SOUTH-SOUTH COOPERATION IN SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

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INTRODUCTION

The role of S&T in the economic. social and cultural development of nations has been realized from at least the beginning of the 20th century if not even earlier. It was therefore, not surprising that as the developing countries of today who were all colonial territories in Africa and Asia of the major imperial powers of the 19th and 20th centuries, came to acquire their political independence starting from Indonesia in 1945 and turned their attention to their economic, social and cultural development, they strove to build up their S&T capabilities as well.

Initially, these countries often turned to their erstwhile colonial masters to build up their capabilities and institutional capacities in S&T and harness those capabilities and capacities to their national development. This was based on the fact that in 1950, the world's resources in these areas were all concentrated in North America, Western Europe and Japan. As the leading British scientist and S&T policy adviser to the British government both during World War II and therefore Patrick Blackett said at the "UN Conference on S&T for the Less Developed Areas" held in New York in 1963, the capabilities and institutional capacities of the Northern countries constituted a "supermarket" where the developing countries of the South could shop for whatever science or technology they needed.

However, as the developing countries got down to the operational modalities of tapping that "supermarket" in terms of getting their first generation S&T personnel trained in the industrialized countries, used so-called experts from the North to set up universities, R&D laboratories their first generation industries and the development of their agriculture from subsistence agriculture to surplus generating agriculture, they came to appreciate that the S&T 'products' in the Blacketian "supermarket" were not always the best or most appropriate ones for their conditions and requirements. They found that their starting conditions in terms of economy, society ecology and weather were very different from those of the North; their needs in terms of agriculture and industry, energy and communication were also different. For example, while the Northern countries were rich in capital and limited in labour, the situation in the developing countries was precisely the opposite. While their domestic markets were small, the industrial technologies that the North offered, except in regard to some basic products, were all based on large plants. When such plants were 'transferred' to the South they inevitably had to be run at low levels of capacity utilization because of the small market sizes, thereby leading to inefficient and high cost production. The human resources which the Southern countries had available from their own higher and middle level education systems were not able to run and maintain such plants efficiently even with extensive training in the plants of the technology and plant supplier in the North. The levels of automation in such plants was an added problem leading to frequent break downs of such plants thereby further worsening their economic viability and cost competitiveness. The Southern countries also found that companies in the Northern countries seldom supplied them with the latest technology which they were using and sold them obsolete or obsolescent plant and equipment making the products produced from the South non-competitive in international markets, both technically and commercially, thereby 'quarrantining' Southern industries to their home markets alone.

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Meanwhile by around the start of the 70's at least some of larger developing countries, like India, Brazil and China had built up considerable capacity in accumulating a pool of S&T personnel, R&D institutions in both agriculture and industry-related areas, including communication and transportation and productive capacity in agriculture and industry. Several of the less developed countries of the South therefore turned to them for technical assistance to build up their own capabilities and institutional capacities in these areas.

SOUTH-SOUTH CO-OPERATION

The principles of South-South Co-operation have been comprehensively defined in three important forums: the Non-Aligned Action Programme for Economic Co-operation among Developing Countries, adopted at the Conference of Non-Aligned Foreign Ministers in 1972; the Buenos Aires Plan of Action (BAPA) adopted at the UN Conference on TCDC in 1978; and the Caracas Programme of Action, adopted by the Group of 77 in 1981. As the three documents contain many similarities, for convenience we have referred here to only one of them, namely the BAPA.

The 1978 Buenos Aires Plan of Action (BAPA) for Promoting and Implementing TCDC provided the international community with a set of guiding principles and a framework for solving the problems of development in a post-colonial context. The Plan described the TCDC modality as a *"vital force for initiating, designing, organising and promoting co-operation among developing countries so that they can create, acquire, adapt, transfer and pool knowledge and experience for their mutual benefit and for achieving national and collective self-reliance, which are essential for their social and economic development.*" (SU/TCDC 1994, p.6)
It identified the basic objectives of TCDC as:

- fostering the self-reliance of developing countries by enhancing their creative capacity to find solutions to development problems in keeping with their own values and needs
- promoting and strengthening collective self-reliance among developing countries through the sharing of experiences and resources and the development of their complementary capabilities
- increasing the quantity and quality of international co-operation and improving the effectiveness of the resources devoted to technical co-operation through the pooling of capacities
- strengthening existing technological capabilities and creating new ones through the transfer of technology and skills
- improving communications among developing countries
- improving the capacity of developing countries for absorption and adaptation of technology and skills
- recognition of the problems of the least developed, land-locked, island developing and most seriously affected countries
- enabling developing countries to increase their participation in international economic activity

The Plan emphasised that the spirit of TCDC must permeate the entire United Nations development system, and all its organisations should play a prominent role as promoters and catalysts of TCDC. However, the role assigned to the United Nations is to support the efforts of developing countries themselves, who are expected to take primary responsibility for organising, managing and financing TCDC activities.

The Plan goes on to identify a number of recommendations aimed at strengthening and supporting co-operation among developing countries. These recommended actions were categorised according to the level of authority at which they should be taken:

National Level:

- national programming for TCDC

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- adoption of favourable legal, regulatory and administrative framework
- strengthening of national information systems
- improvement of existing national institutions
- promotion of national research and training centres with multinational scope
- promotion of greater national and collective technological economic and social selfreliance
- sharing of policy experiences with respect to science and technology
- encouragement of TCDC through national professional and technical associations and through public and private enterprises and institutions
- national information and education programmes
- expansion of bilateral links

Regional and Sub-regional Levels:

- identification of needs and development and implementation of TCDC initiatives
- promotion of complementary industrial and agricultural projects
- strengthening of regional information systems
- improvement of existing regional and sub-regional institutions
- encouragement of TCDC through regional and sub-regional professional and technical associations

Interregional levels

- development/strengthening of interregional co-operation

Global Level:

- exchange of development experience
- control of 'brain drain' from developing countries
- strengthening of transport and communications among developing countries
- maximising use of developing countries' capabilities
- strengthening capacity of UNDP for promotion and support of TCDC
- financial and technical support by developed countries for TCDC initiatives
- harmonisation of development assistance with TCDC
- financial arrangements for TCDC

We note that the framework laid out was fairly comprehensive in terms of the logic for such co-operation and the actions that need to be taken to promote effective co-operation. Technical co-operation among countries can be broadly defined as *any activity that increases human and institutional capabilities in order to promote social and economic development of the countries. It will always involve the development, adaptation and transfer of knowledge, experience, skills and technologies*. At the same time, however, it can be seen that the emphases within BAPA on science and technology specifically are few and very generic. At the Caracas meeting of the G77, held a few years later, there was an increase in the attention paid to science and technology [2].

