South Asian region, more particularly so, the members of the South Asian Association for Regional Co-operation (SAARC) (which is the focus of the study), namely, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka belong to the South. This therefore requires first an understanding of the concept of South, its characters and strategies for development since they are relevant in the South Asian context.

The South as a distinctive political entity arose from the de-clonisation phase in the immediate post Second World War period. They were beset with numerous problems, the foremost being inadequate rates of growth, low standards of living and insufficient modern infrastructure required for economic development. These states were used by colonial powers only as suppliers of raw material and as markets for industrial products from the colonising country. Local manufacturing, and the laying of a scientific and technological base in terms of research, know how and human resource potential was generally discouraged.

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1 UNCTAD, *Report and Recommendations of the Asian Regional Workship on Policies and Planning for Technological Transformation* (Bangalore, 15-26 June 1981), UNCTAD/TT/50, 13 April 1982, p.1.

As the South gained a majority in the United Nations (UN) General Assembly and other UN bodies, the problems of the South were raised in these international fora. The North's response was the initiation of the North-South dialogue, both within and outside the UN.[2] The South raised several demands for access to the North's financial and technical base. The South's concept of an equitable international economic order, its characters and other general demands were consolidated in the shape of the proposal for the New International Economic Order (NIEO), the implementation of which was called for by a UN General Assembly resolution on the NIEO in May 1974. The NIEO included South-South co-operation too in its scope.

As a reaction against the lack of any genuine commitment by the North on the North South dialogue, the South initiated the idea of South-South co-operation to forge a common development strategy. Another factor that influenced the South in formulating this concept was a gradual awareness that total reliance on the North could prove detrimental to the interests of the South. Even as the South strived to continue a meaningful North-South

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2 It was initiated by the Conference on International Economic Cooperation in 1975 and extended up to June 1977. See Earnest H.Preeg, *The Decline of the North-South Dichotomy* (USIS Abstract), 1988/4, p.1.

dialogue, simultaneously they began to look inward in order to formulate a cooperative approach to development. This was termed as the South-South dialogue or South-South co-operation.

2. SCIENCE AND TECHNOLOGY: CONCEPT AND ISSUES

The North-South and the South-South dialogue was carried on in different areas of economic development, but the focus of this work is on science and technology. Technology in a broad sense can be defined, as Donald D.Evans does, "...the means by which man undertakes to change or influence his environment..." and which transcends the engineering art to include forms of human endeavour, methods of rational analyses, and the structure of systems for achieving determined objectives.[3] In another definition formulated by Bernard Gendran and Abdulqawi A. Yusuf, technology encompasses not only the physical hardware but also the technical activities, such as know how, skills and the technical expertise. Included in this definition are innovative capacities and production management skills, which are integral to the success of technology transfer

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3 Donald D.Evans, "Appropriate Technology and Its Role in Development", in Pradip K.Ghosh, ed., *Appropriate Technology in Third World Development* (Connecticut, 1984), p.25.

between countries of differing technical sophistication.[4]

Technology can be classified into various categories. One classification provided by Jequier has three categories namely, private, community and public technologies.[5] The first is employed by small commercial firms, the second involves technologies applicable to communities and requires public co-operation in its development and operation. The third refers to those used by large industrial firms. Abdus Salam categorises civilian technology (as different from military technology, though most technologies have dual applications) into four groups namely, basic sciences, sciences in application, conventional technology, and science based technology.[6]. The first involves the aspect of training human resource in the basic disciplines of science and equipping them for further research and development of technology. The second comprises technologies with broad social acceptability such as agriculture, health, energy and other technologies. The third category is essentially

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4 See Parasara Mishra, "Science, Technology and Development in the Third World: Some Critical Notes on the North-South Technology Transfer Debate", *Indian Journal of Political Science* (Madras), vol.53, no.1, January-March 1992, p.58.

5 Evans, n.3, p.25.

6 Abdus Salam, *Notes on Science, Technology and Science Education in the Development of the South* (Geneva, 1988), p.12.

industrial technology while the fourth is the new frontier areas of science and technology such as new material, space, bio-technology and others.

The importance of technology in the post industrial revolution phase has been steadily increasing. As population and human expectations grow, it is only through the development of technology that the rising goals of living standards can be met. But even more important than this is the role technology can play in attaining basic human needs and helping meet adverse environmental developments.

3. SCIENCE AND TECHNOLOGY ISSUES FOR THE SOUTH

The existing international economic order is characterised by a wide technological gap between the North and the South. There are several reasons for this. These can be analysed in two broad spectrums. One is the inequitable North-South relationship. The second is the inherent drawbacks within the South.

With reference to the North-South divide in technology and its causes, the two most important academic analyses have come from the dependence and the realist schools of economic thought[8]. The dependency school attributes the technology divide to the self centred and exploitative technology policy of the North.

According to Frances Stewart, a major dependency theorist, technological dependence takes place when the major source of a country's technology is from abroad. This dependence arises initially from the imbalance in the capacity to produce technology. Once the importation cycle begins, Stewart explains, a strong tendency to continue procuring advanced and invariably capital intensive technologies is generated . This initiates the technology dependence cycle which is also fuelled by other reasons, as it shall be seen later. This process is exploitative in nature because the North extracts a huge price for the technology supplied.[9]

Dependency scholars are of the view that the acquisition of highly capital intensive technology in unfavourable institutional environments leads to technological stagnation, resource outflow and an

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8 Prominent among the dependency thinkers are E.F.Schumacher, Frances Stewart, Ward Morehouse, Fransisco Sagasti and others. Among the realist thinkers are Samuel Rosenblatt, Richard Eckaus, Gustav Ranis, Harvey Brooks and others.

9 Frances Stewart, *Technology and Underdevelopment* (London, 1977), pp.115-19, cited in Mishra, n.4, pp.59-60.

inefficient use of imported equipment due to inadequate assimilation capabilities. They advocate the remedy of appropriate technology, first advanced by E.F. Schumacher. It can be defined in his words as "...immensely more productive than indigenous technology... [and] less costly than capital intensive technology originating in modern industry".[10] An even more radical solution is advocated by some dependency scholars.It involves what can be termed as selective technological disassociation, whereby the developing countries, disassociate themselves from the International economic system and concentrate on developing indigenous solutions to their problems. This would be a transitory phase, until they can interact in an autonomous manner and free of dependence.[11]

The realist school of thought while recognising the technological dependence of the South to the North, reject the political overtones of this. They feel that it is advantageous for the South to import technologies from the North since they are superior. As regards suitability, the realists feel that it is the domestic structural and market imperfections that are the cause and advocate reformation of these to ensure maximum benefit from technology imports from

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10 E.F.Schumacher, *Small is Beautiful* (London, 1973), p.167, quoted in Mishra, n.4, p.60.

11 Mishra, n.4, pp.61-62.

the North. On appropriate technology they advocate that the formulation of decisions on these be based upon what is available on the technological shelf and what can be produced domestically. Thus they advocate that appropriate technology must not be exclusive of North's technology but complementary to it. They also suggest minimum state intervention in the economy and in the area of social policy with reference to guiding and developing science and technology.[12]

Inherent drawbacks within the South, too, have a role to play in the technology lag of the South vis-a-vis the North. Abdus Salam has four reasons that are the creation of the South by itself, independent of its relationship with the North. These are:

- lack of a meaningful commitment to self reliance in technology;
- inadequate institutional and legal frameworks;
- the manner in which the enterprise of science has been run.[13]

Of this the most important is the lack of commitment to attain self reliance in technology. Within the South there

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12 For a comprehensive discussion and review of the dependency - realist debate on North-South technology issues, see ibid, n.4, pp.57-77.

13 Salam, n.6, pp.19-20.

appears to be a persistent and erroneous belief that technologies developed indigenously are inferior than those available in the North. Besides, as underscored by a scholar, there is also a subconscious preference for technology from the North owing to a misconceived notion that it is prestigious to have it.[14] Similarly the enterprise of science, in the Third World, has been run on an ad hoc manner. It lacks any effective system of accountability and evaluation. Therefore in most cases it has not been able to contribute productively to the national development process.

The yardstick used by people responsible for technology evaluation and acquisition is the level of sophistication, economic efficiency, credit financing, etc. But these can have adverse implications for the economic and social goals in the South's programme for development which includes employment generation, maximum utility of domestic resources and reduction of economic vulnerability through increased self reliance.

Another problem faced in the South is that to a certain extent domestic economic and social structures are not developed or adapted to absorb indigenous breakthrough in

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14 Navin Chandra Joshi, *Planning and Technology in Developing Countries* (New Delhi, 1984), p.11.

science and technology.[15] The countries of the South have had to make an instant transition from a colonial economy to an independent economy. The only models which were available to them were the Western models of development, where social and economic structures were more attuned to absorb the process of constant technological absorption and innovation. Since the South lacks comparable structures, the absorption of local technological innovations becomes difficult. This can also be attributed to the elite in the countries of the South. Generally, technology absorption begins with this class and then percolates to other sections of society. Given their preference for Western technology, they do not accept indigenous technology leading to its discouragement at the initial marketing stage itself.

One reason, as advanced by Parasara Mishra, which holds some significance is that the domestic leadership in the South is yet to fully appreciate the importance of science and technology (in particular indigenous technology) in the national development processes. While most Third World countries have begun to formulate science policies, rarely are these policies integrated effectively with other socio-economic activities in order to yield concrete benefits.[16]

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15 Mishra, n.4, p.57.

16 ibid, p.67.

The initiative in this direction is generally restricted to only verbal pronouncements.

Even within the South, there are differences in the levels of science and technology base and development levels between each country. Surendra J.Patel in a study on the development process has analysed the development of science and technology in different countries. This study has shown that while some countries of the South have achieved high rates of growth through rich natural resources (mainly oil) there has been no increase or development in their technology base. But some other Third World states particularly the Asian tigers, have developed at a fast rate essentially through a significant domestic technological transformation. The next step in their growth path has been an attempt to join the `Centre' (as used in the dependency theory) of the international economic order.[17]

On the other end are the Least Developed countries. The UN Conference on Trade and Development (UNCTAD) has drawn up certain criteria such as per capita Gross Domestic Product (GDP) US $100 or less, adult literacy of 20 per cent or less to identify LDCs. There are 24 such LDCs three of which are in South Asia which include Bhutan and Bangladesh

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17 Surendra J.Patel, "Development and Differentiation Within the South", *RIS Digest* (New Delhi), vol.7, nos.2-4, July-December 1990, pp.35, 39.

(with per capita GDP below US $200) and Maldives (between $400 and $599).[18]

4. SOUTH-SOUTH COOPERATION AND SCIENCE AND TECHNOLOGY

As is well known, in the post-War era the most widely known and successful instance of regional co-operation has been the European Economic Community (EEC) in West Europe. During this phase, Third World countries too had begun forming regional co-operation groups. This was generally the result of active encouragement of first the US and later the former Soviet Union to further their strategic and economic interests. Economically both required protected markets, sources for raw material and protection of their economic ideologies. Later, the West's motives extended to overseas expansion of manufacturing activities and transfer of technology and capital through their Multi National Corporations (MNCs).

There is a second category of South-South efforts at regional co-operation. This is aimed at promoting genuine collective self reliance in a given region or sub-region. Here the objectives are the promotion of regional co-operation through the collective harnessing of the region's natural resources, technology base, manpower, and improving

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18 UNCTAD, *Transfer and Development of Technology in the Least Developed Countries: An Assessment of Major Policy Issues*, UNCTAD/ITP/TEC/12, 17 August 1990, p.20.

their bargaining position vis-a-vis the North through a collective approach.[19]

The broad ideas in the concept of collective self-reliance has been embodied in the International Development Strategy for the Third UN Development Decade (General Assembly resolution 35/56, para 134). It also reaffirms the intentions of the developing countries to the effective implementation of the Arusta Programme of Collective Self Reliance and Framework for Negotiations adopted by the G-77. In the programme there is a call for technical co-operation among developing countries to evolve a less dependent pattern of development in the Third World.[20] But regional co-operation arrangements within the South have never been, as emphasised by the G-77, a substitute for economic co-operation between the developed and developing countries. It is instead one stream of efforts which must combine with developed-developing country co-operation for the attainment

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19 S.D.Muni, "South-South Cooperation in Southern Asia", *Man and Development* (Chandigarh), vol.12, no.3, September 1990, pp.117-19.

20 Department of International Economic and Social Affairs of the UN, "Cooperation Amidst Uncertainty: Priorities for International and South-South Action", in Pradip K.Ghosh, *Development Cooperation and Third World Development* (Connecticut, 1984), p.142.

of the objectives of the NIEO.[21]

Both the global programme of South-South co-operation and regional co-operation arrangements within the Third World have recognized technology as one of its vital sub-programme. Co-operation in technology can assume several forms. The most widely known is the concept of transfer of technology. This covers transfer of skills, tools, commercial and manufacturing knowledge, design, operating techniques, basic and fundamental concepts, knowledge of managing organisation, optimum use of human resources and style of achieving results.[22] Technology transfer is generally conducted on a firm to firm basis either through the private or public sector. The benefits of this mode of co-operation within the South are:

- it offers technology that has been developed, evaluated and perfected in identical environment as that of the buyer;
- through training facilities that accompany this transfer, purposeful knowledge can be acquired for immediate use and provide a base for future research and development

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21 Ervin Laszlo, "Regional Cooperation Among Developing Countries: The Operational Modality of ECDC", in Breda Pavlic, et al, eds., *The Challenges of South-South Cooperation* (Boulder, 1983), pp.93-94.

22 Definition and Scope as formulated by O.P.Dwivedi, in O.P.Dwivedi, "Development and Technology Transfer : An Introduction", in O.P.Dwivedi, ed., *Perspectives on Technology and Development* (New Delhi, 1987), p.1.

efforts.[23]

In the first case, many of the harmful side effects of Western technology such as huge capital expense, employment restriction, non-suitable scale of production, environmental pollution and outdated technologies are eliminated. In the second case it helps buyer countries to develop self reliance and also integrates them into future efforts for joint development of technology.

The joint development of technology is another form of co-operation in science and technology. Here R & D institutions (generally government controlled institutions) of the member countries integrate their research activities. Each institution can concentrate on one or few stages of development of specific technologies over which it has considerable expertise, the required infrastructure and skilled human resource. This ensures the elimination of wasteful duplication. Similarly, since these technologies are jointly developed and therefore jointly owned, all participating countries can make use of these technologies without paying royalties, even while cutting costs of technology creation. This also can help, provided other factors are favourable, in uniform regional development.

The third form of co-operation in science and

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23 T.N. Chaturvedi, *Transfer of Technology Among Developing Countries* (New Delhi, 1982), pp.17-18.

technology confines itself to transfer of knowledge, as different from transfer of equipment. This is conducted through workshops and training programmes where one country imparts training in its field(s) of specialisation, to other cooperating countries. This has empirically proved to be the most successful form of South-South co-operation.

Another form of co-operation in science and technology is initiation of programmes and projects for joint acquisition and utilisation of technology from extra regional sources.[24] This can considerably reduce costs connected with initial purchase and subsequent maintenance. Similarly, sharing information on costs and terms and conditions of technology transfer from extra regional sources can help in ensuring that no country within a regional group pays more than the others in the group for any technology transfer.[25]

An important prerequisite for effective South-South co-operation in science and technology, is that recipient countries of technology transfer must understand the importance of research and development, managerial, organizational and administrative effectiveness, in order to

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24 UNCTAD, n.18, p.61.

25 UNCTAD, n.1, p.31.

reinforce the growing technological capability.[26] This is essential if the ultimate goal of self reliance is to be attained, and technological inequity within the South is to be eliminated. If this goal is not achieved, the recipient country traps itself into the technology dependence cycle and the unequal North-South relationship mirrors itself within the South.

Among the leadership in the Third World an awareness exists now of the importance of science and technology as can be seen in the G-15 leaders `Joint Communique' of June 1990. While pointing out reasons for their technology lag and the corrective measures that developed countries can take, the leaders emphasise their "...determination to initiate a significant programme of co-operation in science and technology to enhance the development of the South". As part of this it was agreed, in principle, to establish a South Investment, Trade and Technology Data Exchange Centre and to set up an Expert Group to work out and finalize the implementation of this project. Besides, note was taken of specific project proposals for improvement in science and technology capability.[27]

The role of the political leadership in a Third World

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26 Chaturvedi, n.23, p.39.

27 "G-15 Leaders Joint Communique: June 1990", *RIS Digest*, vol.7, nos.2-4, July-December 1990, pp.53-54.

state, in fostering science and technology and initiating regional co-operation can never be underestimated. The private sector in these states, in their profit motive, carry out their activities with minimal research and development and increasing radiance on Western technology. But if science and technology is to serve social goals without a high price on a global scale, the initiative will have to come from the governments of the South. During the eighties despite the fact that market oriented approaches continued to dominate the public policy agenda in the South, the realisation that the government will have to play an active interventionist role as far as technology transfer is concerned, has been gaining acceptance.[28] This is a welcome sign but its effectiveness depends on the level of commitment on the part of the governments (in terms of capital and political will), and the choice of priorities.

5. LIMITATIONS OF SOUTH-SOUTH COOPERATION IN SCIENCE AND TECHNOLOGY

The programme of co-operation in science and technology among developing countries faces many limitations as is evident by its tardy progress during the last two decades. The most important limiting factor is the lack of information within the South of each others' available

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28 Mishra, n.4, p.59.

capabilities and technologies. Here the North has a distinctive advantage since they can afford to widely disseminate information on their technological capability.[29] But developing countries that produce new technologies too are to blame. There is barely any effort for the low key but effective publicity of new technologies even in Third World regional forums.

Secondly, a major requirement for the acceptability of new technologies is proof of its effectiveness. The North with its technological supremacy already established has the advantage over the South in this respect. Its claims on its new technologies is readily accepted by Third World countries. On the contrary, there is a predetermined bias in the South against technologies from within the South. In several cases unfound suspicion of getting substandard equipment, has led to developing countries approaching developed countries for equipment, though similar equipment may be available with other developing countries. A possible solution is the setting up of an organisation to evaluate the quality of goods available in developing countries so that recipient countries do not entertain doubts about the efficacy of the transferred know how.[30]

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29 Chaturvedi, n.23, p.35.

30 ibid, p.39.

One factor that generally inhibits the establishment of any genuine efforts towards regional co-operation has been the question of devolvement of power from the national authorities to the regional bodies or institutions. The concept of regional co-operation creates diverse, but uniformly high expectations. But its actual implementation inevitably faces a confrontation with national jurisdiction. A solution put forward by Mekki Mtewa, a former UN executive, involves "...a diversified system of power that is both pluralistic in its outlook, consensual in its scope, accessible in its application and interactive in its effect."[31] Though this solution appears comprehensive, the actual implementation of it has proved to be difficult.

South-South co-operation faces another impediment in the form of procedural bottlenecks and bureaucratic red tapism. Here the need is for speedy and time bound approvals which is essential.[32] This is more so since the North, which produces technology essentially in the private sector, can respond speedily to Third World demand. Unless government bodies responsible for the supply, purchase and clearance of export and imports of technology in Third World

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31 Mekki Mtewa, "South-South Cooperation: The Next Decade", *Political Science Review* (Jaipur), vol.27, nos.3-4, July-December 1989, p.31.