It would be fair to conclude that in much of the earlier period, for many leaders of developing countries, science and technology were seen as activities that were too remote and expensive for their countries, and the only action required from the developing countries was to simply transfer

[2] The Caracas Programme outlines the opportunities ECDC offers for developing countries to take full advantage of existing and potential complementarities in technology, food and agriculture, energy, raw materials, finance, industrialization, and technical co-operation (Group of 77, 1981). Many of the same areas remain important today.

the relevant know-how and technology to their own country (South Commission 1990). Thus, even though the documents from the South did, off and on, refer to co-operation in science and technology, the small number of references, the low level of details provided on what and how, and the paucity of organised information on the subject demonstrate its low priority for the South as a whole, if not in rhetoric then certainly by the actions undertaken, though this is not true for all countries

EVOLUTION: THE PAST 20 YEARS IN SOUTH-SOUTH CO-OPERATION

As we take a brief look at the developments and results of South-South co-operation, and specifically those related to science and technology, it will be useful to avoid the most narrow meaning given to these words. We have mentioned that too often these words only refer to the most recent areas of breakthroughs, of radical technologies, and work that is only done at very large expense at the most prestigious research centres. We would use these words in their wider and correct sense that science is *one form of systematised knowledge* and that a given technology involves *the whole bundle of goods, which include not just a piece of machinery but also the skills of workers and technicians, standards, raw materials, designs, drawings, specifications, and tacit knowledge that is not specified in written form but comes from experience*. Defined in this way, all socially useful activities embody within themselves larger or smaller, more or less advanced sets of knowledge and techniques, and thus science and technology. This begins to suggest that technology co-operation does not begin and end in a standard form which includes only people and institutions involved with R&D, though they are certainly one component. But viewing science and technology solely through the lens of R&D sees only the tip of the proverbial iceberg.

Viewed from the wider perspective, most educational activities are important inputs to science and technology, and elements of technological transfer occur through investments, imports of capital goods, and various types of exports. Further, investments and trade provide the economic basis for additional co-operation in science and technology both more narrowly and broadly defined, and exchanges of scientific and technical personnel and training abroad increases the human relations development necessary for future co-operation.

As we have looked at the evidence available to us, severely limited though it is, it is apparent that South-South co-operation has received its first practical impetus from the motivations of increased trade and investments. It is useful to note that there have been a number of positive developments in this area and these are discussed subsequently. Closely related to the economic aspirations and efforts have been the fairly large number of regional groupings and organisations which have been formed to promote economic relations.

After economic relations, the next priority given by a number of countries, particularly the larger ones and those with well developed education and research systems, is the provision of scholarships, facilities and other mechanisms for the education and training of people from other countries of the South. This again is a natural development, and many commentators and policy makers (see the South Commission Report for example) have been urging more such cooperation.

We would suggest that the efforts so far have remained bilateral and not widely known. It would be useful for the countries to prepare a study of the extent, value and impact of this activity in the South. We also feel that with the continued need for wider co-operation in skills and training it should be possible for the South to develop new mechanisms or strengthen existing mechanisms for more globally administered scholarships for Southern citizens in the South.

The next area which has received considerable attention is the exchange of experiences and policies in different areas of economic development, public sector management, trade and foreign relations, and sometimes health and environment. This again is a natural outgrowth of the increased and differential experiences within the South. We strongly recommend that there is even greater need for such co-operation now than in the past. Some of the new areas for cooperation have arisen from the new global processes such as trade negotiations, environmental policies and restrictions. Some new areas stem directly from the changing context of science and technology, as we have experienced recently in Montreal, where 130 countries have agreed to certain standards regarding the movement and trade in biotechnological products in food and agriculture. As we review the experiences next, we conclude that there has been a less than desirable amount of support for the more scientific and technological areas and that these provide new and important opportunities for co-operation.

Co-operation in Knowledge and Innovation

We have argued earlier that too often science and technology are defined much too narrowly. Ultimately, we are interested in the increased availability of knowledge to all individuals, institutions and societies and in the greater and more effective application of knowledge to economic and social activities. Knowledge both grows out from and contributes to the daily productive activities of people, and to that extent, it is futile to attempt to disentangle knowledge flows from trade and investments (Rath and Herbert-Copley 1993).

Of course, there is a subset of knowledge activities which grow out of more systematic efforts at generation, codification and transfer of knowledge, normally undertaken in educational and R&D institutions. Often it is only the latter type of institutions and their work which are counted as legitimate activities of science and technology. But there has been much useful and practical knowledge generated in the South, within the experiments and experiences of particular countries, that needs to be shared, and this is much larger than the body of knowledge formally declared as science. This includes traditional knowledge of medicines, ecosystems, social formations, and the sustainable use of resources, which cannot always be ignored as outdated and superceded by improved knowledge systems. It also includes the knowledge gained from more modern social experiments, such as large scale vaccination or health delivery programs; extension programs to improve literacy or agricultural productivity; the experience in Chile in stabilising the flows of portfolio investments and in designing social insurance schemes; the recent experiences in a number of Asian countries, and Brazil and Mexico, of better and worse ways of dealing with shocks to the financial system; and the various experiences of promotion of trade, negotiations in WTO, in changing IPR regimes, and in promoting domestic capacity in education, science and technology.

We must also repeat here the fact that science is necessary but not sufficient for technology, and similarly R&D efforts are necessary but not sufficient for innovation (Anandakrishnan 1998). Even in the developing countries which have emphasised the supply side of the science and technology equation, such as building up educational and research facilities and increasing the supplies of trained manpower and resources for technology development, the weakness of the demand for this output from the production units has resulted in poor utilisation. Innovation requires linkages between the producers of knowledge and the users and is no longer seen as a linear process where inputs to science lead to technology development and the new technologies are in turn embedded in the production process as innovations. Rather, it is seen as a more complex, interactive system in which a number of traditional inputs are necessary but not sufficient.