32 Chaturvedi, n.23, p.39.

states (since most developing country technologies are created and routed through public agencies and bodies) are responsive and efficient, the actual implementation of South-South co-operation in science and technology will be hampered.

The issue of financing transfer of technology too causes problems. Developed countries transfer their technology (from both the private and public sector) as part of aid programmes (government and private aid) on a long term basis.[33] This makes technology imports from the North, for developing countries of the South, cheap in the short run. To overcome this problem, regional co-operation programmes must have financing arrangements in cases where technology exporting countries are unable to extend credit for these exports.

There are some problems of attitude within states of the South too which are impediments to the process of South-South co-operation in science and technology. The first and foremost was mentioned before, viz. the preference for ready made Western technologies. Other attitudinal problems as outlined by a scholar are:

- narrow and short-sighted forms of nationalism which ignore advantages of interdependence;

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33 Joshi, n.14, p.11.

- self-centred economic thinking which creates a fear that an equitable economic order within the South will hamper one state's national economic growth and development;
- fears arising from disparities in levels of development and in size and population (more advanced countries within a regional group will dominate less advanced ones);
- fears of depending relationships arising without regional groups.[34]

These issues will require attitudinal changes with all states of regional groups within the South and will have to be overcome if such misconceived notions are to prevent states from joining regional co-operation agreements. Similarly all developing countries, whether more developed or less developed will have to genuinely cooperate on the regional level. The former must ensure they do not try to dominate the group while the latter must ensure they coordinate their internal efforts and develop their technology base as quickly as possible and participate in the programme as equal members.

6. IMPLEMENTATION

The existing South-South programmes in science and technology can be classified in two basic categories:

(a) those which focus on conducting studies and rendering

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34 Laszlo, n.21, pp.100-1.

advise on co-operation;

(b) actual implementation of programmes.

But these two categories are not water tight classifications. Most programmes focuss on both.

6.1 The UN

The largest and most prominent form of South-South co-operation can be found in several organs of the UN. They draw their input from developing and developed countries while their activities are confined mainly to the South. Therefore it can be cited as an instance of South-South co-operation on a global scale. The Department of International Economic Affairs and Social Affairs of the UN and its subsidiary the Centre for Developing Planning Projections and Policies are two UN agencies that focuss on conducting studies and imparting advice on modes of and areas of co-operation within the Third World, which also includes science and technology in its scope.[35]

The UNCTAD has been involved in assisting South-South co-operation in science and technology. It has supported one component of the `Mexico City Programme' which envisages South-South co-operation in the transfer and development of technology through the establishment and linking up of

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35 Department of International Economic Affairs and Social Affairs of the UN, n.20, p.148.

technology centres at the sub regional and inter-regional levels and adoption of joint policy measures in specific fields of science and technology.[36]

The Organisation for Economic Co-operation and Development (OECD) has been encouraging the establishment of regional associations which have a direct bearing in science and technology in the South-South framework.[37] Another instance is the programme of `Economic Co-operation Among Developing Countries' - which has been incorporated by the UN Institute of Training and Research (UNITAR) - which has included, as identified by the G-77, technology industrialisation and technical co-operation. UNITAR, which is implementing the programme, is mandated to research on issues confronting implementation of the NIEO vide UN General Assembly resolution.[38]

The UN Industrial Development Organisation (UNIDO) mandated to promote and accelerate industrial development in the Third World carries out diverse activities and encourages South-South co-operation in science and technology. This includes technical assistance and

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36 UNCTAD Secretariat, "Economic Cooperation Among Developing Countries", ibid, pp.197-8; also see UNCTAD studies cited in bibliography.

37 Mtewa, n.31, p.28.

38 Laszlo, n.21, pp.94, 97.

technical co-operation through advise on right technologies and providing access to these and training personnel.[39] Among other UN agencies that contribute in different ways to the application of science and technology in diverse ways is the UN Economic and Social and Cultural Organisation (UNESCO). It is responsible for research education and training in basic sciences and for promotion of international co-operation in these fields.[40]

In most efforts by UN organs to foster co-operation among developing countries, the main focus is generally on trade and finance. The efforts in respect to science and technology have not attained the same status of the power. But in science and technology, they focus on low key, socially useful technologies. This is a welcome step since the aim is for social improvement and the target groups are generally the underprivileged.

These efforts are hampered by two factors. One is the lack of finance. This has been pointed out by a former UN executive while discussing UN efforts in promotion of

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39 Y.Nayudamma, "UNIDO in Building up Science in the South: A Discussion Paper" in A.Hammende, et al, eds., *South-South and North-South Cooperation in Sciences* (Singapore, 1986), pp.163-75.

40 A.Sorti, "UNESCO in Building up Science in the South", in Hammende, et al, eds., ibid, pp.226-8.

science and technology.[41] The second factor is the lack of effective Third World commitment to UN efforts. This ensures that most of the efforts under the agesis of the UN remain on paper only.

6.2 **Other Groups**

Through several bilateral and multilateral schemes, Third World states have made efforts to foster South-South co-operation in science and technology. One attempt to generate indepth research and local technology at the multilateral level is the establishment of the Central American Institute for Industrial Research Organisation that has been providing consultancy to member states both in the private and public sector.[42] There are some multilateral organisations (intended to improve production techniques) which have concentrated on dissemination of information, preparation of studies, conducting training and coordinating exchange of experience. In South America there are two such organisations: one is the private sector `Latin American Association of Industries of Canned and Related Goods' and the other is the public sector `Latin American Association of Government Oil Companies'. There are other such industry

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41 Mtewa, n.31, p.28.

42 Centre for Development Planning, Projections and Policies, "Salient Features of Economic Cooperation Among Developing Countries", in Ghosh, ed., n.20, p.61.

specific and comprehensive science and technology organisations although in terms of performance they have not attained significant success.[43]

The Arab League has its own subsidiary organ, `The Arab League Educational, Cultural and Scientific Organisation'. Though it has been mandated basically for cultural dimensions of co-operation, the organisation plays a crucial role in the creation of support systems and awareness of science in order to build up an environment conducive for carrying out more serious and specific co-operation in science and technology.[44] Another organisation, the Islamic Foundation for Science, Technology and Development - an organ of the Organization of Islamic Countries (OIC) - is primarily based on religion but covers mainly the Third World (the Muslim segment) in its scope. It undertakes activities in the areas of information, coordination of programmes, consultancy and science and technology for development, with the aim of promoting co-operation between the member states of OIC in science and technology.[45] There

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43 ibid, p.61.

44 A.A.Saket, "The Arab League Education, Cultural and Scientific Organisation", in Hammende, et al, eds., n.39, pp.184-5.

45 M.A.Kettani, "The Islamic Foundation for Science, Technology and Development", in Hammende, et al, eds., n.39, pp.190-1.

are science and technology dimensions in the co-operation programme of the Regional Co-operation for Development (RCD) comprising of Turkey, Iran and Pakistan. Besides these organizations there are a number of science academics and councils with interlinkages between them to promote South-South co-operation in science and technology.[46]

Though South-South co-operation in science and technology is being carried out through several modes, the results are not uniform. Generally it is only in bilateral and multilateral efforts to improve production through exchange of experts, interchange of experience and more significantly imparting of training that has proved highly effective. But where joint research and technology development is concerned, there has been no significant headway.[47] Similarly efforts at promoting inter regional co-operation in science and technology too has not achieved any success as has been the experience of the OECD.[48]

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46 See, R.S.J.B. Rana, "Problems and Expectations from South and South-North Cooperation Through Academies and Science Councils", A.K.Sharma, "The Federation of Asian Scientific Academies and Socieites", and other relevant articles in Hammende, et al, eds., n.39, pp.120-5, 131-5.

47 Centre for Development Planning, Projections and Policies, n.42, p.61.

48 Mtewa, n.31, p.28.

7. CONCLUSION

Technology and more particularly self-reliant technological policy, will continue to play a dominant role, more particularly with recent developments in international trade that have adverse implications for Third World. There are several emergent factors which the South will have to take note of in the 1990s. The major ones are:

- no hope for greater flow of resources from the developed countries;
- a mix of pressures and incentives from the North as a result of growing competition within the latter for markets and resources in the Third World region.[49]

This in turn will lead to efforts on the part of the North to destabilise regional grouping within the South which do not necessarily bear their stamp of approval. The South will have to ensure:

(a) that it generates its own resources and commits itself firmly to the implementation of South-South Co-operation in science and technology, and;

(b) that it unitedly resists pressures from the North. Attempting to stand alone and hoping to use differences with the North to its advantage can have adverse consequences, particularly so, since the North has shown that it can close

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49 Muni, n.19, pp.122-3.

its ranks to achieve its collective interests.

The foundation for any efforts at developing technology is a technologically oriented mass culture. This must be created through technological education which includes popularisation of technology to increase social consciousness of the importance of technology, technological societies and the technological community. In order to realise the full potential of technology for more technologically oriented education is necessary for all sections of the population. As UNCTAD puts it, building a `technology orient mass culture' "is a task which cannot be accomplished within a short time. It is imperative that these efforts be continuously expanded and strengthened."[50]

South-South co-operation must look beyond mere attainment of equity in science and technology, both internally and vis-a-vis the North. It must have a larger goal in constant upgradation and advancement of technology, making it more relevant for society and appropriate for Third World features. While equity within must be considered as a necessary corollary and means to the final goal, it must not be the final goal in itself. Each state in a regional grouping must ensure that it taps its full potential and shares the same in order to make the programme successful. The regional arrangement in turn must ensure that no member state shows any laxity in full utilisation of potential and falls to a lower level of technology base within the group.

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50 UNCTAD, *A Strategy for the Technologicial Transformation of Developing Countries*, TD/227/Rev.1 (New York, 1985), pp.19-20.

CHAPTER III

TECHNOLOGY BASE AND TECHNOLOGY POLICIES IN SOUTH ASIA

INTRODUCTION

South Asia, one of the world's most populous regions, is also one of the world's poorest region. The only resource of substance, which is also in turn a drag, is its human resources. In all other respects such as economic infrastructure, growth, industry, skilled labour and technology base, the region is poor and lags behind most of other regions of the world. This chapter will analyse domestic issues vis-a-vis science and technology in the region through a countrywise study of the member states of the South Asian Association for Regional Cooperation (SAARC). The first section would study in brief the economic characteristic and performance of these countries. The second section would study the science and technological base of these countries. The third section would study the general technology character of South Asia. This would be done through the stock of science and technical personnel, number of science and technology (S&T) institutions research and development (R&D) institutions and trends in S & T and R & D expenditure. The fourth section would study the policy issues and its implementation vis-a-vis science and technology and research and development. This would be followed by the chapter conclusion. This chapter is not exhaustive in nature essentially due to several lacunae in the data and information available on the South Asian countries.

1. **ECONOMIC PERFORMANCE**

An analysis of several economic indicators such as Gross Domestic Product/Gross National Product (GDP/GNP), GDP growth rate, sectoral contribution in GDP etc., present a dismal picture of the region. The GDP levels are some of the lowest in the world, though the growth rates are moderate.[1]

As seen in table 2.1, the high fluctuation in growth rates shows a very high degree of economic instability vis-a-vis economic performance. Similarly while Nepal and Bhutan are heavily dependent on agriculture, in the other states too agriculture is a dominant contributor to GDP.

The population figures for the region show the following highlights: (a) population figures except for Maldives is rising rapidly, (b) without exception, the major part of South Asia's people are rural based and (c) literacy

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1 See Table 2.1

levels are low in the region except for Sri Lanka.[2]

Within the region there are several diversities and disparities. In terms of economic status, as per the 1992 GNP figures, India alone accounts for 75 per cent of the region's GNP while Nepal, Bhutan and Maldives together account for a meagre 1.02 per cent. In terms of population too India has about 76.29 per cent of the region's population (in 1992). As per the United Nations Conference on Trade and Development's (UNCTAD) criteria of least developed countries (per capita GDP of US $100 or less, adult literacy of 20 per cent or less and share of manufacturing in GDP of 10 per cent or less) Bhutan, Bangladesh and Maldives are classified as least developed countries.[3] The others come under the category of developing countries.

TECHNOLOGY CHARACTER OF SOUTH ASIA

A common feature in the region is the problems that hinder the building up of an science and technology base though in varying degrees of magnitude and importance. These problems are low income levels, paucity of investible

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2 See Table 2.2.

3 UNCTAD, *Transfer and Development of Technology in the Least Developed Countries: An Assessment of Major Policy Issues*, UNCTAD/ITP/TEC/12, 17 August 1990, p.20.

funds, abundance of labour supply and poor scientific education. This leads to situation where the countries of the region are unable to launch a development strategy based entirely on high technology.[4]

The technology base of the region can be classified into two categories namely rural based and urban based technological base. The rural industrial sector of the region which is very important for the region has different levels of technology. The main form is traditional technology which is labour intensive, uses less of technology input and has a low labour productivity rate. The next form is intermediate level which is of moderate capital intensity and higher labour productivity. The third form is the modern levels of technology (of which there are very few cases) which is highly capital intensive and has a very high labour productivity.

In terms of labour absorption, traditional level of technology is the major employer. For example, in Bangladesh the traditional sector employs 77 per cent of sectoral employment, the moderate sector employs 15 per cent and modern highly capital intensive sector employs only

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4 Q.K.Ahmad, "A Regional Synthesis", in V.Kannesalingam, ed., *Appropriate Technology for Rural Industries: A Case Study of South Asia* (New Delhi, 1989), p.174.

about eight per cent.[5] In the urban industrial sector there is again the existence of all three levels of technology.

With reference to science and technology, the region can be divided into four categories according to the classification provided by a scholar in 1984.[6] India is termed as having institutionalized its science and technology capability with the capacity for self sustenance. Pakistan has been termed as partly institutionalized, Sri Lanka as `longshots' (meaning that the future of its science and technology is unclear). The other countries of the region are termed as non starters. Through any form of classification, India has established a long lead over its neighbours. The next major science and technology power in the region is Pakistan. Bangladesh, Nepal, Bhutan and Sri Lanka have created an inherent bias against domestic science and technology in favour of technology imports. Maldives is only in the first stages of modern nation building and therefore science and technology though important does not occupy top priority.

A glaring failure of the region is its lack of commitment to the process of developing appropriate

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5 ibid, pp.181, 185.

6 Aaron Segal, "Learning by Doing", Aaron Segal et al, *Learning by Doing: S&T in the Developing World* (Boulder, Colorado, 1987), p.17.

technology. This is essentially due to the lack of political will and the inherent preference for Western technology over indigenously developed appropriate technology. Similarly even comparatively superior and appropriate technologies developed in the South is ignored. But despite the preference for modern technology, the region has not been able to import latest levels of technology. The imported modern technologies are mostly those that are rendered obsolete in the West.

3. SCIENCE AND TECHNOLOGY BASE IN SOUTH ASIA

The process of estimation of a country's science and technology base and capabilities is not through any clear cut method. Several studies have provided and used different approaches. But generally the criteria of research and development expenditure, science and technology personnel and number of patents are followed. According to one study there are five ways for determining the existence and extent of science and technology capabilities.[7] These comprise:

(a) absolute and proportionate expenditure on research and development whereby .005 per cent of GDP is probably the minimum needed for national capability. Smaller sums

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7 ibid, pp.4-6.

devoted to limited sectors makes the country heavily dependent on external technologies for other sectors;

(b) educational infrastructure particularly higher technical education aimed at replicating and incrementing total national stock of scientists and technologists;

(c) a country can be said to have institutionalised its science and technology capability if it begins to export technology irrespective of the fact that it may be a net technology importer;

(d) contribution to world stock of patents and scientific knowledge;

(e) existence of applied research within the country in problems specific to local or national contexts.

Ideally an analysis of domestic science and technology capability must be attempted on these criteria. But due to the paucity of well documented and up to date data a thorough analyses of South Asian countries on the basis of this data is not possible. But what follows is a study based on available data of South Asian countries.

3.1 **Bangladesh**

The last estimate of Bangladesh's manpower with science and technology qualifications was carried out in 1983. As per this study the stock of science and technology qualified manpower was about 1,26,027[8] which is about 0.13 per cent of the estimated 1983 population of Bangladesh. There are about 60 research and development organisations in Bangladesh working under various ministries. The emphasis has been on agricultural sciences.[9]

In terms of expenditure, in 1988-89, research and development organisations spent 296.3 million taka out of the GNP of 114.2 billion taka.[10] This means that research and development expenditure in Bangladesh claimed about 0.26 per cent of the GNP. This is a marginal improvement over the 0.2 per cent of GDP[11] that the research and development sector accounted for before 1983.

3.2 **Bhutan**

Bhutan has not compiled comprehensive statistics on its science and technology manpower base. One study has

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8 The S&T manpower figure is from *The BMPC Manpower Bulletin* (Issue No.1) (Dhaka, 1984), p.88. The S&T manpower as percentage of population is derived from this figure and population data in Table 2.2.

9 *Survey of R&D Activities in Bangladesh* (Dhaka, 1990), p.50.

10 ibid, p.88.

11 Asia and Pacific Centre for Technology Transfer (APCTI), *Technology Policies and Planning: Bangladesh*(Country Study Series) (Bangalore, 1986), p.82.

estimated educational levels in Bhutan.[12] Assuming full employment in Bhutan, it is possible to infer data on science and technology manpower from the statistics on educational levels. Accordingly if the number of people with qualifications in B.Sc., B.E., M.Sc. and MBBS is taken, the science and technology manpower in Bhutan is 516 in 1984 of which Bhutanese nationals are only about 163 or 32 per cent. This is an indication of Bhutan's high dependence on foreigners for its science and technology manpower requirements. Similarly in two institutes - Royal Bhutan Polytechnic and Royal Technical Institute - for which 1989 data is available, out of the 52 teaching personnel, 24 are non-nationals."[13]

Bhutan has a polytechnic and technical institute, besides a veterinary institute, and an agricultural training and research centre.[14] In the field of science education, on a rough estimate out of 58116 Bhutanese students 498 or .89 per cent were undergoing science and technology

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12 W.J.Hilty, et al, *Report on National Manpower Survey* (Thimpu, 1989), p.11.

13 Planning Commission, Royal Government of Bhutan, *Sixth Five Year Plan 1987-92* (Thimpu, 1987), p.36.

14 Tshering Wangdi, "Science Policy in Bhutan", in A.Q.Kazi and Altaf A. Beg, eds., *Proceedings of SAARC Workshops on Science Policy, October 11-13, 1988, Islamabad* (Islamabad, 1989), p.20.

training.[15]

Of the net Plan outlay in Bhutan's Sixth Five Year Plan (1987-92) which is 778.76 million Nu, the outlay on technical institutes account for 31.92 million Nu or six per cent, while the technical education development accounted for five million Nu. or 0.93 per cent.[16] But there are no figures available for net research and development expenditure in Bhutan.

3.3 India

India has by any criteria an impressive lead in terms of science and technology base, capability and achievements, not just as compared to other South Asian states but the developing world as a whole. In 1980 India's net stock of science and technology qualified manpower was estimated at 2.5 million personnel and the annual addition to stock was about 0.15 million.[17] In 1985, the net stock of science and technology personnel stood at 3.139 million. In 1990 this rose to 3.809 million.[18] In this the economically active

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15 Planning Commission, n.13, p.34.