With this background, if we are to take a look at South-South co-operation for knowledge and innovation, we should attempt to map the resources available, the different actors engaged in the process, and the different types of activities, from training and capacity building to research, knowledge sharing, technology co-operation and innovation. Unfortunately, the information we have been able to gather is much too sketchy, without much of the relevant details of the inputs, outputs and impacts. We present next a brief overview of some of the principal actors, namely the UN system and the role of some of the more active countries of the South. We find in our review many positive and other less positive instances of action and follow-up, though the rhetoric has rarely changed.

THE UN SYSTEM

It is noteworthy that the continued validity of South-South co-operation laid out in the Buenos Aires Plan has been repeatedly reaffirmed by the United Nations General Assembly and the Economic and Social Council, among others. In 1992, the Economic and Social Council called on all parties in the development partnership to give "first consideration" to TCDC and to review their policies and practices to facilitate the use of TCDC in the design, formulation, implementation and evaluation of the programmes and projects they support (UNDP 1997). We see in this the continued dichotomy of many actions of the South – the efforts to maintain the continued call for co-operation is indeed heartening but would be more valuable if it was backed up equally with resources and action.

UNDP and SU/TCDC

The Special Unit for TCDC (SU/TCDC) was established within UNDP in 1974 and serves as secretariat of the High-Level Committee on the Review of Technical Co-operation Among Developing Countries. This committee, which meets biennially, is responsible for the overall intergovernmental review of TCDC. The Special Unit also carries out other substantive responsibilities for the promotion and implementation of TCDC activities. Its overall aim is the mobilisation of TCDC. The primary concern is methodological rather than substantive sectoral development per se. The Unit's mandated functions are:

- carrying out research and analysis with respect to TCDC issues and problems
- financial arrangements for TCDC
- development and strengthening of INRES and inquiry services and promoting their wider use through appropriate linkages with the information systems in other UN development system organisations and national institutions
- co-ordination of TCDC matters within UNDP and the UN development system
- promoting wider use of the capacities of developing countries

Some of the examples of successful technical co-operation promoted by UNDP include:

- Ghana is adapting Senegalese techniques for fish-smoking, which are suitable for the traditional communities of West Africa and meet the taste preferences of the local population. (SU/TCDC 1995)
- Peru has a traditional way of preventing weight losses to potatoes, caused by modern refrigeration processes, which affect sugar content. The technique was transferred to Colombia, Cuba and Guatemala. (SU/TCDC 1995)
- China's Wuxi Regional Centre for Integrated Fish Farming became internationally known following a capacity and needs matching exercise organised by UNDP in China in 1983. The Centre has worked with Thailand and Turkey on fish farming through both bilateral and other contacts, and worked with Bangladesh following a second exercise in 1994. (SU/TCDC 1995)
- GLARES, a Latin American network on rural energy for sustainable development, has issued a handbook on rural energy planning. In November 1992, 19 Latin American and Caribbean countries met in Buenos Aires to agree on an agenda for cooperation. (SU/TCDC 1995)

- Biogas technology is moving from market to market, from China to Brazil and Costa Rica and from India through an NGO, AFPRO, to Cambodia. (SU/TCDC 1995)
- In Jaipur, India, Dr. Pramud Karan Sethi and his associates developed a simple, flexible and inexpensive foot-replacement prosthesis. The "Jaipur foot" was vastly improved in the 1980s and the technology has been transferred to Malaysia and Nicaragua. (SU/TCDC 1995)
- "Operation Ear-lift", first conducted in Kenya in 1987 and then in the Lao People's Democratic Republic in 1989 by a Thai mobile unit for hearing treatment, was set up by Dr. Sylaveth Lekagul as a private voluntary enterprise in the early 1970s. The effort received support from other surgeons in Thailand and recognition from the Thai Government in the 1980s. Kenya has set up its own ear-testing and surgery service, using instruments and techniques developed by the Thai surgeon. (SU/TCDC 1995)
- Economic scholarships provided for the training of over 2000 participants between Singapore and the Caribbean (SU/TCDC 1998a)
- The International Centre for Agroforestry in Kenya succeeded in overcoming the traditional Northern dichotomy between agricultural and forestry research, helping farmers in several countries to adopt environmentally friendly and profitable techniques. (SU/TCDC 1998a)
- In the Andes, a pioneering research consortium of institutions, researchers, villagers and farmers focused on poverty reduction, environmental restoration and increased production. (SU/TCDC 1998a)

We note here that most of these cases involve fairly simple technologies with low science inputs, though they are important nonetheless. This raises a challenge for priority making in the future, whether the South should have more of these types of technologies or more hightechnologies involving high science inputs, which is an issue for discussion among the groups at this meeting. Some of the more high technology co-operation efforts, which also appear to have led to useful outputs, are described separately in individual text boxes within this section. SU/TCDC has had a small budget and small staff. It has seen its work to be promotional in a number of key areas. One major effort has been to bring interested parties together to discuss future activities, through Capacity and Needs Matching (CNM) exercises. Between 1983 and 1990, an average of two such exercises were reported to have been conducted per year, for a total of 14. The Unit has also supported the conduct of studies and surveys of needs and capacities, frequently leading to TCDC project agreements between countries, and has held meetings, seminars and workshops for the purpose of considering common problems, matching needs and capabilities, and drafting agreements on joint programmes. SU/TCDC maintains an Information Referral System, recently transformed into the Web of Information for Development, to collect and disseminate information on Southern expertise and successful practices, development institutions, centres of excellence, and training courses (SU/TCDC 1998b). Most support from SU/TCDC has been allocated to projects in areas of poverty alleviation, the environment, promotion of small and medium enterprises as an employment generating strategy, application of technology, coastal fishing development, urban management, and the promotion of women in development.

Many reports identify the critical missing link in South-South co-operation to date as the lack of adequate financial resources to make proposed activities viable. The Special Unit for TCDC has been inadequately funded, with yearly average allocations from UNDP of $0.12 million for the period 1976-8, $1.12 million for 1982-89, $2.0 million for 1992-6, and $3.75 million for 1997-2000. This translates to an overall yearly average of only $1.75 million per year, or a total allocation of 0.2% of the $16 billion total resources available to UNDP, for a global scope mobilisation programme.

Somewhat more positively, during the 1992-1996 programming cycle, the UNDP board identified TCDC as one of its six programme priorities. And, for the 1997-1999 programming cycle, UNDP has for the first time allocated 0.5% of its overall program resources for TCDC.

While this 0.5% allocation represents a jump of 250% over the earlier average of 0.2%, it is still only a small step by any absolute measure.

The developing countries themselves have not become any more alert to the primary responsibility they hold for financing TCDC activities. Very few have taken advantage of the IPF mechanism to allocate resources for TCDC projects. None have contributed to the Trust Fund for South-South Co-operation or the Perez Guerrero Trust Fund for the promotion of South-South cooperation.

Among developed countries, only Japan and Ireland have contributed to the South-South Trust Fund, donating US$8 million and US$36,000, respectively. The Republic of Korea has pledged US$200,000 to promote such activities, and the support for the Seoul Forum is a good step in the direction of more active participation.

A further shortcoming of past co-operation activities has been the absence of systematic follow up. For example, the SU/TCDC arranged 16 programming exercises and project planning meetings between 1983 and 1989. Each one was attended by between 5 and 28 countries, and 2123 potential projects were identified. However, little information exists on how many of these projects were implemented, with what results and how many were cancelled. Many observers feel that the rate of implementation of activities following these meetings is seldom above 50%. Without more careful follow up and assessment it is difficult to say whether a 50% rate is good or bad. Certainly, project-planning meetings should generate many ideas and not all of them will be found worthwhile on later detailed examination.

Comments and ideas from participants suggest that the process has too often been somewhat ad hoc. Often the activities that are agreed to between participating countries are lost sight of completely after the consultation meeting when everyone returns home. In many cases there is little consideration given to the resource requirements for various proposals and the likelihood that the resources will be available. Sometimes, many developing countries cannot even adequately design the activities that are agreed to and for which funding is not difficult or onerous. As such, project agreements are described by some as more of a wish list rather than serious commitments or undertakings (Muhith et al. 1991).

Based on these assessments, the SU/TCDC has set out a new course for itself. This is to focus more on policy exchanges; to move from ad hoc interventions to clusters of activities and some flagship projects that are more carefully planned; to a greater reliance on pivotal countries of the South, which are more active and have greater capacity; to stress increased non-core resource generation; and to make the South network more interactive and dynamic. The Seoul Forum is an example of the new thrust on policy exchange that can develop a cluster of S&T related activities strongly supported by Southern actors and with adequate resources.
We are hopeful that at the Seoul Forum, with the participation of so many eminent persons from the international, regional and national organisations, we will stimulate a renewed vigour and new commitments to strengthened and expanded co-operation for sharing knowledge and promoting innovation, backed up with resources and action programs.

Other UN organisations and agencies
A key difficulty in evaluating the impact of TCDC promoted by the overall UN system lies with the limitations of the available data. Although all agencies report that TCDC activities have been "mainstreamed" such that all programs incorporate TCDC principles, a recent evaluation of the impact of TCDC found available data to be incomplete and largely non-quantitative, thus

preventing the establishment of appropriate benchmarks to assess the true extent of support for TCDC by the UN system.

However, despite limitations in available data, various reports suggest that many organisations in the UN Development System outside of UNDP have undertaken activities aimed at strengthening national and regional institutions in developing countries. A few organisations within the UN development system are particularly noteworthy for their contributions to TCDC. UNFPA and ILO have been active in facilitating skills and knowledge sharing programmes (SU/TCDC 1998a; UNDP 1997). The Food and Agriculture Organisation (FAO) has employed TCDC as a major modality in its service delivery, reportedly engaging in such activities as the use of TCDC experts, training and study tours, regional and sub-regional workshops, support to regional organisations, and the dissemination of information on innovation and best practices. FAO has a comprehensive roster of TCDC experts in the South as part of their Agricultural Sciences and Technology Information System. The World Health Organisation (WHO) reports supporting the preparation of a TCDC directory in the health sector, as well as promoting knowledge sharing between various medical research and training institutions. UNIDO is currently focussed on high-impact TCDC activities at the regional and sub-regional levels, aiming to facilitate the flow of economic and technical support from more advanced to less advanced countries in each region (UNDP 1997). UNIDO manages an industrial and technology information bank and technology information exchange system. The Universal Postal Union maintains a roster of experts in postal services and communications in the South. UNCTAD's Global Trade Point Network provides information on goods and services, trade practices and investment opportunities in 117 Southern countries (UN General Assembly 1999b). A few specific examples of successful UN-sponsored co-operation projects are described below: Nigeria's 1994 Capacity and Needs Matching Exercise in agriculture, industry and technology, sponsored by SU/TCDC, attracted 25 other developing countries from Africa, Asia, Latin America and the Caribbean to explore possibilities for technical co-operation with 70 Nigerian institutions and organisations from both the public and private sectors. The exercise is reported to have generated 271 bilateral agreements, over 95% of which were between Nigeria and other countries, although only about 20% of these agreements have so far been implemented. However, the exercise has contributed to stimulating and facilitating capacity building through sharing of training expertise and facilities. During 1994, approximately 70 Nigerians attended training courses arising from the workshop, in China, India, Indonesia, Singapore, Thailand, Turkey and Uganda. Nigeria has also hosted training courses for professionals from 15 other developing countries.

The International Network on Small Hydro-Power Development among Developing Countries was established based on collaboration between the Hangzhou Centre for Small Hydro Power in China, SU/TCDC and UNIDO. Its aim is to strengthen the capacity of developing countries to develop and mange small hydro-power systems for sustainable socio-economic development. The project's achievements so far include the establishment of the Network itself and its regular annual conference; the enlistment of the participation and support of developed countries in a triangular co-operation arrangement; the establishment of a Trust Fund to fund the project's activities; an increasing number of participating developing countries; and capacity-building efforts such as training activities, information exchange and technical assistance schemes. In 1995 and 1996, training was provided for 82 people from 31 developing countries (Akeredolu-Ale 1999).