16 ibid, p.32

17 Ward Morehouse and Brijen Gupta, "India Success and Failure", in Segal, et al, n.6, p.204 also see table 2.3.

18 See Table 2.3

personnel was estimated at about 81.5 per cent of the net stock.[19] But in terms of the number of science and technology personnel per million of total population, the figure has been dropping.[20]

According to the 1982 data, out of 132,485 personnel employed for science and technology related activities, 54 per cent were employed purely in research and development activities.[21] This is an indication of India's efforts in, as mentioned before, building an universal science and technology base through research and development activities.

India also has a widespread network of research and development institutions. There were about 130 specialised research labs and about 600 inhouse research and development labs in the public and private sector. Over and above this there were 150 engineering consultancy organisations.[22]

Specific data on science and technology education enrollment is not available. Data released by the Planning Commission and the Department of Science and Technology (DST) give details on total university enrollment without any break-up with reference to the disciplines. Besides it

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19 *Research and Development Statistics 1992-93* (New Delhi, 1994), p.89.

20 See Table 2.3.

21 Morehouse, n.17, p.203.

22 ibid, p.204.

does not include private sector educational institutions awarding technical diplomas, but come outside the purview of the university education service (marine engineering, computer applications etc.)

research and development expenditure in India has shown an absolute growth throughout the past forty years.[23] Similarly the overall research and development expenditure, after showing a constant rise until 1985-86, appears to have reached a plateau when taken as a component of GNP. It has been steady at about 0.84 per cent since 1990-91. But given the average 3.1 per cent growth of GDP (at constant prices) from 1990-91 to 1992-93, it means that research and development expenditure (at 1980-81 prices) too is growing by around three per cent annually. The share of private sector's research and development expenditure has been growing steadily until it has evened out since 1990-91.

3.4 **Maldives**

Among the countries of the South Asian region Maldives can be seen as the most traditional and backward in terms of modern concepts such as economic diversity, higher and specialised education, science and technology et al. Its greatest handicap is its lack of geographic contiguity and

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23 See Table 2.4.

low concentration of people (spread out in islands). It therefore requires Maldives to build a large infrastructure (larger than all other South Asian countries) if it wants modern development on a national scale.

A distinct science and technology community in Maldives is practically absent. Its educational facilities are restricted to the intermediate level. The science curriculum in Maldives is therefore of a very basic nature. The only institutions that imparts science education is the `Science Education Centre' at the secondary level[24] and the `Training Centre' under the Ministry of Education. The latter conducts a variety of programmes in technical field which aims at meeting the training needs of the main sectors of the economy.[25] But as will be seen in the next section, this agency as other agencies in Maldives acts only as a liaison between foreign research bodies and their target segments in Maldives. The priorities vis-a-vis education in Maldives at present is to impart training in tourism and expanding formal education. science and technology education does not figure in its priorities at present.

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24 Ministry of Education, Republic of Maldives, *Education and Human Resource Development Plan 1985-1995* (Male, 1985), pp.18-19.

25 ibid. The source does not provide any data on education enrollment, future plans for expansion of S&T training or existing stock of S&T qualified manpower.

3.5 Nepal

In terms of stock of science and technology personnel in Nepal, data is available for different levels of skills for 1980 and 1985. For 1990 only the total stock of science and technology personnel is available.[26] There has been no compilation of personnel engaged in research and development alone, primarily due to the fact that research and development activities in Nepal are still in its infancy stage.

The data on the science and technology personnel has been divided into three categories of skills i.e., high, medium and basic, but the scope of each level is not given. It is the basic level of science and technology manpower that constitutes the major share in total stock of science and technology personnel, and therefore these figures may not be accurate. Taking into consideration only the middle and higher levels of skills, Nepal has seen a steady increase in science and technology personnel though it is not yet sufficient to meet the demand.[27]

The government in Nepal as in other SAARC countries has

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26 See Table 2.5

27 Narendra B.Singh, "Status of Science and Technology, Nepal", in *Proceedings of the National Conference on Science and Technology, April 24-29, 1988, Khatmandu, Nepal* (Khatmandu, 1989), p.64.

been the major employer of science and technology personnel. It accounts for 56 per cent while semi government agencies employ 31.9 per cent and about 12.1 per cent find employment in the private sector.[28]

Despite its low rate of industrialisation and low capacity to absorb technology, Nepal continues to face the problem of deficit vis-a-vis demand and supply of science and technology personnel. While the deficit in highly skilled personnel stood at 1283 in the Fifth Plan period (1975-80) it fell to 1226 in the Seventh Plan (1985-90). But at the middle and basic levels of skills, this deficit rose from 4,893 at the end of Fifth Plan (1975-80) to 8,788 during the Sixth Plan and subsequently fell to 7,386 in the Seventh Plan.[29] In overall terms the deficit which stood at 22.4 per cent of net demand during the Sixth Plan, dropped to 14.3 per cent during the Seventh Plan.

This decrease owes itself to the gradual increase in science and technology education in Nepal. At present there are seven trade schools, eight basic level and 35 certificate and degree level campuses in the country. But with reference to utilisation of potential Nepal has problems. As such student enrollment assumes a pyramidical

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28 ibid, p.64.

29 ibid, p.63.

structure with rates dropping sharply at higher levels. Similarly in terms of successful completion of courses the record is poor. For example, in 1987, at the certificate level, diploma level and degree level, out of total enrollment only 12.5 per cent, 7.1 per cent and 21.2 per cent successfully completed the course.[30]

Nepal has 143 institutions that are connected with science and technology as a whole. Within this about 47 institutions/organisations are involved with research activities. While those connected with agriculture are fairly well equipped, the others are not as well equipped. This is based on a study carried out in 1987.[31] The study has also identified 23 professional societies that are connected with science and technology.

Nepal's research and development budget in absolute figures has been growing steadily.[32] But as a component of total national budget, this is very low and constitutes only about 0.13 per cent of GNP. Since actual expenditure figures of Nepal are not available and therefore it becomes difficult to compare Nepal's research and development expenditure with other SAARC countries which stands at over

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30 ibid, p.65.

31 Singh, n.27, p.68

32 See Table 2.6

0.2 per cent of GNP. The sectoral distribution in Nepal's research and development budget is not balanced.[33] For example in engineering and agriculture its share has increase from 30 per cent to 33.4 per cent in the period 1980-87 while the share of medicine, transport, communication and construction is well below one per cent. Areas like transport, health and electricity were ignored until about 1984.[34]

3.6 **Pakistan**

In the case of Pakistan too there is the problem of availability of data. The data available is restricted to 1980-81. Pakistan's stock of science and technology manpower has been growing over the years.[35] But the average annual growth after showing an increasing trend between 1949-50 and 1974-75 showed a small decrease between 1975-80. Similarly the number of science and technology personnel per million of the population too has been increasing steadily.

According to another study,[36] Pakistan's stock of research and development personnel is estimated to be 4005

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33 See Table 2.7.

34 Singh, n.27, p.68.

35 See Table 2.8.

36 *Growth of R&D Manpower and Expenditure in Pakistan* (Islamabad, 1985),pp.8-9.

in 1973-74 and rose to 8000 in 1980-81, which do not match with official figures.[37] Therefore it is difficult to conclude precisely, Pakistan's human resources base engaged in research and development. Similarly a comparison of science and technology manpower and research and development manpower too is not possible due to lack of data for corresponding years.

The number of research and development organisations in Pakistan has witnessed a tremendous increase from six in 1974 to about 130 in the mid eighties.[38] But there is no data available on science and technology institutions as a whole. The major problem facing Pakistan with reference to research and development has been the bias among producers and customers in Pakistan, for foreign products and technology,[39] which hinders full utilisation of research and development potential, despite this impressive rise in number of research and development institutions. According to a study, Pakistan's research and development expenditure has been increasing at an average annual rate of 13.32 per

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37 See Table 2.9.

38 A.Q.Kazi and Altaf A. Beg, "National Science and Technology Policy in Pakistan", in Kazi and Beg, eds., n.14, p.85.

39 ibid, p.161.

cent at current prices.[40]

The allocation for science and technology in Pakistan in its Five Year Plans has been showing a rapid increase between the Fifth Plan (1978-83) when it was P.Rs. 1,830 million and the Sixth Plan (1983-88) when it was P.Rs.5083 million which is an increase of 177 per cent.[41] The allocation for research and development during the Seventh Plan (1988-93) rose to P.Rs.7042 million which was an increase of 38.5 per cent. During the Sixth Plan the allocation to science and technology was 1.81 per cent of net public sector outlay while during the Seventh Plan it rose to 2.01 per cent, which represents a marginal increase in the emphasis on science and technology. But in terms of actual utilisation of science and technology allocation, during the Fifth Plan it was about 79 per cent and 77 per cent during the Sixth Plan. This is due to the fact that while allocations are made, actual grants do not match this allocation. Over and above this is the fact that about 75 per cent of the total science and technology allocation is spent on establishment costs, leaving very little for actual

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40 APCTT, *Technology Policies and Planning: Pakistan* (Country Study Series) (Bangalore, 1986), p.106.

41 It is not clear from the source whether these allocations are at current or constant prices.

research.[42]

Sri Lanka: In Sri Lanka's case individual data on science and technology manpower is not available. But one study[43] estimates that between 1977 and 1984, the average annual increase of science and technology personnel is about 171. But the average annual output of science and technology trained human resources from universities during the same period is 645. This indicates that Sri Lanka faces an acute problem of high migration of trained science and technology personnel from the country, a trend it can ill afford.

The emphasis on research and development as can be seen from sectoral distribution of research and development expenditure has been an agricultural sciences and in terms of achievements too it has been research and development efforts in agriculture that has yielded maximum results. The public sector is the most dominant in research and development accounting for 93 per cent of research and development expenditure.[44]

The research and development expenditure as part of GDP

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42. A.Q. Kazi, "Analysis of S&T Component in Sixth and Seventh Five Year Plans", Science, Technology and Development (Islamabad), vol.7, no.5, September-October 1988, pp.48-49.

43 APCTT, *Technology Policies and Planning: Sri Lanka*(Country Studies Series) (Bangalore, 1986), p.153.

44 ibid, pp.149-53.

had been declining between 1959-60 and 1983-84, except for an increase during the period 1970-71 to 1975-76.[45] This is the result of Sri Lanka's policies vis-a-vis research and development as shall be seen in the next section.

4. SCIENCE AND TECHNOLOGY POLICIES IN SOUTH ASIA

In the South Asian region, given its traditionalism, backwardness and other problems, it is imperative that the state structures take the initiative for promoting development and utilisation of science and technology. Ideally this must be in the form of a comprehensive `Science Policy' that integrates all fields of science and all institutions within the countries. It must also ensure the total dissemination of knowledge gained. In this section the existing science and technology policies of South Asian countries will be studied.

Essentially, as outlined by a South Asian scientist, there can be[46] science policies with two broad focus which must be initiated in its logical order. Firstly the focus of science policy must be on development of science within the country emphasizing on the areas of weakness. After an

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45 See Table 2.10.

46 M.Anis Alam, "Possible Science and Technology Policies for SAARC Countries", in Kazi and Beg, eds., n.14, p.137.

adequate and comprehensive science and technology base has been built then the focus must shift to following a development strategy based on science, to reap the full advantages of the former process. But by far as will be seen in this section, South Asian countries are only in the first stage, with India as an exception, combining both. A discussion on the science and technology policy in the member countries of SAARC follows.

4.1 **Bangladesh**

Bangladesh had been born in the midst of a traumatic politico-security environment. Even after independence it was beset with several problems particularly political instability which hindered the process of initiating a comprehensive science and technology policy. The policy goal of constant technological upgradation has found a mention in successive Five Year Plans though this has not been seriously implemented partly due to the absence of a coherent and comprehensive national science and technology policy framework.[47] Eventually during the mid seventies, the process of formulating a national plan for science and technology policy was initiated. This science and

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47 Q.K. Ahmad, "Uprading of Technology for Rural Industries in Bangladesh: A Review of Experience", *BUP Occasional Papers* (Dhaka), no.1, February 1988, p.1.

technology policy was prepared and adopted in 1980.

The 1980 plan was not successfully implemented. But it generated among the national policy formulating authorities, a greater awareness of the importance of S&t. Subsequently the National Committee on science and technology was set up under the President of Bangladesh and was mandated as an apex body for all technology related decision making in the country.[48] The fact that it came under the President signified its enhanced status and coordinating powers.

The 1980 plan was followed by a new science and technology policy adopted in 1986 which aimed at raising the technology base of the economy through research and development and integration of technology with socio-economic planning, development of human resources and technical infrastructure and technical cooperation with other, particularly, developing countries.[49] But its achievements have not been assessed as yet and since detailed information is not available it is not possible to do so in this work. In the rural areas of Bangladesh government activities in research and development, with reference to technological upgradation, has been overshadowed by the increased involvement of public sector

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48 ibid, p.1.

49 ibid, p.2.

agencies and NGOs.[50]

Atiur Rehman in his assessment of Bangladesh's science and technology policy feels that an increasing dependence on externally aided development is ensuring that technologies inappropriate to the national needs is being imported. Genuine technology cooperation with other developing countries is being ignored under pressure from Multinational Corporations (MNCs) and institutional creditors. The existing kind of joint ventures in Bangladesh did not involve high technology inputs, nor did it generate high employment.[51] Another scholar has observed that Bangladesh's overdependence on external aid, is leading to large scale technology imports which leads to trade creation, but defeats the objective of encouraging cooperation with other developing countries for transfer of high technology and management skills to Bangladesh.[52] Thus Bangladesh through its policies of trade liberalisation and emphasis on increasing exports is ignoring the need to build a strong indigenous technology base and utilizing its human resources.

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50 ibid, p.2.

51 Attiur Rehman, *Political Economy of SAARC* (Dhaka, 1985), p.57.

52 H.G.A. Siddiqi quoted in ibid, p.57.

4.2 Bhutan

Bhutan is a country that for a very long time ignored all modern concepts of development and the importance of science and technology during its self imposed isolation until the fifties. In terms of developing indigenous science and technology, Bhutan lacks two major requirements. The first is of trained personnel particularly among its citizens. The second is the lack of internal funds or potential to mobilise the same. So Bhutan's science policy has had to incorporate two priorities. One was to develop a national human resource base and thus reduce its dependence on foreign science and technology personnel which at 1988 level stood at 68 per cent of the total science and technology educated population in Bhutan.[53] Two, to finance its science and technology policy the government has had to depend on and maximise its receipt of bilateral and institutional aid to finance technology related proposals.

The major goal of Bhutan is science and technology policy is for implementation of science and technology rather than creation or innovation. Even while the government recognizes the need to "...develop indigenous powers of investigation and a creative ability..." among the people of Bhutan, it avoids the need for pure research

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53 Willy, et al, n.12, p.11.

mainly due to lack of internal resources and the dire need for "...implementors rather than innovators or creators."[54] But despite the need to import most of its technology requirements the government has stated that it does not allow Bhutan to be a passive recipient of Western innovations and gear itself towards the needs of the West.[55]

Following this requirement, Bhutan's is `Division of Science and Technology' was created as a central agency for both monitoring domestic research and trial activities in various sectors and assessing foreign technologies most appropriate for Bhutan. For this the emphasis is on capital intensive technologies. This serves to overcome the domestic shortage of labour. It also helps boost exports by attaining international quality standards of the same[56] From this it is possible to infer that Bhutan has relegated the importance of indigenous development of science and technology. It has accorded preference to manpower training and importation of technologies responsive to Bhutan's needs.

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54 Wandgi, n.14, pp.20-21.

55 ibid, pp.20-21.

56 ibid, p.21.

4.3 **India**

The constant feature of India's science and technology policy over the past fifty years has been its basic goal orientation of being an integral part of national development. Until the present, India has had three stages in its science and technology development. Until the late sixties the emphasis was on building a diverse scientific capability base. From the seventies the efforts began to focus on certain sectors and is supported by specific planning. Simultaneously the importance of technology upgradation through intensive research and development was recognised as an important corollary to pure scientific research and the former too began to get the same attention as the latter.[57] In 1983 the Technology Policy Statement was released by the government. This was followed by the formation of several technology missions based on existing capabilities and infrastructure available, and aimed at disseminating technology in certain selected sectors particularly for short term basic needs.[58]

Among India's policy initiative in science and technology is the science and technology chapter in its Five

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57 Ashok Jain and V.P. Kharbanda, "Status of Science and Technology in India", in Kazi and Beg, eds., n.14, p.23.

58 ibid.

Year Plans. This involves the Planning Commission, government departments and other ministries involved in science and technology. Similarly since 1980 the states too are incorporating science and technology in their respective plans. Besides the Plans, there is the Science Policy Resolution of 1979 and the Policy Statement of 1983. Another important science and technology policy document is the report of the Science Advisory Council titled `An Approach to a Perspective Plan for 2000 AD.: The Role of Science and Technology' presented to the Prime Minister in the late eighties. There are also policy resolutions referring to other sectors of government activity and have a bearing on building up of scientific infrastructure and technology base in India.[59]

A study on India's science and technology has observed that India had outlined two basic incompatible objectives in its science and technology policy due to which the policy had to swing between these two objectives.[60] One was to meet the needs of its people and the other was to eliminate or diminish the dependent industrial and technical relationship vis-a-vis the West. Their conclusion is that while India has built a modern sector of its economy and

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59 ibid, pp.23, 26.

60 Morehouse, n.17, pp.189-90.

infrastructure in advanced technology that "enhances national political power", it has failed significantly in developing a technology base appropriate to its size and factor endowments. To infer that India's science and technology has suffered due to the above mentioned objectives being inherently incompatible is inaccurate. The real reason appears to be the wrong approach selected for the second objective, which made this objectives incompatible. Rather than concentrating seriously on appropriate technologies with efficient rural applications and high labour absorption capability, as these scholars have also stated, India concentrated on trying to develop indigenously the same kind of technology as available in West, which were not efficiently applicable in the context of rural India. But there are a few exceptions where non conventional rural technologies have been developed and yielded excellent results. These include biogas techniques, public facilities powered by solar energy and others.

As a whole, the actual achievements of India's science and technology development programme appear mixed. It is still dependent for designing and technological development. But it can add incremental improvements and design modification. It has also built an impressive indigenous technology base. But it has failed considerably in ensuring widespread dissemination of indigenously developed appropriate technology.

India has an extensive programme for technical assistance to other developing countries both within and outside the South Asian region which precedes the inception of SAARC. It has been an active participant in the multilateral aid programmes under the Colombo Plan, Asian Development Bank, ESCAP, Commonwealth Fund and Un programmes. Besides it has a initiated technical assistance on a bilateral level in the public and private sector with Bangladesh, Nepal and Bhutan. It has spent about Rs.9,936 million on bilateral assistance and Rs.99.3 million on multilateral assistance between 1950 and 1980.[61] Similarly India has been a major participant in SAARCs programme for science and technology cooperation as shall be seen in the following chapters.

4.4 Maldives

The thrust of Maldives' economic policy has been on tourism and fisheries which are the primary revenue generators. But it has realized that it needs to develop the internal sector of the economy particularly agriculture for economic survival.

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61 Ministry of External Affairs, Government of India, *Economic and Technical Cooperation Among Developing Countries: India's Views and Contributions* (New Delhi) MEA-86/XPO/Z/82, 1982, pp.52-53.

Maldives has a limited science and technology development plan which aims primarily at agriculture. It has established the support for `Agricultural Extension Services Project (MDV/88/005).' In this programme several field stations have been set up. These stations basically diffuse scientific inputs of agriculture into these islands. The Food and Agriculture Organisation has been assisting the Maldives Ministry of Agriculture by conducting extensive workshops on data collection, monitoring and statistical interpretation.[62] These are the only available information of science and technology in Maldives.

Given this primitive stage of science and technology there is no effort to formulate an science and technology policy and it may not materialise for a long time to come.[63] Similarly Maldives may have to assume the role of the biggest recipient in South Asia's programme for science and technology cooperation.

4.5 Nepal

Nepal for a very long time lacked any indigenous

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62 Ministry of Planning and Environment, Republic of Maldives, *National Development Plan 1991-93*, Vol.I (Maldives, 1990), pp.44-45.

63 Maldives had requested for expert assistance from SAARC member countries for formulation of its S&T policy. This has been discussed in the Chapter IV.

science and technology base or policy. It lacked any modern infrastructure or policy apparatus to launch an science and technology policy. Until 1975, its development programme centred only around solving immediate problems assisted by foreign aid and technology. It was only from the Fifth Plan (1975-80) onwards that the issue of science and technology manpower development was included in the rational development agenda. Science Policy had to wait until the Seventh Plan (1985-90) where science and technology was accorded a sectoral status, a policy statement and a separate development programme.[64] But even this was in a very rudimentary and loose form.

This trend in Nepal was mainly due to the fact that it failed to coordinate the isolated instances internal efforts link them with other socio-economic sectors and provide a well defined direction. In an attempt to redress these problems, the first draft of a comprehensive science and technology policy for Nepal was proposed for Nepal in 1988.[65] The main thrust of this proposal is at using science and technology to fulfill basic socio economic aims, improve quality and increase annual addition to net stock of

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64 Singh, n.27, pp.62-63.

65 Ratna S.J.B.Rana, "National Policy for Science and Technology of Nepal", in *Proceedings of the National Conference on Science and Technology*, n.20, p.9.

science and technology manpower. Technology creation was not recognised as an immediate priority.

Nepal continues to face problems vis-a-vis science and technology. Despite the existence of the 1988 policy and the fact that science and technology had been directly under the King, Nepal has not made much headway. It continues to rely on other countries particularly India and Japan for its technological requirements. Nepal has been expanding its science and technology stock of manpower though the entire demand for personnel has not yet been met.

Another problem faced by Nepal is in terms of resource mobilization. On this issue the 1988 policy places emphasis both on internal and external resources. In the latter both the programme for `Technology Cooperation among Developing Countries' (TCDC) and SAARC have been accorded special priority.[66] But it has still failed to considerably enhance internal resource mobilisation in order to accelerate science and technology development. Nepal also lacks the necessary political will and prefers the option of external dependence.

4.6 Pakistan

Pakistan's science and technology development has been

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66 ibid, p.9.

hindered considerably due to constant political changes. Each new government introduces its own policy changes. The process for the formulation of a comprehensive national science policy was begun in 1975 by the National Science Council. The policy document was prepared and adopted by the government in March 1984. It contained several recommendations on improving human resource development programmes, expansion of research and development facilities, etc. This was followed by the drafting of an `Action Plan' for its implementation.[67] But the recommendations in this policy are general in nature and appear more like an encouragement rather than a concrete programme.

Pakistan's Five Year Plans contain a section exclusively on science and technology with selected thrusts in the planning process which changes in every Plan. The priority areas in the science and technology sector of the Sixth Plan (1983-88) has been improving quality of human resources, creating conducive environments for research and development, and building up its institutional infrastructure. The Seventh Plan (1988-93) in addition to these priorities also aimed at ensuring requisite facilities

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67 S.M.A. Shah and Naeem Ahmad Khan, "Science and Technology Policy and Industrial Development", in Kazi and Beg, eds., n.14, p.160.

to ensure retention of domestic science and technology talent. The science and technology specific brain drain has been a major problem for Pakistan. Similarly it recommended that the National Centre for Transfer of Technology has to be strengthened and should provide better services.[68] The most notable achievement of the Sixth Plan was in ensuring qualitative improvement of human resources through extensive training.

The Ministry of Science and Technology, which acts as the secretariat for the `National Commission for Science and Technology' (NCST), is the apex body for science and technology research activities in the government sector. It presides over 12 science and technology organizations, ensures expansion of research and development efforts carried out in the country and provides guidelines for development of an integrated system of science and technology and its utilisation for socio-economic goals. The `National Centre for Technology Transfer' acts as a data bank of available technologies, for other ministries.[69]

Pakistan has a considerable science and technology base, though it is concentrated in certain sectors. Its weakness lies in lack of inter industry and public-private

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68 Kazi, n.42, pp.48-49.

69 Kazi and Beg, eds., n.38, pp.84-85.

sector ties, neglect of appropriate technology and the brain drain to Middle East and the West.[70] Though this brain drain is viewed as favourable in Pakistan due to the forex receipts, in the long run, drain of specialised skills seriously impairs indigenous development of science and technology.

Pakistan has set up Joint Economic Commissions (JEC) with all the SAARC countries. These JECs had at different points of time, identified and recommended specific proposals for technical cooperation.[71] But for several reasons, the main being bureaucratic tangles, these have failed to materialise. The only concrete results are imparting of some training facilities for Sri Lanka's textile technologies and consultancy work for Maldives, Nepal and Sri Lanka, which can be considered negligible. The official stand of Pakistan is that due to several reasons, the main one being a common dependence of modern Western technology, and existence of similar technologies, the potential for science and technology cooperation in South Asia is very low. But it also feels that sharing of experience in the region is mutually beneficial. Pakistan

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70 Segal, n.6, p.9.

71 For details on proposals for S&T cooperation see Planning Commission, Government of Pakistan, *Economic Cooperation Among SAARC Countries* (Islamabad, 1990), pp.69-73.

supports the need for the preparation of technology profiles of South Asian countries and devising a common policy on technology transfer.[72] Pakistan's reluctance to encourage science and technology cooperation in the region probably stems from the fear that since "Relatively speaking India's reliance on South Asia has been the least..."[73] India is on the most advantageous position to dictate the direction and reap maximum advantages from this cooperation which need not necessarily be of economic or technological in nature but politico-strategic. This fear will be discussed in detail the following chapters.

4.7 **Sri Lanka**

Sri Lanka's process of indigenous science and technology development has been overshadowed to a large extent due to its policy of industrialisation based on foreign inputs. Despite the fact that Sri Lanka was one of the earliest states in the region to set up an research and development institute (CSIR which was established in 1955) there were no serious efforts to develop indigenous research and development. Following pressure from the domestic science and technology community, the National Science

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72 ibid, pp.74-75.

73 ibid, p.77.

Council (NSC) was set up in 1965. It proved to be ineffective. This step was followed by the establishment in 1966 of the Industrial Development Board to act as a link between research and development institutes and industry though it too proved to be a failure. In 1976 an UNCTAD mission had recommended measures for indigenous development of science and technology but it was largely ignored.

It was only after 1978 that the political executive began to explicitly recognise the importance of science and technology and efforts to prepare a National Science Policy Plan and Implementation Document were launched. A major step in the development of indigenous science and technology was in 1982 when the National Science Council was brought under the President and was given more powers.[74] Efforts for the formulation of the `National science and technology Policy', which began in 1984, received a set back when the draft of the document was rejected by the government due to several inherent lacunae.[75] Hence Sri Lanka is still without an officially documented national science and technology policy.

The major thrust in Sri Lanka's science and technology

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74 APCTT, n.43,pp.21-23, 25-29.

75 L.C.A. de S.Wijesinghe and R.P. Jayawardene, "Formulation of Science and Technology Policy in Sri Lanka", in Kazi and Beg, n.14, p.99.

policy has been in using it for maximisation of exports which requires incorporation of modern science and technology originating in the West. This has ensured that indigenous efforts at building an science and technology base, particularly in research and development, has received a set back. An exception is the agricultural sector which has a small research and development base. The thrust of Sri Lanka's science and technology policy has been emphasised in the 1984 budget speech of the Finance Minister who stated that the aims of science and technology policy is to maintain adequate links with technological development abroad so that our export capability is not undermined by outdated technology."[76] Similarly Sri Lank's science and technology development also suffers from financial biases as in other South Asian states. Most of the science and technology programmes have evolved only after financial considerations.

A study has also concluded that so far, Sri Lanka's attempts to coordinate science and technology efforts have failed and therefore, it was advisable to concentrate on individual sectors working independently. Regarding the formulation and implementation of a comprehensive science and technology policy the study points out that Sri Lanka,

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76 APCTT, n.43, p.44.

rather than taking the initiative, must observe the approaches and results of other SAARC countries efforts before taking any step.[77] Thus it appears that Sri Lanka also follows the same policy vis-a-vis science and technology as that in Nepal and Bhutan, though it had initiated this trend in the region. Sri Lanka has also recognised the need to cooperate with other countries of the region in science and technology though it has not committed itself substantially to this approach.

5. CONCLUSION

All the states of the region have very low science and technology base. Even India which in quantitative terms is one of the largest science and technology powers in the world and has the third largest research community, has a poor base when related to the size of its population. The science and technology status of the SAARC member countries cannot be compared primarily due to lack of comparable data.

All the countries signify the great importance they attach to science and technology by placing it directly under the head of government. But even this strategy has proved to be a failure due to lack of genuine commitment on the part of the state structure. This in turn is due to the

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77 L.C.A. de S.Wijesinghe, n.75, p.102.

fact that, except India to a certain extent, no other state has a distinctive economic nationalism, a factor that is primarily responsible for generating state will power in ensuring rapid indigenous science and technology development with the goal of a high degree of self reliance.[78]

There is an inherent bias in the regions both on the part of the state and its people for anything including science and technology originating in the West. This is seen most distinctively in Nepal, Pakistan and Sri Lanka. These countries also share a lack of strong administrative and institutional infrastructure to ensure effective dissemination of indigenous technological creations innovations.

Efforts made, if any, to formulate science and technology policies on a rational scale and initiate science and technology cooperation at the regional level is hampered by the lack of well documented information and data on existing base and capabilities. There are efforts being made in SAARC to redress this (as will be seen in the next chapters) but they still pose a serious problem.

There are some positive features vis-a-vis science and technology in South Asia. First as that the quality of its

78 The experience of all the technologically developed countries and the case of India, Argentina and China (at different points of time) bears out this hypothesis.

science and technology personnel is comparable to that in the West. There is a large base of South Asian science and technology professionals working with distinction in the West. This is more so with India, Pakistan and Sri Lanka. Similarly the region has a base of traditional technology which can help in building an `appropriate technology' base. Thirdly the existence of a regional cooperation arrangement creates a potential for common development of science and technology.

Thus as seen in the chapter it is with certain positive features, with several problems and with inherent biases that the seven countries of SAARC have launched the programme for cooperation in science and technology. How has this programme fared will be seen in the next two chapters.

TABLE : 3.1
SOUTH ASIA : GROSS DOMESTIC PRODUCT INDICATORS

SL.NO	COUNTRY	GDP (Per Capita)in US $			GDP growth Per Annum(%)			GNP(1992) in US $	Share of Agricul-ture in GDP (1992)in % ages
		1980	1990	1991	1980	1990	1991		
1	2	3			4			5	6
1	BANGLADESH	139	182	187	1.2	6.6	3.4	24672	34
2	BHUTAN	118	183	142	NA	4.9	5	263	42
3	INDIA	254	355	278	6.6	5.6	1.3	271638	32
4	MALDIVES	269	574	655	NA	16.2	7.6	114	NA
5	NEPAL	133	158	134	-2.3	6.1	5.5	3285	52
6	PAKISTAN	286	349	358	7.3	4.7	5.6	49477	26
7	SRI LANKA	257	465	504	5.7	6.2	4.3	9459	26

Source:
1. Economic and Social Commission For Asia Pacific.Statistical Indicators for Asia and the Pacific(New York) Vol XXIII. No.4.December 1993 and
2. World Bank Atlas 1994 (Washington D.C)

TABLE : 3.2
SOUTH ASIA : POPULATION STATISTICS

SL NO	COUNTRY	MID YEAR POPULATION (in Million)				DISTRIBUTION OF POPULATION(in %)		ADULT LITERACY Rate(1991) in %	
		1895	1990	1991	1992	RURAL	URBAN	MALE	FEMALE
1	BANGLADESH	82.58	113.01	116.44	119.29	83.0	17.0	47.1	22.0
2	BHUTAN	1.53	1.54	1.57	1.61	94.0	6.0	51.0	25.0
3	INDIA	750.86	827.06	844.32	890.00	74.0	25.7	61.8	33.7
4	MALDIVES	0.18	0.22	0.22	0.23	73.8	26.7	93.0	93.0
5	NEPAL	16.32	18.11	18.49	18.88	90.8	9.2	37.6	13.2
6	PAKISTAN	96.18	112.05	115.52	119.11	71.8	28.2	48.8	22.1
7	SRI LANKA	15.84	16.99	17.25	17.40	78.5	21.5	93.4	83.5

Source:
Economic and Social Commission For Asia and Pacific, Statistical Indicators for Asia and the Pacific(NewYork).Vol.XXIII, No.4,December 1993

TABLE : 3.3

INDIA : STOCK OF SCIENCE AND TECHNOLOGY PERSONNEL

YEARS	NET POPULATION (in Million)(#)	STOCK OF S&T PERSONNEL (in Million)	S & T PERSONNEL (per million population)
	1	2	3
1980	675.00	2.500 (*)	270
1985	750.86	3.140 (@)	239
1990	827.06	3.809 (@)	217

Source:

(#) = Estimates from, Economic and Social Council for Asia Pacific, Statistical Indicators for Asia and the Pacific (New York) Vol.XXIII, No.4, December 1993.

(*) = Ward Morehouse and Brijen Gupta, India: 'Success and faliure' in Aaron Segal et.al, Learning by Doing: Science and Technology in the the Third World.(Boulder,Colorado:Westiew Press,1987)

(@) = Research and Development Statistics 1992-93(New Delhi: Department of Science and Tecnology, Government of India, 1994)

TABLE : 3.4
INDIA : RESEARCH AND DEVELOPMENT EXPENDITURE TRENDS

(Rs in Crores)

YEARS	R&D EXPENDITURE Govt Sector	R&D EXPENDITURE Private Sector	TOTAL (Rs)	SHARE($)	GNP(*) (Rs)	R&D EXP as %age of GNP
	1	2	3	4	5	6
1955-56	12.14	n.a	12.14	0.00	9707	0.13
1965-66	65.96	2.43	68.39	3.55	23899	0.29
1975-76	314.39	42.35	356.74	11.87	70946	0.50
1985-86	1816.84	251.94	2068.78	12.18	232370	0.89
1990-91	3424.19	549.98	3974.17	13.84	468059	0.85
1991-92	3875.87	636.94	4512.81	14.11	540143	0.84
1992-93	4369.87	771.77	5141.64	15.01	616504	0.83

Note :
($) = Share of private sector R&D in Total R&D Expenditure (in Percentages)
(*) = GNP at Current Prices

Source :
Research and Development Statistics 1992-93 (Department of Science and Technology, Government of India, 1994)

TABLE : 3.5
NEPAL : STOCK OF SCIENCE AND TECHNOLOGY PERSONNEL

YEARS	S&T PERSONNEL	AVER. ANNUAL INCREASE(%age)	POPULATION (@)	S&T PERSONNEL (#)
	1	2	3	4
1980	19975	n.a	14.63	1365
1985	30674	10.80	16.32	1880
1990	44146	8.90	18.11	2438

Note :

(@) = Mid Year Estimates (in Million)
(#) = Per Million of Population

Source:

(1) APCTT, Technology Policies and Planning : Nepal(Country Studies) (Bangalore : APCTT,1986)

(2) Population estimates are from ESCAPP, Statistical Indicators for Asia and Pacific (New York) Vol.22, No.4,December 1993.

TABLE : 3.6
NEPAL: RESEARCH AND DEVELOPMENT BUDGET

(in Nepal Rupees '000)

YEARS	TOTAL R&D BUDGET	%AGE GROWTH (ANNUAL)
	1	2
1981-82	4,27,49	
1982-83	12,53,25 (#)	193.00
1983-84	n.a	
1984-85	5,54,43	27.5 (*)
1985-86	6,53,93	14.00
1986-87	7,63,91	20.10

Note:
(#) = This sharp increase is due to a heavy budget allocation for petroleum works.

(*) = Average annual growth (negative) between 1982-83 and 1984-94

Source:
Compiled from S.R Adhikari and M.Ranjit, *An Analysis of R&D Expenditure in Nepal* (Khatmandu: National Council of Science and Technology, 1987)

TABLE : 3.7

NEPAL : RESEARCH AND DEVELOPMENT EXPENDITURE (SECTOR WISE)

SL. NO	SECTORS	1979 -80		1984 -85	
		R&D EXPENDITURE	%AGE OF TOTAL	R&D EXPENDITURE	%AGE OF TOTAL
	1	2	3	4	5
1	ENERGY	1,000	5.5	76,999	71.8
2	MANUFACTURING	16,383	90.0	23,431	21.9
3	TRANSPORT	823	4.5	3,496	3.3
4	COMMUNICATION	N.A	-	3,293	3.1
5	TOTAL	18,206	100	1,07,219	100

Source:

APCTT, Technology Policies and Planning : Nepal (Country Studies Series)

(Bangalore : APCTT, 1986)

TABLE : 3.9
PAKISTAN : RESEARCH AND DEVELOPMENT MANPOWER

YEAR	RESEARCH AND DEVELOPMENT MANPOWER			R&D MANPOWER PER MILLION POPULATION
	SCIENTIST AND ENGINEERS	TECHNICIANS	TOTAL	
	1	2	3	4
1964-65	1200	n.a	1200	35 (*)
1970-71	2199	2140	4339	58
1972-73	2499	2775	5274	63
1980-81	5144	6476	11620	62
1982-83	5397	7138	12535	60

Note: (*) = as in original source
Source: ibid

TABLE : 3.10

SRI LANKA : RESEARCH AND DEVELOPMENT EXPENDITURE.

YEARS	R&D EXPENDITURE(*) (at Constant Prices)	R&D AS %AGE OF GDP
	1	2
1951-52	8.2	0.17
1959-60	18.2	0.29
1965-66	17.6	0.23
1970-71	15.6	0.18
1975-76	22.7	0.21
1983-84	28.9	0.14

Note: (*) = Base year not given in the source.

Source: APCTT, Technology Policies and Planning: Sri Lanka (Country studies series) (Bangalore:APCTT,1981).

CHAPTER IV

SCIENCE AND TECHNOLOGY IN SAARC: SOME ISSUES

Introduction

After having studied the broad gamut of issues in the programme of South-South co-operation and the science and technology base in South Asia, this work now turns to the South Asian Association for Regional Co-operation (SAARC). There are several issues involved in SAARC's programme of science and technology co-operation. These arise primarily from the national policy stands of the member countries and the regional component of their foreign policies. Similarly the economic, scientific and technological environment in the region also offers potential and poses constraints to the process of co-operation in science and technology. This chapter will focus on these issues. Section one will briefly discuss the concept and inception of SAARC. Section two will study the institutional framework in SAARC which guides the co-operation process. This holds relevance for all sectors of co-operation in SAARC and includes science and technology. The potential for co-operation will be discussed in section three. Section four will discuss the constraints to co-operation arising from the regional environment and the nature of SAARC. Section five will discuss the various modes of co-operation which can be adopted by the SAARC in its programme for science and technology co-operation. Section six will discuss specific areas of science and technology co-operation as identified by academics and science and technology professionals of the region. Section seven will comprise the chapter conclusion.