The project entitled *Best Practices on Poverty Reduction: Technical Co-operation in Latin America and the Caribbean* was created to identify and disseminate successful poverty-reduction practices in Argentina, Bolivia, Colombia, El Salvador, Jamaica and Venezuela, and to contribute to the development of practical guidelines for building alliances for poverty reduction. The project was sponsored by SU/TCDC, UNDP, EDI/World Bank, and the Inter-American Foundation.

Outputs of the project include 100 case studies of successful partnerships and 400 profiles of best practices for poverty reduction; the creation of a network of academic and research organisations; and 20 training courses and seminars to disseminate the project's findings at regional and sub-regional levels. The project has significantly raised the level of awareness regarding strategies and best practices for poverty reduction (Akeredolu-Ale 1999).

Within the UN system, scientific and technical co-operation activities have largely focussed on sharing information concerning different countries' technical capabilities. Most UN organisations have collated information on expertise, institutions and best practices within developing countries. However, we have been unable to find any reports on the effectiveness of these databases and information services. The information has been collected and made available, but who uses these services, how useful are the databases, and how active and current they are cannot be gauged.

Recent evaluations suggest that TCDC has failed to live up to its expected potential within the UN system. Indeed, "in terms of relevance of inputs, despite the wide range of 'TCDC' activities reported by the organisations of the UN development system over the years, … 'TCDC and ECDC are still not optimally applied in the operational activities of the UN system'" (Akeredolu-Ale 1999, para.33, quoting Doc. No. A/53/226/Add.4, para.31). The main impediments to the effective implementation of TCDC have often been listed as: lack of agreement on critical terms such as the concept of TCDC itself, its fundamental objectives, and the appropriate roles of different partners; lack of information concerning the usefulness and applicability of TCDC; weak organisation and a lack of institutionalised technical support; shortage of funds; and negative attitudes towards TCDC (South Commission 1990). All too often, there have been conferences and planning exercises sponsored by UN organisations to develop co-operative projects which are never implemented due to lack of follow-up and insufficient resources. Several examples of this, given by Akeredolu-Ale (1999), are given below.

Project Title: Capacity And Needs Matching Exercise: The Coconut Industry (1992)
This exercise, promoted and funded by the SU/TCDC, took place in Jakarta in March 1992, bringing together twenty-five coconut-producing countries from Asia, Africa, Latin America and the Caribbean. The meeting allowed the participants to share their experiences and discuss technical and economic co-operation issues related to the coconut industry, and yielded ninetyfive proposals for technical co-operation. However, implementation of these proposals has proved problematic, primarily due to lack of funds. Thus, apart from providing an opportunity for discussion, the project cannot be said to have made a significant impact.
Sponsored by SU/TCDC

Project Title: Inter-University Cooperation In Policy Research For Sustainable Development (Ethiopia, 1993)

This project was a follow-up to a UNESCO seminar on cooperation among universities in the South in policy-oriented research for sustainable development, and was intended to facilitate networking among eight African universities and two universities each from Europe and North America. While the network is reported to have been established, it has not undertaken any significant activities due to weak telecommunication capacities of the participating African universities, inadequate management, and lack of funding. The few research papers produced under the project have not been published due to lack of funds, and other papers commissioned have yet to be completed three years after the deadline.
Sponsored by SU/TCDC

Project Title: Workshop on Simple and Low-Cost Meat Preservation Technologies for French-Speaking African Countries (1992)

The objective of this workshop, which was attended by participants from 18 francophone African countries, was to disseminate the results of applied research on low-cost meat preservation technologies and strengthen the institutional basis for technical co-operation among francophone African countries. Although the project improved the technical knowledge of the participants in this area, the decision to create a network for continued interaction and exchange has not yet been followed through.
Sponsored by SU/TCDC

Project Title: Regional Centres for Transfer of Technology

A particularly important programme of South-South Cooperation in the area of technology under UN auspices at the regional level has been that of setting up Regional Centres for the Transfer of Technology by the respective UN Regional Economic Commissions. The core funding of these Centres is provided by the developing country of the Region in which the Centre is located while project funding is provided by UNDP and the UN specialized Agencies or bilateral donors from both the North and the South. If our experience with the RCTT located in Delhi, called the Asian and Pacific Centre For the Transfer of Technology (APCTT) is anything to go by this mechanism has become a very useful mechanism for bringing about South-South Co-operation in technology in particular at the regional level.

Project Title: CGIAR International Agricultural Research Institutes

In the area of agriculture, the several international research institutes all located in developing countries funded jointly by the World Bank, the UNDP and the FAO under the umbrella of the Consultative Group on International Agricultural Research (CGIAR) have also played an important role in fostering South South Cooperation. One of these institutes located in India the International Centre for Research in the Semi-Arid Tropics (ICRISAT) set up in the early 70's is doing excellent work on the difficult agricultural problems of increasing agricultural production developing pest control and soil moisture retention techniques in Southern countries around the globe. These institutes, which are manned overwhelmingly by developing country scientists from around the world, have also facilitated these scientists getting to know each other personally and professionally and to build lasting relationships.

Project Title: South-South Conference on Trade, Finance and Investment (Costa Rica, 1997)

The objective of this meeting was to provide a forum for discussion of the central development challenges facing the South with respect to trade, finance and investment, as well as to formulate a concrete programme of cooperation among developing countries in these areas. The conference was attended by member-States of the Group of 77 identified as business and industrial leaders, China, UNCTAD, UNIDO, regional inter-governmental organisations, privatesector organisations and regional development banks. The San Jose Programme of Action was adopted at the conference, outlining the opportunities and challenges presented by globalisation and liberalisation, and a draft plan for increased co-operation among developing countries in trade and investment. However, there has been little or no follow-up action on the San Jose Programme.

Sponsored by SU/TCDC, Government of Costa Rica, and other private sources
Overall, the South Commission Report (1990) summarises the impact of TCDC activities up

to 1990 as follows:

In most cases, idealism has not been tempered by a degree of practicality or matched by commitment to action. A tendency to underestimate obstacles and the effort and time needed to get tangible benefits has often left expectations unfulfilled and thus led to frustration and even cynicism. (p.149)

National Actions

There are many examples of outstanding national programmes and institutional arrangements. The UNDP finds that the 25 countries listed in Table 4 have fairly well-established institutions and programs for South-South technical co-operation. We have not been able to find any systematic information on each country but have below a few cases and examples [4].

Asia and the Pacific	**Africa**	**Latin America & the Caribbean**
China	Nigeria	Argentina
India	Senegal	Brazil
Indonesia	South Africa	Chile
South Korea		Colombia
Malaysia		Costa Rica
Pakistan		Cuba
Singapore		Mexico
Thailand		Peru
		Trinidad & Tobago

Despite the absence of a national policy for technical co-operation and problems of inadequate funding, Nigeria has participated in many important co-operation activities, some of which were initiated and largely funded by the country itself. Its co-operation activities have largely focussed on training and exchange of experts. It has promoted the mobilisation of its own technical experts to serve in other countries of the South through the Nigerian Technical Aid Corps scheme (see box below), and has used experts from other developing countries in implementing some of its major development programmes.[4] Akeredolu-Ale (1999) was a source for several of the individual examples and country profiles.

THE NIGERIAN TECHNICAL AID CORPS SCHEME (1987)

This project represents a national co-operation initiative that was not funded and promoted by SU/TCDC. The project was implemented and managed by the Directorate of Nigeria's Technical Aid Corps, a special Directorate in the Ministry of Foreign Affairs. Under the scheme, volunteers are assigned abroad for a period of two years. The objective of the scheme was "to assist Black African, Caribbean and Pacific countries which regularly request for Nigerian Technical Assistance…[and] to demonstrate Nigeria's concern for the developmental aspirations of the Third World, while also offering a unique opportunity for young and dynamic Nigerians to contribute to the development of sister African countries" (Akeredolu-Ale 1999, para.184).
Not much information could be found on the size, scope and impact of this initiative. However, data suggests that at least 300 volunteers were deployed to over twenty countries between 1987 and 1992. The volunteers in highest demand during this period were science teachers, nurses, medical doctors and engineers.
Initiative of the Nigerian Government, no external funding.

Senegal has participated in many technical co-operation projects over the last five years. The country has provided short-term training to thirty students attending the Centre de Formation Professional et Technique, and has provided technical assistance to other francophone developing countries. Both of these initiatives were funded under a triangular co-operation arrangement with France. Senegal has also been a recipient of technical assistance from Tunisia, Morocco, Egypt and Saudi Arabia, and has benefited from training courses offered by a number of Asian and Arab countries.

China has a substantial programme of technical co-operation, from which the country itself has acquired valuable knowledge in fields such as environmental protection, meteorology, agriculture and forestry, and from which many developing countries are benefiting (UNESCO 1998). The Chinese Government has established technology co-operation agreements and exchanges with over 135 countries. As of 1993, China had become a member of over 800 international academic institutions, and in 1994 alone held 400 international academic science and technology meetings for over 10000 visiting scholars (UNESCO 1998). The Chinese Government is reported to spend approximately US$1.0 million per year on TCDC training courses for other countries of the South. Courses were held in 1997 and 1998 on such topics as Small Hydro-Power, pottery technology, and mushroom technology. Between 1993 and 1998, 124 Chinese experts were deployed to 23 countries.

India has been formally involved in technical co-operation activities since 1964 and views TCDC implementation as an integral part of the country's foreign policy. The Indian Technical and Economic Co-operation Programme (ITEC) implements substantial co-operation activities in the areas of training and study tours, deployment of Indian experts and consultants, and direct technical support to industrial and infrastructure projects. Although ITEC is essentially bilateral, its resources have on occasion been used to finance trilateral and regional programmes under the Economic Commission for Africa, UNIDO and Group of 77. The programme trains nearly two thousand persons from over 100 countries each year in 54 Indian institutes. ITEC also arranges around twenty study visits per year for delegations from partner countries. Recent projects undertaken by ITEC include the establishment of solar energy plants in Cuba, Mauritania,Mauritious, Maldives, Kampuchea and Costa Rica, computerisation of some offices of the Government of Senegal, augmenting milk production in Kyrghyzstan, and sharing experience in dry-farming techniques with Iraq. India spends approximately US$60-70 million per year on ITEC activities and these amounted to a cumulative expenditure of US$2.0 billion in 1997, over a period of 33 years.

In addition to its financial outlays through ITEC, India deploys 10% of the assistance it receives from UNDP for technical co-operation activities, including Project INTERACT, India is also very active in providing education and training facilities for students from the South. The country offers roughly 1000 scholarships annually for students from developing countries. In 1994, there were 13000 foreign students pursuing higher education in India, including about 5800 from Africa, 4400 from East and South Asia and 2000 from West Asia (Technical Co-operation Division, Ministry of External Affairs, Government of India 1999; UNCTAD 1998).

The Ministry of Railways of the Government of India not only launched a programme of training railway engineers from other developing countries but also providing the services of its consultancy and design engineering company, the Railways Industrial Technical and Engine ring Services (RITES) to undertake the preparation of Feasibility and Project Reports for railway projects in other developing countries in association with such local railway personnel as those countries had or had been trained in India. As a follow on of such work the capacity and capability of actual building railway systems in other developing countries. Often such projects

were at least part financed with lines of credit offered by Zindia to the developing country in which the system was to be built.

Similarly in the area of petroleum and petrochemicals, the consultancy and design engineering company. Engineers India Ltd.. (EIL) performed similar assistance functions with particular emphasis on concurrently building up institutions with similar capabilities and capacity in the other developing country involved. The counterpart to RITES and EIL which the Government of India had set up in the mid 60's in the area of water and power the Water and Power Consultancy Services Company (WAPCOS) did likewise on a whole of range projects in numerous other developing countries. The late 70's and 80's saw the same type of mechanism being followed in the area of Telecommunication with the Telecommunications Consultants India Ltd. (TCIL) playing the corresponding role, while Educational Consultants India Ltd. (EDCIL) in the area of setting up schools whole university campus and providing teacher/faculty training and provision of curricula, libraries and laboratories and Hospital Consultancy Services Ltd. Undertaking the equivalent task in the area of hospitals in both urban and rural areas. Several equivalent institutions in Brazil and Chine also do likewise.