1. SAARC: CONCEPT AND INCEPTION

Despite the abundance of internal hostility and tension within the region, South Asia has been hearing of proposals for regional co-operation since several decades. By the mid-seventies regular discussions among the intellectuals and scholars of the region, led to various ideas on facing the common economic, social and political problems. The formation and activities of the Committee on Studies for Co-operation and Development in South Asia (CSCD), a forum set up in 1978 by scholars of the region, too went a long way in propagating the idea of regional co-operation in South Asia.

In May 1980 President Zia-ur-Rehman of Bangladesh first proposed the idea of a summit meeting of South Asian leaders to discuss possibilities of regional co-operation. But since this proposal had expressed security policy issues it met with scepticism. Subsequently in November 1980 a modified proposal focussing only on economic issues provided the base of discussions for regional co-operation which were carried out at the level of Foreign Secretaries.[1] Subsequently, areas for co-operation were identified and special working groups were set up. In August 1983 a formal programme was set up, through the adoption of the Delhi Declaration, and termed as South Asian Regional Co-operation (SARC). This programme of co-operation was institutionalised as the South Asian Association for Regional Co-operation (SAARC) during the first summit level meeting of South Asian Heads of State/ Government in Dacca, 1985.

Five areas of co-operation were first identified in the Foreign Secretary level meeting of April 1983. Subsequently four more areas were identified. In April 1983 as per the Delhi Declaration the Integrated Programme of Action (IPA), which now comprises 13 broad areas of co-operation, was launched. Science and technology is one of these areas of co-operation.

2. FRAMEWORK FOR CO-OPERATION

As laid out in the SAARC Charter, there is four tiered institutional framework for carrying out co-operation. At

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1 Pran Chopra, "SAARC and the Assymetry Issue", in Ponna Wignarja and Akmal Hussain, eds., *The Challenge in South Asia: Development, Democracy and Regional Cooperation* (New Delhi, 1989), p.326. Also see, Christian Wagner, "Regional Cooperation in South Asia: Review of SAARC", *Aussen Politik* (Hamburg), vol.44, no.2/93, second quarter, 1993, p.186.

the base is the Technical Committees set up for each area of co-operation included in the IPA. The members are both career diplomats and professionals in the specified area of co-operation. The proposals for co-operation are first discussed by these Technical Committees and programmes are formulated. Subsequent to the approval of these programmes by the higher decision making bodies of SAARC, the Technical Committees are entrusted with the responsibility of monitoring the implementation of these approved programmes. Parallel to these committees is the Programming Committee which prepares the annual programme for co-operation. These Committees report to the Standing Committee of Foreign Secretaries, which is the main body for regulating co-operation in SAARC.

Next in the institutional hierarchy is the Council of Foreign Ministers. The supreme authority in SAARC is the summit level comprising of the Heads of State/Government which the highest level of decision making.[2] The principle of unanimity applies for the approval of any programme for co-operation and at any level of SAARC's institutional structure. The SAARC Secretariat at Kathmandu has the mandate to conduct overall coordination and implementation of SAARC activities. A representative of the Secretariat is

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2. SAARC, *SAARC in Brief* (Khatmandu, 1994), pp.3-4.

present at each meeting of SAARC and its committees.[3]

3. POTENTIAL FOR SCIENCE AND TECHNOLOGY CO-OPERATION

From the discussions in the preceding chapter it is evident that the region as a whole is backward in science and technology as compared to the developed countries. The region also faces the problem of what can be termed as technology stagnation. A scholar terms it as hi-tech stagnation i.e., a phenomena where the countries of the region - who are anywhere between 60 to 200 years behind the developed countries in terms of science and technology are attempting a direct transformation from the bullock cart age to the space age throughout their forty years of independent existence. Technologies appropriate to their present phase of development have been developed (to a certain extent) in areas like sugar, jute textiles et al. In the process of the development of these, several experiences have been learnt by individual countries which can be shared by them.[4] This can guide the future of the technology development programmes in the countries of the

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3. SAARC, *Memorandum of Understanding on the Establishment of the Secretariat* (Kathmandu, n.d.), p.2.

4 M.Venkata Rao, "Potentialities and Constraints in Economic and Trade Cooperation", in Arif A.Waqif, ed., *Economic and Sectoral Cooperation in South Asia* (New Delhi, 1993), p.156.

region. The third factor is the great degree of technological disparity within the region. Undoubtedly India, as seen in the previous chapter, is the leader not just in the region but in the South as a whole. India has been identified as a country that con contribute substantially to the programme of South-South co-operation in science and technology.[5]

India's advantage is in the fact that it has attained a series of breakthroughs in technologies with characters that make it appropriate to the Third World context. These characters include high utilisation of local resources, generation of greater linkages with other sectors and adaptability to Third World conditions. More important is that Indian technology supplied to Third World states are generally indigenised and adapted to the latter's requirements.[6] The National Research Development Co-operation markets these technologies. These technologies

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5 Official recognition of India's potential has been accorded by NAM in its fifth meeting where India was designated coordinator for cooperation in science and technology. Similarly there have been other recognitions. For details see, Basabi Bhattacharya and Satanu Bhattacharya, "South-South Cooperation in Technology: A Sub-Regional Approach in SAARC Perspective", in D.K.Das, ed., *SAARC: Regional Cooperation and Development* (New Delhi, 1992), p.200.

6 I.N.Mukherji, "Economic Constraints and Potential", in Bimal Prasad, ed., *Regional Cooperation in South Asia: Problems and Prospects* (New Delhi, 1989), pp.104-5.

can be used in the small scale sector and with a rural orientation. The inputs are generally agro-based, utilise wastes, employ high amounts of labour, are simple to operate and with low gestation periods. More important, the capital requirements for these technologies are comparatively low.[7] Pakistan too has a small base of technologies that are suitable for transferring to other South Asian countries. Similarly, Bangladesh, India, Pakistan and Sri Lanka have the required base to impart science and technology training, though at different levels of specialisation. This differential level of science and technology base in the region provides the potential for co-operation.

4. CONSTRAINTS TO SCIENCE AND TECHNOLOGY CO-OPERATION

The issues discussed in this section are general in nature which has implications for regional co-operation as a whole and in the process also inhibits science and technology co-operation. The most important constraint to co-operation in South Asia is the conflictual relationship between India and Pakistan. It would be a mistake to assume that this conflict is limited to the regional security environment alone. It has percolated down to all levels of

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7 R.A.Rao, "India's Opportunity for Regional Cooperation in Technology Transfer Among South Asian Countries", in *An Anathology of Papers Read Out in Various Seminars on SAARC* (Dacca, 1985), pp.373-4.

regional interaction. Attempts to gloss over the shadows cast by political tensions on economic relations (with implications for science and technology) will only lead to a faulty assessment of the potential for co-operation.

An indication of this problem is available from the state of bilateral science and technology co-operation between India and Pakistan. The first meeting of the Indo-Pakistan Joint Economic Co-operation (JEC) in 1987, identified eight areas where India could supply technical co-operation.[8] But in an official publication, Pakistan claims that it has whatever technologies India has offered, while India has not responded to Pakistan's technology offers.[9] As a result of such positions being taken, it was inevitable that the JEC has not been able to achieve anything concrete in terms of science and technology co-operation.[10] This stalemate is not just restricted to bilateral relations alone, but also, as shall be seen in the next chapter, affects the progress of science and technology co-operation in SAARC too.

The fluctuations that marks India's relations with

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8 H.S.Tandon, "Indo-Pakistan Trade and Economic Cooperation", in Waqif, ed., n.4, p.207.

9 Planning Commission, Government of Pakistan, *Economic Cooperation Among SAARC Countries* (Islamabad, 1990), pp.74-75.

10 H.S.Tandon, n.8, p.207.

other countries of the region also casts its shadow on science and technology co-operation. They, rightly or wrongly, have concluded that India uses its advantages in terms of military and political strength to impose its hegemony in the region. As a corollary they also suspect the intentions behind India's role in science and technology co-operation given its formidable lead in science and technology.

A distinctive cleavage in SAARC (which is not openly expressed in public) is the issue of generating resources to finance co-operation. India has its reservations about certain modes of finance envisaged by some member countries, since it implies utilisation of extra-regional funds. This can lead to external manipulation of regional co-operation programmes. India had proposed, in 1986 during the Bangalore summit a regional fund for SAARC. This was opposed by some members.[11]

In 1987, Bangladesh proposed a multi-sectoral investment institution on the model of the Asian Development Bank, to finance the regional co-operation programme. India opposed this proposal on the grounds that it would negate the importance of achieving regional self-reliance. The Indian delegation in the 1987 Standing Committee meeting

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11 Nancy Jetly, "Emergence of SAARC", in Prasad, ed., n.6, p.73.

also pointed out that it would circumvent Art.9 of the SAARC Charter whereby each case of external funding had to be examined and approved by the Council of Ministers.[12] Similarly the Standing Committee as a whole was of the opinion, that all institutions set up by SAARC had to confirm to the SAARC charter and the respective policies of the member countries.[13] Given the different national policy approaches to external funding in the region, this investment institution, if set up, could never confirm to these guidelines. A change in India's national policy approach to external funds which is discernible since the late eighties, has now paved the way for external funding of SAARC programmes.

The implications of this disagreement was also felt in the programme for co-operation in science and technology. An initial offer of EC assistance in this sector was not utilised primarily due to India's stance on the issue.[14] But, in 1993 the SAARC-Japan fund was set up and it now finances co-operation activities in SAARC which also

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12 *Financial Express* (New Delhi), 30 October 1987.

13 *Deccan Herald* (Bangalore), 30 October 1987.

14 This has not been documented but it can be inferred. It was during this phase that India was talking about regional self-reliance, which in effect meant the exclusion of extra regional funds.

includes science and technology. India has concurred with this decision. So the issue of finance no longer poses a serious constraint, though India is not agreeable to unrestricted and uncontrolled soliciting of extra-regional funds for SAARC activities.

5. MODES OF CO-OPERATION

Among the countries of SAARC there is, as discussed before, the fear of Indian domination, which is more so in the area of science and technology. There is the fear that since India, given its base, can act only as a contributor in the co-operation process there is the danger of other countries particularly Nepal, Bhutan and Maldives, becoming technologically dependent on India. Therefore, in order to be effective in the long run, regional co-operation in science and technology in SAARC must first focus on the issue of building up an indigenous science and technology and research and development base in each member country. This requires that the main instrument of co-operation must be training programmes.

Co-operation with the goal of building up an indigenous base for science and technology and research and development can be carried out in several ways. The most effective and immediate form is organisation of training programmes of varying duration. It can be supplemented by imparting formal science and technology education to people of one country in the educational institutions of other countries. Organisation of workshops and seminars in a regular manner can help in keeping science and technology personnel of the region aware of developments in member countries. It also increases the interaction between the science and technology personnel of the region.[15]

At the present stage where all countries of SAARC are net importers of technology, co-operation can be carried out in the sector of technology imports, in various dimensions. The first is the establishment of a regional `Technology Monitoring and Intelligence Cell'.[16] Such an institution can keep a track of technological developments all over the world. It can function as an assessment body for technologies intended for importing into the region. Since some countries of the region lack the required expertise to comprehensively assess and evaluate modern technologies from extra regional sources, the services of trained personnel of other countries can be utilised through such an institution. Similarly the information and experience of alternative technologies and suppliers, available in the region can be

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15 M.Masihuddin, "Regional Cooperation in Science and Technology", in Arif A.Waqif, ed., *South Asian Cooperation in Industry, Energy and Technology* (New Delhi, 1987), p.233.

16 Falguni Sen and VLVSS Subba Rao, "Scientific and Technological Cooperation Between South Asian Countries: Some Issues", in Waqif, ed., n.15, p.226.

exchanged. A scholar while discussing the potential for economic co-operation in the region has put forward the idea of the creation of a `Secretariat for Economic Co-operation'. Within this, he suggests that there should be a `Technology Exchange Department'. This department can pass on to all member countries the experience gained by individual countries in the process of developing their technologies[17] (discussed earlier in this chapter). In cases where several countries of the region have similar technology requirements, joint acquisition can be conducted. This can lead to reduction in prices due to joint bargaining and higher volumes of purchase. It can also lead to relaxation of the terms and conditions attached to such deals, particularly through transfer of technology and licence for subsequent production. Another function of the cell can be to help ensure that the countries of the region are not at the risk of quick obsolescence of imported technologies by gathering information on impending introduction of improved versions.[18]

In several instances, adaptation and assimilation of imported technologies is difficult due to the lack of the required technical infrastructure and management

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17 Rao, n.4, p.156.

18 ibid, p.226.

capabilities. This can be overcome through pooling of regional skills in adaptation, assimilation and management of imported technology. It can also be extended to co-operation in the maintenance of imported technology. Maintenance costs of sophisticated technologies is very high and more so when carried out by firms of developed countries. Similarly development and production of maintenance equipment may not be possible for a single national market. A common policy on maintenance also expands the market for maintenance equipment through which the development and manufacture of these equipment within the region becomes economically viable.[19]

The base for the next stage of co-operation is reached when each country of SAARC has built its science and technology base and inhibitions of technological dependence recede on account of greater confidence in indigenous capabilities. In this stage regional co-operation in science and technology can be carried out in its true sense. The first step would be the preparation of an `Inventory of Capabilities'[20] in the region. This would involve the exchange of scientific information, material and technology designs. This would help formulating regional demand in

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19 ibid, pp.226-7.

20 ibid, p.227.

tune with the technologies available in the region. Similarly, exchange of information on research and development being conducted in the region can help in the technology planning process.[21]

Transfer of technology within the region could be initiated first in essential services such as flood control, ground water surveys, oil exploration, public utilities, etc.[22] These are areas where the social impact is greater than other sectors such as industrial and consumer technology. Once this mode of co-operation is consolidated and psychological barriers are brought down, science and technology co-operation can be extended to industrial technology. Parallel to this process, collaboration and joint research projects can be undertaken. The focus could be on common problems facing the countries of SAARC.[23]

Co-operation in support services too are essential to ensure smooth flow of science and technology personnel, knowledge and technology transfer. Among these support services are financial arrangements, transport and communication.

Co-operation can be carried out in three institutional

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21 ibid.

22 ibid.

23 ibid.

levels. The first is through establishment of specialised regional institutions. These institutions could act as research and development agencies or collecting and disseminating information of science and technology and research and development of individual SAARC member states. The second is through multilateral arrangements such as study groups and specialised committees, which can identify, initiate and monitor co-operation while assigning the actual task of co-operation to relevant national agencies of member states. The third is through the private and public sector firms in the form of `Joint Venture'.[24] This can involve industrial and market surveys, consultancy, technical collaboration, supply of equipment and technology management skills, turnkey projects and buy-back arrangements.

6. SPECIFIC AREAS OF CO-OPERATION

A number of cases where science and technology co-operation can be undertaken in SAARC have been identified in several studies. The broad areas include:

Agro-Processing

This involves both food and cash crops. In food crops, the region faces considerable losses due to defective or

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24 V.R.Panchamukhi, et al, *Economic Cooperation in the SAARC Region: Potential, Constrints and Policies* (New Delhi), pp.127-8.

absence of processing facilities that help crops last longer. Among SAARC countries India has developed food processing technology to a considerable extent, particularly equipment. Similarly Pakistan has well developed training facilities for wheat and rice production technology. Co-operation can also be undertaken on processing exportable cash crops. Where two or more countries are competitive exporters (such as India and Bangladesh in jute and India, Sri Lanka in tea) processing knowhow and training facilities could be included in the scheme for regional co-operation.

Natural Resource Surveys and Remote Sensing

This is an important area of co-operation for the mineral resource starved countries such as Nepal and Bhutan. India and Pakistan have developed remote sensing and surveying facilities that could be used to further co-operation.

Preservation of Environment

This involves three different areas of co-operation. One is in preservation of the environment through environment regeneration technologies such as controlling desertification of soil and developing appropriate technologies that can provide substitutes to forest produce. This includes energy (particularly for cooking and heating), packing materials, wood substitutes etc. The second area of co-operation is in prevention of natural disasters, through forecasting technologies. The third area is pollution control through technologies for waste treatment, ecology friendly industrial technologies etc. An important activity and challenge for the region's scientific and technological personnel, is to effectively integrate traditional knowhow with modern technologies. The inputs should be regional and not merely national in scope for greater effectiveness and relevance.

Infrastructural Technology

This is an important area not just due to its relevance but also due to its effectiveness as proved by bilateral co-operation in this area between India on the one hand and Nepal and Sri Lanka on the other hand. Similarly technologies which have applications in social welfare too is important for the region and holds good potential for co-operation. This includes population control, low cost housing, basic telecom facilities etc.

Other Areas

Other areas that have potential for regional co-operation in science and technology are mining, ore benefication and electronics among others.[25]

In cases like chemical processing and pharmaceuticals, where one country has acquired a licence from extra regional sources, this knowhow can be transferred to the other countries of the region after the expiry of the licence period. In the areas of frontier technology, such as bio-technology and informatics, where research and development activities are capital intensive and requires skilled personnel, the resources of the region could be pooled to initiate massive research projects.

7. CONCLUSION

Given the politico-security environment of South Asia, which cannot be ignored while studying techno-economic relations, it is inevitable that South Asia has to evolve its own pattern of science and technology co-operation, even while adapting relevant aspects of the South-South programme of science and technology co-operation. In the field of science and technology, if the region decides to do away with all restrictions on intra-regional science and technology flows, there is the risk of the North-South

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25 For detailed discussions on identified areas of cooperation and its potential see Mhisuddin, n.15; Sen, n.16; Schokman, n.23; and Panchmukhi, n.24; also see Ajit N.S.Thapa, "Areas of Cooperation in Specific Economic Sectors and Commodities", in Woqif, ed., n.4, p.118.

technology divide replicating itself within the SAARC framework.

The ideal pattern of co-operation in science and technology would be to first focus entirely on exchange of training and scientific knowledge. It is only after each country of the region attains the minimum required science and technology capability that co-operation must be launched in the field of technology transfer and development. Any attempt to hasten the process without completing the first stage in its entirety will seriously affect the prospects of regional co-operation in science and technology in the long term. Both the technologically advanced and backward countries of the region can share equal responsibility in ensuring the successful implementation of the first stage.

The region has already suffered to a great deal due to its technological backwardness and therefore, offers great potential for co-operation in technology transfer and development. But the region has its share of constraints too. Even while redressing these constraints the region must ensure it completes the first stage in the shortest possible time and commences the next stage of co-operation in science and technology. Whether the SAARC is moving in that direction and at the required pace will be seen in the next chapter.

CHAPTER V

SAARC INITIATIVES IN SCIENCE AND TECHNOLOGY

After the discussion on the background of co-operation in science and technology in South Asia, this work now turns to a study of the activities of the South Asian Association for Regional Co-operation (SAARC) in science and technology. Discussions and studies on the concept and implementation of regional co-operation in South Asia (economic co-operation in general and science and technology co-operation in particular) has generally tended to confine itself within two broad parameters. One is an analysis of the high level meetings within SAARC (Foreign Ministers and Heads of State/Government). The second is of an explanatory and advisory nature.

Both these approaches have inherent drawbacks in conducting critical analysis of SAARC activities given the climate of mistrust and political opportunism which marks the general relations between India and her neighbours, the summit meetings and meetings of Foreign Ministers is generally a verbal exercise and an endorsement of what the bureaucrats have already accomplished through mutual discussions. Studying these summit meetings does not yield any information on the actual process of negotiations that guides co-operation within SAARC.

The second strand of discussion is essentially carried out by professionals and academic experts. The general nature of their discussions indicate that they are, again, not based on a study of what is actually happening within the lower institutional structures of SAARC. Instead it is only full of suggestions on what can be done and criticism of what has not been done.

This chapter deviates from both these parameters. It concentrates on the discussions and results achieved through the meetings of the Technical Committee for Scientific and Technological Co-operation. Besides it will also carry a brief study of the achievements of other Technical Committees which have a bearing on science and technology co-operation. It will first discuss the general character, and details of the Technical Committee on Co-operation in Science and Technology meetings. Section two will discuss the broad areas that have been selected for co-operation. Section three will discuss the instruments or modes of co-operation that have been used. Section four will discuss the procedure adopted by the Technical Committee for co-operation on science and technology to implement co-operation at each stage. Section five will be the core of the chapter since it will discuss each programme of co-operation organised by the Technical Committee for Scientific and Technological Co-operation. Section six discusses the mode of financing as laid down by the Technical Committee. Section seven will analyse the factors that are a constraint to co-operation in science and technology. Section eight will carry out an overview of the activities of the Technical Committees which have a bearing on science and technology co-operation. Section nine will comprise the chapter conclusion.

1. TECHNICAL COMMITTEE ON SCIENCE AND TECHNOLOGY

Science and technology was one of the first nine areas of co-operation identified in 1981 during the meeting of the foreign secretaries of South Asian countries. A study group was set up which met first in June 1982, in Islamabad under the chairmanship of Pakistan. This group was later renamed as the Technical Committee for Scientific and Technological Co-operation and met in Islamabad in 1983. The chairmanship rotates after every two years among the member countries and its meetings are held (at least once a year) in the chairing country. Pakistan chaired the Technical Committee from 1982 to 1984, Sri Lanka from 1984 to 1986. Bangladesh was in the Chair between 1986 and 1990.[1] India chaired it during 1990-

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1 This was two years more than the normal since Bhutan indicated its inability to do so, and there were changes in the rotation system of the chair country as directed by the Standing Committee. For details see, SAARC, *Report of the Seventh Meeting of the TC on Scientific and Technological Cooperation* (Dhaka, 1989),

92 while Nepal is now in the chair.

Focal points have been identified in each country through which the Technical Committee conducts co-operation. With the exception of Maldives, the member countries of the region have participated in all the meetings of the Technical Committee. But one major shortcoming is that in several cases, such as Sri Lanka in 1983,[2] and Pakistan in 1985,[3] the country delegation comprises only bureaucrats from the foreign ministries or embassies in the host country. The Technical Committees are permitted in the SAARC Charter to meet as many times in a year as required but the Technical Committee for Scientific and Technological Co-operation has met only once each year. India had proposed in 1990, the convening of a special session for discussing the past activities of the Technical Committee since its inception, but for some reason not explained this

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p.8.

2 SAARC, *Report of the First Meeting of the Technical Committee for Scientific and Technological Cooperation* (Islamabad, 1983), p.8.

3 SARC, *Report of the Third Meeting of the Technical Committee for Scientific and Technological Cooperation* (Colombo, 1985), p.6.

was not held.[4]

In 1989, the Standing Committee (of Foreign Secretaries) had issued guidelines to regulate the activities of the Technical Committees. Taking these into consideration, the Technical Committee decided that:

(a) The number of short term activities such as workshops, seminars and symposia by each Technical Committee under the Integrated Programme may be restricted to two per year per sector.

(b) Reports of the Technical Committee should contain a section on evaluation of preceding events to facilitate drawing up of the new annual calender of activities.

(c) Chairpersons of Technical Committees should meet annually for coordination of sectoral programmes and selection of well identified target oriented and time bound programmes.

(d) Technical Committees should include at least one activity per year involving participation of recognised Non Governmental Organisations (NGO) as well as professional bodies in the private sector.[5]

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4 SAARC, *Report of the Eighth Meeting of the Technical Committee for Scientific and Technological Cooperation* (Dhaka, 1990), pp.3-4.

5 ibid, p.2.

2. **AREAS IDENTIFIED FOR CO-OPERATION**

The first meeting of the expert group on science and technology in 1982 had identified 14 broad areas of co-operation. These are:

() Science policy

(b) Energy (integrated approach to energy problems, Research and Development in non conventional and renewable sources of energy)

(c) Food Technology

(d) Transfer and Adaptation of Appropriate Technology

(e) Survey of Natural Resources and Remote Sensing

(f) Forestry Development and Erosion Control

(g) Mining and Ore Benefication

(h) Microelectronics

(i) Marine Sciences

(j) Instrumentation (including repair and maintenance)

(k) Solar Technology

(l) Genetic Engineering

(m) Environment (with special reference to pollution control)

(n) Informatics.[6]

In this list, some areas have experienced more

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6 Yvonne Schokman, "Proposals for Cooperation in Science and Technology in South Asia", *SAARC Perspective*(Khatmandu), vol.3, no.5, June 1989, p.36.

intensive co-operation as compared to others. Similarly some areas overlap, the most common are being solar energy as its applications came in energy (solar power) food technology or appropriate technology (solar cooking equipment) and micro electronics (photovoltaics).

3. INSTRUMENTS OF CO-OPERATION

Co-operation in SAARC as witnessed until now, has assumed the forms of -

(a) Seminars/Workshops: A member country proposes the organization of a seminar/workshop on a specific subject. If approved by the Technical Committee and Standing Committee, the proposer hosts the seminar. Country papers on the status and policies vis-a-vis the chosen subject along with other general papers are presented and discussed. The seminar workshop then proposes future stages of co-operation in that subject through a report.

(b) Training Programmes: Again some country proposes to host a training programme. If it meets the criteria laid down, it is organised and a report prepared which includes recommendations on the next stage of co-operation.

(c) Preparation of Directories: This is a step to compile a regional data base of any particular area or subject. One country is designated as the coordinator country which compiles the data received from other member countries. The emphasis is generally on personnel and activities being conducted in the chosen subject.

(d) State of Art Reports: The procedure for the preparation is the same as that in the case of directories. The difference is that the context focusses on institutions involved in research and development activities in the subject concerned, the specific activities being carried out and present research and development.

(e) Networking Arrangements: Under this mode of co-operation, each member country identifies a nodal agency in the chosen subject. These agencies then interact among each other and thus develop their capabilities which can be diffused within each member country.

(f) Joint Research Projects: This in a sense signifies the highest degree of co-operation. In this a particular aspect is chosen and each member country is assigned a particular stream of research or activity. When coordinated, it results in overall development of that aspect.

Besides these there have been proposals for three other modes of co-operation. Of these, in two viz., expert assistance and exchange of experts, there are no proposals which have been implemented. The third is the proposal for the publication of a Science and Technology Newsletter put forward by India. But despite being approved by the Technical Committee, this proposal is yet to be implemented.

These modes of co-operation have been followed both independent of each other as in some cases and as a combination in some. In the latter, co-operation begins with the holding of a seminar or workshop which recommends a specific programme of training.

4. PROCEDURE FOR CO-OPERATION

The member countries of SAARC raise individual proposals for co-operation in the meeting of the Technical Committee on Scientific and Technological Co-operation (this is the case for other Technical Committees too). The Technical Committee deliberates on these proposals. Generally co-operation in any field is included only if there are two or more beneficiary member countries. The proposals which meet this criteria and the approval of the delegates is then accepted by the Technical Committee for co-operation. It then decides on the apt mode for co-operation.

A report is prepared at the end of any programme initiated by the Technical Committee. This report is circulated among the member countries and discussed in the Technical Committee meeting. A decision is then taken on further initiatives for co-operation in the selected sector. In the case of directories and state of the art reports, member countries are expected to independently utilise the information available particularly for bilateral programmes of co-operation.

5. NATURE OF ACTIVITIES

Since 1983 when science and technology was first deliberated on by the SAARC expert group, a number of initiatives have been taken on science and technology co-operation.[7] As mentioned before fourteen areas were identified and nine modes of co-operation suggested. A discussion on these proposals follows.

5.1 Science Policy and Status

The first initiatives in this aspect of science and technology co-operation was the preparation of a SAARC directory on science and technology activities in South Asia. It was prepared in 1985 by Pakistan on the basis of inputs from member countries.[8] In an effort to study women's participation in science and technology in the region, a seminar was hosted on this topic by Pakistan. This was attended by the leading women science and technology personnel of the region. The problems faced by them in pursuing science and technology as a career, their

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7 For a detailed list of these activities, see Appendix 1.

8 SARC, n.3, p.3.

role in the development of science and technology and measures to improve their status in the science and technology hierarchy of each country was discussed. There were country papers and other issue specific papers too.[9]

The most important initiative in the direction of discussing the region's science and technology status and policy was the workshop on science policy for SAARC region in 1988, Pakistan. Papers on the science and technology base and policies of individual member countries were presented and discussed in the workshop. A framework for formulating a common science policy in the region too was discussed.[10]

Maldives in the fourth meeting of the Technical Committee had requested that the other member countries of SAARC provide expert services to help Maldives in the preparation of a situation analysis report on science and technology activities in Maldives and advise on science and technology policy formulation which has not yet been

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9 For details see, SAARC, *SAARC Workshop on Women in S&T: Report* (Islamabad, 1987).

10 A.Q.Kazi and Altaf A. Beg,eds., *Report of the Workshop on Science Policy for the SAARC Region*, (Islamabd, 1988).

undertaken.[11] This actually provided a good potential for SAARC to initiate the basic level of science and technology co-operation i.e., assessing the science and technology base of the most backward (vis-a-vis science and technology) member country. Similarly Maldives had absented itself from most science and technology co-operation initiatives primarily due to the fact that it had little or no information on most of the subjects taken up for co-operation.[12]

In the ninth meeting of the Technical Committee, it was decided that India would undertake the task of compiling an updated version of the 1985 directory on science and technology activities in the region[13] (based on inputs from other SAARC countries). At the eleventh meeting India had circulated its input among other SAARC countries. The others were requested to submit their input by March 1994.[14]

Nepal, in the fourth meeting of the Technical

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11 SAARC, *Report of the Fourth Meeting of the Technical Committee for Scientific and Technological Cooperation* (Colombo, 1986), p.6.

12 ibid, p.7.

13 SAARC, *Report of the Ninth Meeting of Technical Committee for Scientific and Technological Cooperation* (New Delhi, 1984), p.8.

14 SAARC, *Report of the Eleventh Meeting of Technical Committee for Scientific and Technological Cooperation* (Kathmandu, 1993), p.2.

Committee, had suggested that the Technical Committee deliberate on devising programmes for co-operation in technical manpower training and the establishment of equivalent technical training standards. The meeting decided that Nepal prepare a working paper to act out as a base for further discussions.[15]

One mode of co-operation suitable for the region, as discussed in the previous chapter, is co-operation in technology assessment and diffusion particularly with reference to extra regional imports of technology. The Technical Committee had decided on organising a training course on this aspect but it had to be deffered twice[16] and has not yet been held.

5.2 Energy

This is one area where the Technical Committee has given special emphasis. The various aspects studied through seminars were: biomass production, renewable energy resources, solar energy and photovoltaics in 1985. Sri Lanka had then prepared a consolidated version of the recommendations of these seminars, which has been used as a source material to formulate further co-operation. A

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15 SAARC, n.11, p.10.

16 SAARC, n.14, p.5.

seminar on biomass gassification was held in 1990. India was entrusted with the responsibility of compiling a state of art report on bio-gas in the region.

India had also proposed during the second Technical Committee meeting, the formulation of a regional programme in the field of bio-gas and solar energy through the networking and interaction among respective concerned institutions in the region.[17]

A new dimension in energy co-operation was introduced during the ninth Technical Committee when it recommended that nodal points be identified by the member countries for interaction in energy modelling techniques.[18] Bangladesh, India, Maldives, Nepal and Sri Lanka have tentatively named their nodal points. Pakistan and Bhutan have been requested to submit details on their nodal points and the others have been requested to confirm theirs by December 1993.[19] The information base for this field of co-operation was first compiled through the organisation of a workshop on energy modelling techniques in 1993.

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17 SARC, *Report of the Second Meeting of the Technical Committee for Scientific and Technological Cooperation* (Islamabad, 1984), p.8.

18 SAARC, n.13, p.8.

19 SAARC, n.14,pp.2-3.

5.3 **Food Technology**

This is another area that has witnessed intensive co-operation at different levels. Workshops and seminars have been held in food processing technology, formulation and development of pesticides, biofertilizers and prawn hatchery.

The importance of this sector lies primarily in devising methods of preservation of agricultural produce. As part of this, food processing equipment and the technology has been chosen as the primary field of co-operation, within co-operation in food technology. Bangladesh had presented a working paper for post harvest technology with reference to perishable food items. Based on this paper the Technical Committee in its sixth meeting decided to initiate a Joint Research Project in design and manufacture of food processing equipment with India as coordinator.[20]

As part of this project, a meeting of regional experts in this field was convened in 1992, in New Delhi. This meeting recommended that the project be launched involving all member states. According to the proposal, India and Pakistan would undertake designing of equipment, Maldives and Bhutan would establish workshops for fabrication of

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20 SAARC, n.1, p.8.

spare parts and simple components, while Bangladesh, Nepal and Sri Lanka would set up modern fabrication shops to build machines and plants designed by India and Pakistan. It has also recommended as an immediate measure, the preparation of a directory of existing equipment manufacturers of the region.[21] This step represents the most advanced form of co-operation in science and technology within the SAARC framework. To what extent will it be successful is yet to be seen particularly given the fact that SAARC has shied away from physical co-operation to date.

The Technical Committee during its sixth meeting had decided to initiate a Joint Research project in prevention of nutritional disorders of rural children with Bangladesh as the coordinating country.[22] But there has been no further action initiated as yet. The Technical Committee has also approved the preparation of a directory in Process Engineering/Pilot Plant facilities in agro food processing with Sri Lanka as the coordinator. It is scheduled for completion by April 1994.[23] This is a part fulfilment of the recommendation of the expert group mentioned earlier in

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21 For details see, SAARC, *Expert Group Meeting on Design and Manufacture of Food Processing Equipment* (New Delhi, 1992), pp.17-19.

22 SAARC, n.1, p.4.

23 SAARC, n.14, pp.6-7.

this section.

5.4 Appropriate Technology

The focus in this area of co-operation has been essentially on low cost housing. Two initiatives on this subject were taken in 1988. As a followup to a workshop held on Low Cost Housing, Sri Lanka and India were to organise training programmes on low cost housing and India on pre stressed concrete.[24] While Sri Lanka conducted this programme in 1989, the one scheduled in India had to be postponed and is yet to be held.

The Technical Committee has approved the preparation of a state-of-art report on Building Materials and Technology, to be coordinated by India and targetted for completion in July 1994.[25] The Technical Committee had also recommended the identification of nodal points in each member country in the field of low cost Housing and Building Technology.[26]

Among other fields of co-operation in appropriate technology, Pakistan had proposed a Joint Research Project on developing and utilising cottage scale wool processing technology between Nepal and Pakistan.[27] But this has not

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24 SAARC, n.1, p.3.

25 SAARC, n.14, p.5.

26 SAARC, n.13, p.8.

27 SARC, n.17, p.6.

been included in the calender of activity by the Technical Committee probably due to the fact that the proposal does not meet the criteria of two or more beneficiary countries.

Besides this, a seminar has hosted by Bangladesh on delivery systems of improved stoves for rural users. This is an important field of co-operation since none of the member states have been successful in effective diffusion of appropriate technologies in the rural context. But, what is probably indicative of their lack of genuine commitment is that, there has been no further activity in this field of co-operation.

India was to hold a training programme on technology assessment and technology diffusion in the second half of 1992. But this has been postponed twice and is now scheduled to be held in 1994. The Technical Committee has approved the preparation of a state-of-art report on selected rural technologies i.e., food processing technology and handicrafts with Nepal as the coordinator and scheduled for completion by September 1994.[28]

5.5 Survey of Natural Resources and Remote Sensing

This is an area where substantive co-operation has occurred with the preparation of two state-of-art reports.

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28 SAARC, n.14, pp.5-6.

This area has assumed increased importance as a result of greater attention it commands in the domestic policy environment in South Asia. The countries of the region are now very active in ensuring the maximum utilisation of their natural resource potential. Surveys are the most widely accepted form of effective identification of resource potential. Another form, which isore recent origin and gaining acceptance is remote sensing.

The Geological Survey of India has prepared a state-of-art report on mineral resource exploration in the SAARC region. It has inputs from all SAARC countries but for Maldives. It has identified the prospects for fruitful co-operation in mineral exploration. It also provides a source of data for the capabilities of each SAARC country.[29] India has also hosted a workshop on methods and techniques in ground water exploration.

Bangladesh has prepared a state of the art report on utilising remote sensing techniques in natural resource surveys. It has also offered lower level training in this field and has requested for training at advanced levels of remote sensing techniques. Sri Lanka too has offered

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29 For details see, SAARC, *State-of-Art Report on Mineral Resource Exploratin in SAARC Region* (New Delhi, 1987), pp.3-21.

training in some fields of remote sensing.[30] But no formal programme in the field of remote sensing has been initiated.

5.6 Forestry Development and Erosion Control

This is one area where the Technical Committee has not initiated any substantial action per se, since it overlaps with other sectors, such as biotechnology, within the Technical Committee on Scientific and Technological Co-operation. Besides, there are separate Technical Committees on environment and agriculture whose activities are of a similar nature. The SAARC has taken initiatives, outside the scope of the Technical Committee on Scientific and Technological Co-operation, coming out with two regional studies on environmental degradation.[31]

An initiative taken by the Technical Committee on Scientific and Technological Co-operation has been the organisation of a seminar hosted by Bangladesh on protecting the environment from degradation. Bangladesh has repeatedly raised the issue at several meetings of the Technical Committee requesting the formation of expert groups particularly for flood management. But this has not yet

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30 Schokman, n.6, pp.38-39.

31 SAARC, *SAARC in Brief* (Khatmandu, 1994), p.34.

received the approval of the Technical Committee.[32] Neither has the Technical Committee discussed or initiated any follow up measures after the seminar mentioned above.

5.7 Mining and Ore Benefication

Though this area had been identified as one of the areas of co-operation in 1983, there has been no work undertaken as yet. The first initiative in this area has been the hosting by Pakistan of a seminar-cum-workshop on ore benefication in 1993. The report is yet to be submitted.[33] It remains to be seen as to what further action will be recommended by the Technical Committee.

Regarding training in this area, Bangladesh has requested training from India and Sri Lanka in the field of benefication of limestone.[34] The Technical Committee has not included it in the programme of co-operation probably due to the fact that only Bangladesh has forwarded the request. Following the seminar-cum-workshop held, it is possible that other countries too may put their requests for training in this area.