With the intellectual inputs and those of past experience coming from another developing country, the so-called 'recipint' developing countries have found such arrangement not only more appropriate to their conditions, problems and needs but also much cheaper than equivalent assistance from the highly industrialized countries. Most importantly there were no strings attached and strong elements of empathy and understanding of 'recipient' country problems and difficulties as India, Brazil, China and other major developing countries had faced similar difficulties and problems themselves. South-South Cooperation in S&T and associated production systems in various socio-economic sectors and in science itself was born. The last twenty five years have seen this cooperation grow manifold, diversify into ever newer areas and widen and deepen. Thus, for example, the ITEC Programme of India which had a budget of only US$10 million in 1990 is running today at around US$100 million annually. In the case of South Asia, India also has, separately from ITEC, large bilateral technical assistance programmes to Nepal, Bhutan, Bangla Desh, Sri Lanka, Maldives and even as far as Mauritious.

Indonesia has implemented many significant co-operation activities under its "Strengthening of TCDC" programme, funded entirely from the country's IPF for a total cost of US$1.9 million. Notable activities include the training of 252 Indonesians abroad, largely in other developing countries; an Expert Group Meeting on Poverty Alleviation, which was attended by 34 participants from 8 developing countries; numerous study visits at Indonesian institutions for overseas trainees; and 16 technical assistance missions to Cambodia and the Philippines. Through this programme, the country has also been the recipient of technical assistance from other countries in 65 projects. The programme demonstrates how a developing country can combine in one cooperation project activities in which it is the net-recipient with those in which it provides technical assistance to other countries.

PROJECT INTERACT (1981-1984)

This project dealt with the application of small/mini computer systems to electric power systems management, passenger reservation systems on railways, and advanced weather forecasting techniques. R&D collaborators on the project included the Computer Maintenance and Services Corporation (CMC, a public sector computer company) and the departments responsible for the sectors, and computer specialists from Venezuela, Mexico and Yugoslavia. It was agreed that the technology flowing from all three aspects of the project would be fully shared between the participating countries and that each country would be free to commercially use the technologies without future technology payments. Total funding to Project INTERACT was approximately US$2.1 million, US$1.5 million of which was provided by the now defunct UN Fund for Science and Technology for Development and the remainder provided by the GOI under its IPF allocations. The project was completed in 1984 and was favourably reviewed by leading external

experts.

Through the Singapore Co-operation Programme, Singapore has sponsored training courses and study visits for over 7000 professionals from 105 developing countries since 1992. The annual budget of these activities is US$10.0 million. Although many of Singapore's technical assistance activities are bilateral arrangements, the country also uses triangular arrangements, and now has Third-Country Partnership arrangements with eleven developed countries. Both the private sector and centres of excellence in the public sector participate strongly in implementing co-operation programmes.

The Government of Brazil established the Brazilian Co-operation Fund to finance cooperation with other members of the Organisation of American States in the area of human and institutional capacity building. Efforts have included courses, internships and technical visits; fielding of Brazilian experts to conduct courses and seminars; and the provision of expert and advisory services. The Fund has financed 47 technical co-operation projects in agriculture, energy, health, environment, public administration, and education. Brazil also participates in several co-operation implementation networks, such as FAO's Agreement on the Use of Experts in TCDC; triangular co-operation activities with SELA; and the MERCOSUR regional block. The country's co-operation activities also extend to Asia, Africa, and Eastern Europe.

Chile has been particularly active in the area of technical assistance. Chile's International Co-operation Agency (AGCI), which manages and coordinates technical co-operation activities with other developing countries, raised US$1.2 billion in concessional funds and technical assistance from international multilateral and bilateral co-operation sources between 1990 and 1998. Chile's co-operation efforts also include a scholarship programme for continuing education, which is aimed at other Latin American countries.

National TCDC Focal Points work with SU/TCDC, acting as channels of communication and assisting with the identification of opportunities for the application of TCDC. Their activities include formulating projects with co-operative partners, matching needs and capacities for specific development activities, and mobilising resources for technical co-operation. The Focal Points implement programmes through partnerships with the organisations of the UN development system and other intergovernmental and non-governmental organisations. Most developing countries display an awareness of the appropriateness and costeffectiveness of TCDC as a technical co-operation modality, and continuously affirm the

relevance of the TCDC modality to their own economic and social development strategies and to the strengthening of South-South co-operation and self-reliance. However, many are not making the maximum effort to practice and advance TCDC (South Commission 1990). Despite participation in and initiation of TCDC projects, most developing countries do not yet have a national TCDC policy. China, India, Brazil, Singapore, and Kenya are exceptions to this (Akeredolu-Ale 1999).

According to a number of reports, national TCDC focal points frequently have an inadequate grasp of their capacities and needs, not to mention mechanisms to manage the transfer and absorption of technology (South Commission 1990). Many suffer from poor quality of leadership, support personnel, administrative facilities, communication facilities and funding. Such weakness of national focal points, coupled with the absence of specific national policies, imposes a critical limitation on the ability of developing countries to participate effectively in TCDC. In addition, serious shortcomings exist in the funding of national technical co-operation projects, as most

developing countries make no specific or regular budgetary allocations for the effective running of focal points and funding of TCDC initiatives (Akeredolu-Ale 1999).

Furthermore, despite the strength of some national co-operation programmes, there is a clear predominance of activities in TCDC-related training and the exchange of experts rather than in technical co-operation activities concerned more directly with the development of particular productive sectors. As well, existing programmes exhibit a strong regional focus, as in the case of the Latin American Economic System and of the high-capacity pivotal countries in Asia. Countries tend to collaborate more readily with those with whom they share language, history, or cultural traditions. An example of South-South co-operation cited by Dr. Vargas that breaks out of this tradition is the project between Brazil and China to co-operate in remote sensing applications using satellites.