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32 For details see, SAARC, *Report of the Fifth Meeting of the Technical Committee for Scientific and Technological Cooperation* (Dhaka, 1987), p.15.

33 SAARC, n.14, p.3.

34 Schokman, ,n.6, p.38.

5.8 **Microelectronics**

This is an area where co-operation will have to be highly restricted and guarded since this area of science and technology has wide dual applications (i.e. in the military applications too). Given the security environment in the region, this a very sensitive issue.

Pakistan during the second meeting of the Technical Committee, proposed a Joint Research Project involving itself, India and Bangladesh on silicon technology through co-operation among silicon technology development centres of these countries.[35] There has been no progress on this proposal. Silicon technology, being at the base of modern electronics (particularly its importance in miniaturisation of electronic circuits) on which modern defence increasingly relies, is a sensitive issue in the Indo-Pakistan context where as it is, an arms race in raging on. This could be a probable reason for the lack of progress by the Technical Committee on this proposal

The first initiative in the area of microelectronics was the training programme held by India in electronics interconnection and packaging in December 1993. The report has been circulated among member countries.[36] Follow up

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35 SARC, n.17, p.6.

36 SAARC, n.14, pp.4-5.

action may be initiated by the Technical Committee after it discusses the report.

Besides this, Bangladesh is now coordinating the compilation of a state of the art report on local electronic products in the SAARC region. It is scheduled for completion by September 1994.[37] These two fields of covered in the area of microelectronics indicates that co-operation will be restricted to exclusively civilian oriented aspects of the electronics industry.

5.9 Marine Sciences

This is one area where the Technical Committee has not initiated any work despite the fact that two member states of the SAARC are island states and three have an extensive coastline. Sri Lanka has proposed offering on the job training in basic oceanographic fields but there have been no takers for this offer.[38]

5.10 Instrumentation

Work on this sector began with the holding of a workshop in Pakistan on Instrumentation: Maintenance, Repair and Callibration. It was identified, in this workshop, that

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37 ibid, p.7.

38 Schokman, n.6, p.39.

the facilities in the region for maintenance and repair facilities is very poor. One recommendation of this workshop dwelt with the need for a training programme in this sector. Sri Lanka and Nepal have requested for training in this sector.[39] While Sri Lanka (which requires training in maintenance of sophisticated instruments) and Nepal have requested this training from India, Pakistan has requested for training in this field from Sri Lanka.[40]

The Technical Committee in its sixth meeting decided that a training programme in Instrumentation Repair and Maintenance be held.[41] But this has not yet been implemented.

A workshop on low cost scientific educational equipment was held in Bangladesh in 1989. The scope of this goes beyond mere instrumentation, since the workshop deliberated on science education policy with reference to designing and utilisation of science education equipment. The present state of affairs vis-a-vis source of science education equipment, problems associated with indigenisation of efforts for manufacture and maintenance of these equipment and other issues were discussed. The recommendations

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39 See Appendix 2.

40 Schokman, n.6, p.39.

41 SAARC, n.1, p.3.

included creation of a data bank on equipment and state-of-art report on latest levels of technology available in this field.[42]

In part fulfilment of these recommendations, the Technical Committee has approved the preparation of a directory on specialised analytical and instrumentation facilities and techniques to be coordinated by Sri Lanka and scheduled for completion by April 1994.[43]

5.11 Biotechnology, Genetic Engineering and Health Related science and technology

Co-operation in this sector began in 1988 with a workshop on cultivation and processing of medicinal and aromatic plants. Until 1989-90, the Technical Committee on science and technology had seen discussion only on this aspect. As the issue of biotechnology gained relevance in the Third World context it came for discussion in the SAARC summit in Male, November 1990. The summit leaders noted that biotechnology was widely important for both long term food security and medicinal purpose. They directed that co-operation be expanded to this sphere, particularly through exchange of expertise in gene conservation and maintenance

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42 For details see, SAARC, *Report of the SAARC Workshop on Low Cost Scientific Educational Equipment* (Dhaka, 1989), pp.5-6.

43 SAARC, n.14, p.6.

of germplasm banks.[44]

The Standing Committee in 1990 had recommended a meeting of an expert group on trends in biotechnology and genetic engineering in the SAARC region. Again in 1990 the Secretary General of SAARC had written to the Chairperson of the Technical Committee on Scientific and Technological Co-operation requesting him to examine the possibility of co-operation in the field of biotechnology and genetic engineering. Following this the Technical Committee decided to initiate action in this field.[45]

As a beginning the Technical Committee recommended the following plan of action:

a) Designing specific research and development centres in member countries as SAARC centres for biotechnology research.

b) Preparing a directory of persons working in the field of biotechnology and circulating it in the region.

c) Establishment of a bio-informatics network with existing institutions.

d) Organising seminars and workshops.

e) Organising manpower training programmes on short term

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44 *SAARCH Newsletter* (Kathmandu), vol.1, no.4, October-December 1990, p.3.

45 SAARC, n.5, p.27.

and long term basis.[46]

The Technical Committee also recommend that as part of the cooperative programme nodal points be identified in biotechnology and genetic engineering in each member country for continued interaction. This is in the process of being implemented.[47]

As a follow up to the SAARC Expert Group meeting on solar energy, biogas and photovoltaics, a training programme was proposed on biogas technology covering fermentation and microbiology.[48] Though this is primarily applicable in food technology, it also marks a step in co-operation in biotechnology.

In 1991, India had prepared a proposal for the establishment of gene bank for medicinal plants and herbs in developing countries. Though this proposal is of a general nature with relevance for SAARC too, there is another section in the proposal titled "Some Suggested Areas for Co-operation among SAARC Countries in the Field of Biotechnology". This section identifies existing capabilities in India vis-a-vis different applications of biotechnology such as cattle breeding, acquaculture, etc.

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46 SAARC, n.13, pp.6-7.

47 SAARC, n.14, pp.2-3.

48 SAARC, n.1, p.3.

It has also provided information on the main agencies in India that are involved in specific biotechnology research.[49]

In 1991 again, India hosted a SAARC expert group meeting on trends in biotechnology and genetic engineering. This was then followed by a training course on molecular biology held in the first quarter of 1994. Nepal was to host another expert group meeting on plant tissue culture but it has been postponed.[50] In the field of health related science and technology, a workshop was held on immunodiagonistics in New Delhi, 1993. The report has been circulated and it is expected to be discussed in the twentieth meeting of the Technical Committee for formulating further action.[51]

5.12 **Environment (With Reference to Pollution Control)**

Co-operation in this sector had been initiated through a training programme in tannery waste management, conducted by India, in 1988. The issue of tannery waste has assumed significance in the region due to two factors. One is the

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49 *A Proposal for the Establishment of a Gene Bank for Medicinal Plants and Herbs in Developing Countries*, prepared by India (unpublished), II Section, pp.1-3.

50 SAARC, n.14, pp.4-5.

51 ibid, p.4.

highly polluting nature of this industry which affects river systems and drinking water sources. This is compounded by the fact that the leather industry is being promoted vigorously in South Asia since it has been identified as an export commodity with high potential. Therefore, it becomes essential that the region finds ways to deal with not just existing levels of pollution, but future levels too.

Consequent to the training programme, it was decided by the Technical Committee to compile a state-of-art report on `Integrated Management of Tannery Waste' with India as the coordinating member. This is scheduled for completion in July 1994. The Technical Committee has also been informed that there would be no inputs from Bhutan and Maldives since they have no tanneries.[52]

The other aspect covered in this area of co-operation has been the treatment of water particularly for drinking purpose. Two programmes have been held. The first was a seminar on treatment of water for drinking purpose in Nepal 1988. The second was the workshop on recycling waste water and developing pollution controls. The report has been circulated though it is yet to be discussed by the Technical Committee for further co-operation.

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52 ibid, pp.5-6.

5.13 **Informatics**

This is again one of the sectors that has been repeatedly ignored in the programme of co-operation in science and technology. The Technical Committee has organised a workshop on technology information and its linkages, hosted by India in 1991. The workshop discussed the various policies, plans and perspectives in the national context of member countries regarding technology information. Data on existing information and networking systems of the region was presented and discussed. The modalities of future co-operation in this area too was discussed. Among the recommendations of the seminar is the one pertaining to the establishment of a SAARC Library Information Network and another pertaining to a SAARC data base on non-indexed science and technology documents generated within the SAARC countries.[53] As part of this, the SAARC Documentation Centre (SDC) has been established at the Indian National Scientific Documentation Centre (INSDOC). The SDC is intended to be fully functional by mid 1994. The SAARC Documentation system will comprise of the SDC, sub-units in each member country, SAARC secretariat nd SAARC institutions. It will focus among others, documents

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53 SAARC, *SAARC Workshop on Technology Information and Its Linkages* (New Delhi, 1991), pp.3-5.

generated in the SAARC and its member countries.[54] Once this centre is operational SAARC can hope to have a data base which will also include publications and data bases of other regions.

One decision taken by the Technical Committee in the area of co-operation in informatics is to facilitate interaction among countries in the region through identification of nodal points for technology information with Sri Lanka as the coordinator. This is under implementation.[55]

The broad thrust and nature of the recommendations of the seminars/workshops held on these areas of co-operation as stated by the Technical Committee on scientific and technological co-operation relate to:

- development of mechanisms for information exchange;
- preparation of directories of institutions and experts engaged in various areas of work and technologies relevant to the region;
- establishment of networks for sharing experiences, information and materials;
- designation of specific research and development centres in the member countries as SAARC centres for

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54 SAARC, n.31, p.26.

55 See section on biotechnology.

research in respective areas;

- constitution of expert groups with members from SAARC countries in identified areas.
- organisation of seminars/workshops in related fields;
- organisation of long and short term training programmes;
- organisation of exhibitions;
- development of research and research and development programmes;
- development of low cost equipment;
- participation of Non Governmental Organisations in the co-operation process of SAARC.[56]

From what has actually been identified, it can be inferred that the priority has been on collecting information on existing national infrastructure, capabilities and policies vis-a-vis the identified areas of co-operation. Since the criteria of two or more beneficiary countries applies only to some of the areas identified, further co-operation has limited potential within the SAARC framework. It is expected, as the Technical Committee stated in the case of directories, that the member countries use this SAARC generated data bank to guide and formulate bilateral co-operation programmes outside the scope of the

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56 SAARC, n.13, pp.6-7.

SAARC.[57] Similarly due to financial constraints, the extent to which physical co-operation (Joint Research Projects funded by SAARC) in science and technology will be undertaken within the SAARC framework will be limited.

During the course of the first five meetings of the Technical Committee, all the countries of the region submitted lists of requirements and offers in terms of training programmes and scholarships.[58] From this the priorities of the member countries that guide the value of their participation in the SAARC programme of co-operation in science and technology can be inferred.

Bangladesh has focused its requests on appropriate technology applicable in the rural sector. This should be due to the fact that Bangladesh has a high concentration of rural population coupled with high density of rural population in the region. Another area where it is interested is in flood management since it is a perennially flood prone region.

Bhutan has mainly requested training in energy generation, particularly hydro power and agriculture. India has not specifically submitted any list of requirement for training. But it has sent its delegates for all training

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57 ibid, p.6.

58 For a detailed list see Appendix II.

programmes organised.

Nepal has focussed its requests essentially in instrumentation i.e., basically on science education aids. This is part of an attempt by Nepal to vigorously develop its science and technology base.

Pakistan's requests are essentially in high technology and the target source is India. It has also requested for some middle level training in Sri Lanka. But the emphasis is an areas like silicon technology, marine geology and informatics from India.

Sri Lanka has requested training on both rural oriented appropriate technology as well as modern science and technology with applications in geology, diamond processing etc. In certain areas like remote sensing and acquaculture, Sri Lanka has attained expertise in certain levels of technology while it is still deficient in higher levels of science and technology specialisation.

Science and technology co-operation in SAARC continues to be limited to government agencies. The private sector in South Asia nor the region's NGOs have been permitted to participate in the Technical Committee meetings to contribute to formulating co-operation. The role of the private sector is limited to the enumeration of some of them in the event of a state-of-art report or directory being prepared on their sphere of activity.

6. MODE OF FINANCE

Under the present arrangements set up by the Technical Committee on Scientific and Technological Co-operation, there are two modes of financing programmes of co-operation from internal sources. One is for short term programmes such as seminars and workshops. Here local hospitality expenses are borne by the host country while travelling expenses of the delegates are paid for by the home country. For training programme, each country has to bear the travel and other expenses of the members it sends to the programmes. The host country waives the training cost and fees connected with training programme.

Besides this two SAARC funds have been set up to help finance the co-operation programmes. The SAARC Fund for Regional Projects (SFRP) was established in 1991 to make available credit on easy terms for the identification and development of regional projects. The SAARC Regional Fund (SRF) was set up to fund among other things "...costs of programme component of networking arrangements, development projects of scientific and technical nature...."[59] Its sources were to be grants from extra regional and private sector sources. But it remains unimplemented due to lack of finance. One project initiated by the Technical Committee

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59 SAARC, n.31, p.29.

on Scientific and Technological Co-operation i.e., design and manufacture of food processing equipment is under the consideration of the SFRP for implementation.[60]

The SAARC-Japan fund was created in September 1993. It includes a component to finance SAARC activities. Two training workshops i.e., "Molecular Biology, Genetic Engineering and Bio Technology" in Pakistan and "Pollution Control" in India were selected for financing from this fund.[61] Of this the training workshop on pollution control has been implemented.

There had been an offer from European Community to finance some programmes in science and technology. On the basis of this offer, the Technical Committee decided to select the areas of rural technologies.[62] But, for reasons not clearly stated in subsequent Technical Committee meeting reports, this did not materialise. One possible reason is due to lack of definite guidelines on the transfer and utilisation of these funds. A more plausible reason could be India's stand on extra-regional funding in the context of regional self-reliance.

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60 SAARC, n.14, p.7.

61 *SAARC Newsletter*, vol.7, no.7, July-September 1993, p.4.

62 SARC, n.2, p.3.

7. **CONSTRAINTS IN CO-OPERATION**

One of the major constraints in the progress of co-operation, which is true of all areas and more so of science and technology in particular is the lack of professionals in the country delegations. This tends to hinder the activities of the Technical Committee as it then lacks the required professional expertise required for the kind of specialised activities undertaken in the field of science and technology. As had been mentioned in section one, in several cases the delegation comprises foreign ministry officials posted in the embassies in the host country.

Another constraining factor is the lack of participation of members in various programmes. During the fourth meeting, India had also implied lack of commitment of member countries towards these programmes.[63] But the Technical Committee instead felt the reason could be due to procedural delays and other constraints. As a remedy it advised that the existing eight week notice being given be extended to three months.[64]

A number of seminars and workshops have had to be

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63 India while stating that the workshop it was to host on Biogas and Photovaltaics was postponed, streesed on the importance of a firm commitment by member countries to participate. See SAARC, n.32, pp.2-3.

64 ibid, pp.2-3.

deffered during the eleven year course of the Technical Committee's activities. Generally it was the programmes that were to be hosted by India and Pakistan that had to face the problem. Another constraining factor is the defferment of programmes (recommended by the Technical Committee) by the Standing Committee. The combination of these two factors i.e., poor response and defferment by Standing Committee led to a situation where most programmes scheduled for implementation between October 1991 and November 1992 had to be postponed. This was despite the fact that the Technical Committee was following the directives issued by the Standing Committee (regarding number of programmes), since October 1990.[65]

The problem of poor response is not restricted just to participation in programmes. At the fourth meeting of the Technical Committee, India, Bangladesh and Sri Lanka stated that the response of member countries in supplying information as required to compile the state of art reports was poor. The Technical Committee advised that questionnaires be prepared so that other countries could

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65 The Standing Committee had issued a set of guidelines which stipulted, among other things, that only two short term activities (workshops, Seminars and Symposia) be held per year, per section by each Technical Committee. See SAARC, n.5, pp.3-4.

prepare reports quickly.[66] The Technical Committee had also expressed concern that member states were not taking any steps to utilise the information in the 1985 directory, such as training facilities.[67] During the fourth meeting again, the Chairman stated that country responses to his circular letter on beginning a newsletter was poor.[68]

A factor that leads to the delay of almost all efforts at co-operation is the lengthy communication channels used in SAARC. Keeping this in mind, the Technical Committee during its fourth meeting advised that the focal points keep directly in touch with each other and copies of communication be given to the respective foreign offices.[69] But surprisingly the Technical Committee, for reasons unstated, reversed this advise during its sixth meeting, stipulating that all communications and transmissions of reports would be routed through the normal diplomatic channels.[70]

These are constraints that can be, with effort, resolved. What it first and foremost requires is genuine

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66 SAARC, n.11, pp.6-7

67 SAARC, n.13, p.6.

68 SAARC, n.11, p.8.

69 ibid, p.3.

70 SAARC, n.1, p.13.

commitment among the leadership in South Asia since it is they who are basically the cause of these constraints. The very asymmetry in the region (vis-a-vis science and technology) which is mistaken as a constraint, in reality offers ample scope for co-operation and the region has the required science and technology base to sustain this co-operation. Therefore, the political and bureaucratic apparatus must be unshackled to prevent efforts in order to maximise not just the number of programmes, but also results from this programme.

8. SCIENCE AND TECHNOLOGY CO-OPERATION IN OTHER SECTORS

Given the emphasis that SAARC has given to the role of science and technology in the co-operation process and the universal application of science and technology, it is natural that science and technology co-operation will also be involved in the other Technical Committee's under the Integrated Programme of Action of SAARC. The sectors which have significant science and technology component in their activities are agriculture, communications and the technical subcommittee on airlines.

The Technical Committee on agriculture had set up the SAARC Agricultural Information Centre (SAIC) in Bangladesh to collect and disseminate information on developments regarding agriculture.[71] This also includes agricultural sciences and technologies. One activity that the SAIC has initiated is promoting exchange of prototypes of farm tools and equipment among member countries for trial and adaptation. It is also in the process of compiling a data base on Technology and Training facilities in agricultural sciences.[72]

Communications particularly the telecom sector has a high component of sophisticated technology in its infrastructure base. Activities undertaken by the Technical Committee on communications includes seminars on management and maintenance of these sophisticated equipment and adoption of new technologies in rural telecom system, transition from analogue to digital transmission and IDR satellite technology. Training course were held in new technologies for managing and maintenance of modern telecom equipment.[73] But the Technical Committee has failed to initiate any co-operation in joint research, development and production of telecom equipment, transfer of technology within the region with reference to telecom equipment and joint assessment and procurement of foreign technology.

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71 *Bangladesh Times* (Dhaka), 3 December 1988.

72 SAARC, n.31, pp.7-8.

73 ibid, pp.9-10.

The Technical Committee on education and culture has identified science and technology as a priority area and nodal points have been nominated for greater interaction.[74] The Technical Committee on rural development has held workshops and training courses on appropriate technology. A research study has also been undertaken in the field of transfer of technology.[75]

Besides the SAIC thee is a SAARC regional institution, namely SAARC Tuberculosis Centre (STC) located in Kathmandu. It is assigned with the responsibility of, among other things, networking of TB research institutions of South Asia. This represents a step forward in medical science research in the region. The SAARC Meteorological Research Centre (SMRC) is another SAARC regional institution expected to be operational by mid 1994 and based in Dhaka. It would focus on research in weather forecasting. This is the only institute among the three SAARC regional institutions, whose main rsponsibility would be to conduct scientific research in the area of weather and climate.[76]

A proposal was formulated by the SAARC Airlines Technical Sub-Committee carrying two recommendations. One

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74 ibid, p.10.

75 Ibid, p.15.

76 SAARC, n.31, pp.25-26.

was that SAARC countries should opt for the same type of aircraft. The second was to collectively utilise available manpower in the region and set up a specialised engineering and servicing plants for maintenance of the air fleet.[77]

As pointed out in this meeting, maintenance costs in the aviation industry are very high (they account for about 15 per cent of total operating costs).[78] For local maintenance (which can save outflow of hard currencies) large volumes are required. Therefore only through regional standardisation of fleets can volumes be built up for economically viable maintenance infrastructure. Following this meeting the SAARC Aviation Consortium was launched in September 1987. It envisaged among other things setting up of joint maintenance facilities and sharing training facilities.[79] But nothing has been heard of this.

One progressive step taken by SAARC, particularly with reference to co-operation and full utilisation of the regions science and technology potential, has been the setting up of the Committee of Chairpersons of the Technical Committees which meets once a year. This body helps not just in ensuring effective networking among the Technical

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77 *Financial Express* (New Delhi), 20 August 1987.

78 *Financial Express*, 24 August 1987.

79 *Times of India* (New Delhi), 15 September 1987.

Committees but also a forum for identifying areas in other Technical Committees, where science and technology inputs would be required and on which the Technical Committee on Scientific and Technological Co-operation can initiate programmes.

9. CONCLUSION

From this study on the activities initiated by the Technical Committee on Scientific and Technological Co-operation it becomes clear that the focus is on sectors that do not have any major commercial application nor involve transfer of technology per se. Except for the case of food processing technology, the other initiatives have been limited to the level of seminars, training programmes and building of data bases. Therefore it is clear that the SAARC apparatus has understood the need to avoid such modes of co-operation that can either actually create, or create an impression of a technology dependence emerging within the region.

The co-operation process that has been undertaken from the past decade has its own positive and negative features. Positive in the sense that it is contributing to the knowledge base in certain areas and offers the scope for the present science and technology asymmetry in the region to be redressed as far as the knowledge base is concerned (with the exception of security sensitive areas such as electronics and metallurgy). Similarly it offers a forum where professionals in science and technology and research and development can meet and interact, something that bureaucracy-imposed norms and procedures cannot restrict or control. The negative factors are outlined in section seven on constraining factors.

Progress in science and technology Co-operation in SAARC appears to make two steps forward and then one step backward. Even as ambitious programmes are approved for implementation, it is affected either due to poor response or other factors. But given the stage from where this co-operation began, i.e., on regional environment of technological backwardness and mutual hostility, the fact that an organisational base for co-operation has come up and a body has been set up to initiate and monitor science and technology co-operation is in itself a progress in the regional context.

CHAPTER VI

CONCLUSION

South-South co-operation had its genesis, as seen in Chapter I, in the disillusionment of the South over the North's reticence to redress the former's needs vis-a-vis the international economic order. The countries which comprise the South Asian Association for Regional Co-operation (SAARC) viz. Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, are also part of the South. South-South co-operation was meant as an instrument of collective self reliance to be achieved through common utilisation of the South's resources, and forming a collective bargaining partner in the New International Economic Order. In terms of actual achievements, this concept has not achieved substantial progress. South-South co-operation continues to remain an ideal professed by Third World States, but devoid of any genuine commitment on their part.

This holds true for science and technology co-operation too. While the South as a whole lags behind the North in science and technology (estimated to be between 60 and 200 years), there is a great degree of inequity within the South as well. One common feature that marks scientific and technological development in the South is the common goal orientation. All these countries have expressed preference for adopting the Western path of developing science and technology. Concepts such as appropriate technology are met with general skepticism in the South.

SAARC can be said to have partially achieved the features of South-South co-operation. It remains an endeavour among developing countries. It is also free of any extra-regional involvement, manipulation or guidance. Theories and frameworks for South-South co-operation and science and technology are not entirely relevant in the SAARC context. These theories do emphasize on the need for official commitment to the goals of South-South co-operation in science and technology. What they lack is an alternate framework of co-operation which can be implemented in a situation where this commitment is limited The latter is the situation in the case of South Asian states. In other words these theories and frameworks are not flexible enough to be applicable in scenarios such as South Asia.

The socio-politics-economic environment in South Asia has created certain parameters within which the programme of co-operation conducted by SAARC has to operate. A general climate of hostility vis-a-vis India prevails in the region. The reasons are:

- international relations in the region is essentially a competition among the region's elite for the fulfillment of perceived interests;

- a general lack of each other's sensitivities;

- in economic political and geographic dimensions, India is disproportionately large within the region;

- India being at the geographic centre of the region, is the only country that shares borders (land and sea) with each country (with the exception of Maldives). The presence of such a large and strong contiguous state raises fears of India and its intentions, among other South Asian states.

The economic asymmetry in the region also holds true in terms of science and technology status, base and capabilities. India is again a phenomenal science and technology power when compared to Pakistan or the other South Asian countries. The region as a whole is in a stage of technology dependence (India being only a partial exception).

The orientation of science and technology differs from country to country Bangladesh, India, Nepal and Pakistan can be categorised as a group that professes to achieve self reliance in science and technology. India had, till the late eighties, proceeded on this path. But this policy had been followed in letter and spirit only in the areas of space research and defense related research. India did build a commendable science and technology infrastructure and had pioneered certain technologies, particularly those with a rural orientation But this is far short of its potential. Bangladesh and Pakistan too have achieve limited capabilities in assimilation of technology. Nepal has not succeeded in building the required infrastructure to achieve these capabilities. These countries have, officially recognised, national science policies but have failed considerably in its implementation.

The asymmetry vis-a-vis science and technology in the South Asian region which causes apprehensions about co-operation also, in turn provides the required potential for science and technology co-operation. The demand for science and technology is generated from within the countries whose science and technology base is poor while the supply is available from those countries that possess a significant science and technology capability. There is another factor that contributes to co-operation in the region. A country will have specialised in certain fields of science and technology, which the other countries have not. Similarly the level of specialisation also varies. These differences in specialisation also contributes to potential for co-operation between say Pakistan and Sri Lanka in lower levels of remote sensing, Sri Lanka and India in higher levels of remote sensing.

In the given politico-security economic environment, it is the exchange of science and technology and training programmes which is the most apt form of cooperation. This also helps induce a relative level of science and technology equity in the region. These two modes of co-operation can be supplemented with expert assistance and interaction among science and technology professionals. Attempting to include the other modes of co-operation such as transfer of technology, joint development of technology at this stage will only be counter productive, particularly in the long run.

The SAARC initiatives are generally confined to exchange of knowledge through seminars, workshops and training programmes. Similarly state-of-arts reports and directories, which are other modes through which scientific and technological knowledge can be exchanged, have also been used extensively . There have been only three instances of expert meeting which s the threshold for joint projects. It indicates that the participating countries have developed the capability to participate in regional development of science and technology (different from exchange of knowledge). The fact that only three Expert meetings were held indicates that the region as a whole is not sufficiently developed vis-a-vis science and technology to initiate the process of joint projects and joint development and innovation in science and technology.

The thrust is on technologies with a rural orientation. Another thrust area has been genetic engineering and related activities This shows how the region is aiming at both improving the traditional technology base of the region, and stepping into selected high technology areas that are of relevance to the region.

The implementation of science and technology cooperation within SAARC has generally been conducted between government agencies and bodies. Despite the directions of the Standing Committee that Non-Government Organisations (NGOs) should also be included in the cooperation programme. Part of the reasons for this could be the general apprehensions with which the state apparatus. In the South-Asian states, views any NGO. This is more so in areas of appropriate technology where NGO's have achieved greater success than government agencies (as is the case of low cost housing in Bangladesh). Another reason could be in the inherent character of these NGOs, which are funded and at times partially controlled by extra regional interests.Just as in the case of extra regional funding ,NGOs could provide an indirect avenue for extra-regional manipulation of the co-operation process. This holds greater relevance in the case of science and technology where Multi-National Corporations (of the West) are monopolies of modern science and technology, and spare no efforts to preserve and extend their stranglehold on science and technology.

Science and technology co-operation, as can be seen from Appendix I, has tended to focus on community technologies which has the potential to be utilised by the community as a whole (for the exact definition of this concept, see chapter I). It is different from the conventional categories of technology such as industrial and consumer technology in its ownership and applicability. The latter have not been included in the science and technology co-operation agenda.

As stated before the areas and modes of science and technology cooperation currently being implemented in SAARC, which refrain from physical science and technology cooperation have been evolved to meet the politico-security-economic environment of the region. This environment is, to a considerable extent, the creation of the political apparatus in these states. The bureaucracy has played a major role in slowing the pace of co-operation in the region. As discussed in chapter V, the dominance of officials from the foreign ministries of South Asian states, in the Technical Committees, has led to problems regarding professional expertise to propose, discuss and assess co-operation in the Technical Committee meetings. Moreover, all the cooperation programmes are subject to the approval of the Standing Committee (which comprises of Foreign

Secretaries). Similarly interaction between the focal points are required to be conducted only through the foreign ministries, which causes considerable procedural dealing.

This study concludes that the direction of science and technology cooperation and the framework adopted by SAARC are appropriate, given the ground situation in the region. It is the slow pace and the administration of this process that are the major lacunae. Similarly one prerequisite for progressing to the next stage of population is the lack of regional institutions. Until the nineties, the main cause for this was the paucity of finance. But now that extra regional sources of finance is being tapped, this should no longer be a problem. A proliferation of regional institutions could lay the base for progressing on to other modes cooperation.

One mode of co-operation as discussed in chapter IV was exchange of experience and training for effective assimilation of imported technologies. This mode of cooperation hypothetically can be implemented in the region without the threat of technology hegemonism or technology dependence. The reason for non-implementation could include the percolation of bilateral security tensions in fields of science and technology cooperation; the bias for relying on the West for any technology related activity, contractual obligations imposed on technology importers by Western technology exporters.

SAARC is now firmly entrenched in the South Asian region. Several political and security developments have occurred in the region which are beyond the scope of SAARC. These include the 1988-89 India-Nepal stalemate, 1988 military violation of Sri Lankan airspace and the 1989 near war situation between India and Pakistan. These developments had its implications for high level contacts in SAARC, but did not seriously threaten the existence of SAARC, neither did it have any implications on the lower level of contacts in SAARC such as Technical Committee meetings, seminars et.al. This testifies to the commitment of the member states to continue cooperation (at the levels already initiated).

All the countries of the region are now in the process of opening up their economies. This leads to a chain reaction which has its implications for the future of Science and Technology cooperation in SAARC. Integration (at any cost and at whatever terms imposed) with the West is the firm goal of each nation's economic development programme. In this strategy maximisation of exports is a major priority. To achieve this, meeting, both, the demands of the international markets and international quality standards are essential, which in turn requires Western technologies and modes of production.

Attempts to do so through a reorientation of domestic economies are bound to affect the commitment of these states to move forward from existing levels of Science and Technology cooperation to the advanced areas of industrial and infrastructure related Science and Technology. This means that as long as the member countries retain the above discussed priorities, Science and Technology cooperation in SAARC will stagnate at present levels.

The very fact that the countries, that now comprise the SAARC, have agreed to initiate and continue cooperation, in general and Science and Technology in particular, is a progressive step. After forty years during which cooperation was dictated by political considerations and restricted to bilateral levels, cooperation in the region has now partially shifted to multilateral levels (though still guided and inhibited by political considerations). This itself marks a step forward in the concept of South-South cooperation in the South Asian region.

APPENDIX I

LIST OF PROGRAMMES HELD AND DOCUMENTS PREPARED UNDER TECHNICAL COMMITTEE ON SCIENTIFIC AND TECHNOLOGICAL COOPERTION

	NAME OF PROGRAMME/DOCUMENT	HOSTED/ PREPARED BY:	YEAR
(A)	SCIENCE POLICY AND STATUS.		
1	Workshop on Women in Science and Technology.	Pakistan	1987
2	Workshop on Science Policy for SAARC Region.	Pakistan	1988
(B)	ENERGY		
3	Seminar on Biomass Production.	Bangladesh	1985
4	Workshop on Renewable Energy Resources.	Pakistan	1986
5	Meeting of Experts on Solar Energy and Seminar on Photovoltaics and Biogass.	India	1986
6	Consolidated recommendation of 3 SAARC Meeting on Subject Relating to Renewal of Energy.	Sri Lanka	1987
7	Progress Report: Technical Committee on Science and Technology Cooperation.	Sri Lanka	1987
8	State-of-Art Report on Bio-Gas.	India	1989
9	Seminar/Workshop on Biomass Gasification Workshop on Energy Modelling Techniques with special reference to Rural Areas.	Sri Lanka	1993
10	Workshop on Solar Thermal Technology and Standardisation of Thermal Devices.	n.a	defered
(C)	FOOD TECHNOLOGY.		
11	Workshop on Post Harvest Tecnology & Food Technology.	India	1985
12	Workshop on Pestcides Development including Formulation.	India	1987
13	Workshop on Bio-Fertilizer Technology.	Nepal	1989
14	Draft Working Paper for the Project on Appropriate Post-Harvest Technology for Preishable Food Items such as Fish, Fruits and Vegetables.	Bangladesh	1990

15	Training on Innovative Tecnology for Development of Prawn Hatchery.	Bangladesh	1990
16	Joint Research Project on Design and Manufacture of Food Processing Equipment.	India	1992
(D)	TRANSFER AND ADOPTATION OF APPROPRIATE TECHNOLOGY.		
17	Seminar on Delivery System of Improved Stoves for Rural Users.	Bangladesh	1988
18	Workshop on Low Cost Housing Technology Diffusion in Rural Areas.	Bangladesh	1988
19	Training Programme on Low Cost Housing.	India	1988
20	Training on Low Cost Housing.	Sri Lanka	1989
21	Training Programme on Technical Assesment and Technology Diffusion.	India	defered
22	State-of-Art Report on Selected Rural Technology.	Nepal	Sep 1994 (Target)
23	State-of-Art Report on Building Materials and Technology.	India	July 1994 (Target)
(E)	SURVEY OF NATURAL RESOURCES AND REMOTE SENSING.		
24	State-of-Art Report on MineralResources Exploration in SAARC Region.	India	1987
25	Workshop on Methods and Techniques in Experimental Geophysics for Ground Water Exploration.	India	1987
26	State-of-the Art Report on Application of Remote Sensing Techniques in Natural Resource Survey.	Bangladesh	1989
27	Directories on Processing Engineering/ Pilot Plant Facilities in Agra Food Processing.	Sri Lanka	April 1994 (Target)
(F)	FORESTRY DEVELOPMENT AND EROSION CONTROL.		
28	Seminar on Protecting the Environment from Degradation.	Bangladesh	1985
(G)	MINING AND ORE BENEFICATION.		
29	Seminar cum Workshop on Ore Benfication.	Pakistan	Feb.1993

(H) ELECTRONICS (INCLUDING MICROELECTRONICS).

30	Training programme on Electronic Interconnection and Packaging.	India	Dec.1993
31	State-of-Art Report on Local Electronic Product .	Bangladesh	Sep 1994 (Target)

(I) INSTRUMENTATION (INCLUDING REPAIR, MAINTAINENCE AND SCIENCE EDUCATION.)

32	Workshop on Instrumentation: Maintenance Repair and Callibration.	Pakistan	1987
33	Workshop on Low cost Scientific Educational Equipment.	Bangladesh	1989
34	Directories on Specialised Analytical Instrumentation Facilities and Techniques.	Sri Lanka	April 1994 (Target)

(J) BIOTECHNOLOGY GENETIC ENGINEERING AND HEALTH RELATED S&T.

35	A Proposal for the Establishment of a Gene Bank for Medicinal Plants and Herbs in Developing Countries .	India	1991
36	Experts Group Meeting on trends in Bio-Technology and Genetic Engineering.	India	1991
37	Training Programme on Molecular Biology.	India	defered
38	Workshop on Immunodiagnostics.	India	Jan.1993
39	Meeting of Experts on Plant tissue Culture.	Nepal	Dec 1993 (Target)
40	Workshop on Cultivation and Processing of Medicinal and Aromatic Plants.	India	1988

(K) ENVIRONMENT (WITH SPECIAL REFERENCE TO POLLUTION CONTROL)

41	Training on Tannery Waste Management.	India	1988
42	Seminar on Treatment of Water for Drinking Purposes for Rural and Urban Areas.	Nepal	1988
43	Workshop on Recycling of Waste Water and Development of Technologies for Pollution Control.	Pakistan	1991
44	State-of-Art Report on Integrated Management of Tannery Waste .	India	July 1994 (Target)

(L) INFORMATICS

45	Workshop on Technology Information and its Linkages.	India	1991

APPENDIX 2

LIST OF TRAINING REQUIREMENTS AND OFFERS BY SAARC MEMBER COUNTRIES

(Prepared During the Sixth Meeting of the Technical Committee on Scientific and Technological Cooperation)

Training Requirements

Bangladesh

1. Benefication of ilmenite (in India and Sri Lanka);
2. Water resources management by Remote Sensing at higher level (in India)

Bhutan

1. Biogas and micro turbine technology.

Sri Lanka

1. Diamond core drilling (in India)
2. Digital processing techniques in Remote Sensing Works (in India);
3. M.Sc. level training in Geodesy and photogrammetry;
4. Instrumentation technology in the area of fine instruments, precision mechanical workshop technology and optical instrument technology (in India);
5. Productivity studies and aquaculture with special reference to food technology.

Maldives

1. Low-cost housing

Nepal

1. Instrumentation (in India);
2. Information planning and analysis (in India);
3. Rural Trade School in civil construction trade for vocational school instructors.

Pakistan

1. Marine Geology (in India);
2. Instrumentation and maintenance (in Sri lanka);
3. Informatics (in India);
4. Silicon Technology (in India).

<u>Training Offered</u>

Bangladesh

1. Non-Destructive Testing all levels I and II;
2. Water Resources Management by Remote Sensing at lower levels;
3. Various types of surveys (e.g. health, population, agriculture, industry etc.)

Sri Lanka

1. CISIR could offer training facilities for technicians/ scientists in the area :-

   a) use of modern analytical instruments

   b) analysis of organic substances.

   Four persons could be accommodated each year (duration 6 weeks).

2. NERD Centre could offer other SAARC countries.

   a) training of an electrical/electronic engineer and a technican in the technology and commercialization of the fluorescent light operated on a storage battery

   b) training/familiarization in the use of gasifiers for smelting non-ferrous metals, running water pumps and running boat engines.

3. The Remote Sensing Centre of the Survey Department offers training in Analog Remote Sensing techniques for a limited number of technicians.

4. The Post-harvest Technology Institute of NARA could provide opportunities for researchers to be trained in processing, preservation and quality control of fish and fishery products, and for two persons from the region to join in the on-going coastal ecosystems programme focusing on coral reefs, estuaries and mangrove areas.

5. The Oceanographic division on NARA could provide limited opportunities for on-the-job training in basic oceanographic fields.

6. The Survey Department can offer training at Higher Diploma Level in Geodesy and Photogrammetry.

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