At the same time, both the South Commission (1990) and SU/TCDC (1995) have noted a tendency on the part of many developing countries to view South-South co-operation as a less desirable co-operation modality compared with North-South exchanges. The forging of South-South bonds must overcome the habit of using familiar links with the North, often a habit supported by powerful domestic and foreign interests but at other times due to the larger resources available for North-South linkages. The orientation of the business sector towards the North and links with trans-national corporations have tended to limit contracts within the South, and deliberate policies to promote private co-operation have been largely absent. However, this situation is beginning to change.

We would suggest a modification to the Secretary General's observation “co-operation in industry, technology transfer and enterprise development is perhaps one of the weakest aspects of South-South co-operation. This is due largely to limited involvement of the private sector in schemes of South-South co-operation,”(UN General Assembly 1999b, para.25). Of the suggested weaknesses we find that co-operation on specifically technology related activities remains the weak area and probably much more needs to be done regarding firm to firm co-operation[5].

Despite these limitations of national co-operation schemes, a number of recent positive developments can be noted. These include the use of more sophisticated and complex forms of exchange rather than just single training episodes or study tours; the expansion of interregional activities rather than just bilateral and intraregional programmes; the increasing use of triangular co-operation arrangements with developed countries; the growing role of high-capacity pivotal countries; and the increasing participation of the private sector and NGOs in implementation of co-operation projects. Interfirm technology agreements have increased from approximately ten per year in the 1980s to forty per year in 1996. Greater efforts are visible within the stronger regional groupings such as MERCOSUR and ASEAN. A few of the newer type of more innovative projects are cited here and many more examples were provided by the participants.

[5] For a more detailed discussion of inter-firm technology co-operation refer to T. Tesfachew, “The Role of Governments in Promoting Inter-Firm Technology Co-operation,” in UNCTAD 1998, and Plonski, Alcorta and Rimoli (1998) for case studies of inter-firm collaborations within Latin America.

VISUALSOFT INDIA LTD. AND KONSORTIUM BUMI KOMPUTER (KBK) (MALAYSIA)
In 1997, Visualsoft, a company specialising in software development for networks, signed a Memorandum of Understanding with Malaysia’s KBK for co-operation in software development and services. The agreement included setting up two joint-venture centres, one to be built in Hyderabad, India and the other in Malaysia. The partnership provided KBK with technological and R&D support, as well as a steady and guaranteed supply of network softwares needed for the Malaysian market. Visualsoft received new capital and the opportunity to upgrade its

technology and establish a strong presence in the South-East Asian market.

AFRICA/ASIA JOINT RESEARCH: INTERSPECIFIC HYBRIDZATION BETWEEN AFRICAN AND ASIAN RICE SPECIES

This project is developing radically new low-management, high-yielding varieties of rice through cross-breeding of African and Asian rice. The new rice varieties have the capacity to suppress weeds and withstand environmental stresses and diseases. The project includes rice experts from institutions in several countries, including the University of Tokyo; Japan International Centre for Agricultural Sciences; the University of Kyoto; seventeen African National Agricultural Research Systems; the West African Rice Development Association; the International Rice Research Institute in the Philippines; the Institut Français de Recherche Scientifique pour le Développement en Coopération; the International Centre for Tropical Agriculture; and Cornell University.

In 1997 and 1998, the project dispatched back-cross progenies to Asia, Latin America and seventeen African nations, including Benin, Burkina Faso, Cameroon, Ivory Coast, Gambia, Ghana, Guinea, Guinea Bissau, Nigeria, Sierra Leone, and Togo. The farmers themselves have been allowed to take a leading role in the breeding process. Preliminary results show that increased proportions of farmers from Ivory Coast, Guinea, Ghana and Togo are including at least one variety in their seed profiles, and in some cases three to five. Studies indicate that by the year 2000, a modest 10-15% adoption rate will reduce imports by 10-25% and increase farmers' incomes by more than 25%.

THE EAST ASIAN ECONOMIC DEVELOPMENT EXPERIENCE TRAINING PROGRAMME (1997)

This programme provided policy-oriented training on East Asia's development experience for midlevel professionals from the civil service, academia, the media and the private sector in Southern and East Africa. The month-long training programme included a series of lectures, visits to key economic institutions in Singapore, guided use of the facilities available at the Institute of Southeast Asian Studies, and field visits to Malaysia and Thailand.
Source: SU/TCDC 1999

THE BOLIVAR PROGRAMME

The Bolivar Programme is an international non-governmental organisation and program which was formally launched in 1992, combining the previously established ENLACE, a regional programme to link production and scientific research sectors, and a similar initiative called the Bolivar Program for Regional Technological Integration, Innovation and Industrial Competitiveness. Its Board of Directors is comprised of individuals of a high business and technical profile. The mission of the Bolivar Programme is the promotion of technological, productive, financial and trade integration, competitiveness and industrial innovation, and facilitating the establishment of partnerships between enterprises and/or research centres from two or more Latin American countries as well as between them and similar entities in other regions.

The programme has created National Commissions in 18 Latin American and Caribbean countries, involving more than 600 top ranking individuals and approximately 200 institutions from the region. These Commissions constitute lobbies which generate a favorable environment for the Programme's activities. Liaison Offices support the work carried out by the National

Commissions, promoting meetings and joint initiatives between firms and research centres and assessing the projects submitted by them.

Through the Bolivar Programme, co-operation agreements have been signed with at least 23 regional and international organisations, including ALADI, COLCYT, SELA and UNESCO. Up to April 1993, approximately 110 projects had been submitted in a wide range of productive sectors, including petrochemicals, communications, tanneries, and information sciences.
Source: "Programa Bolivar"

IBEROEKA

The IBEROEKA projects support innovation in the industrial sector and promote interfirm cooperation in R&D. The projects form part of the Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo (CYTED) international co-operation activities. The initiative involves national science and technology councils, technological institutes and centres, universities and various government bodies from 19 Latin American countries, as well as Spain and Portugal. The specific projects are defined and designed by companies from at least two member countries, possibly in collaboration with a science and technology centre. Projects are financed by the governments of the partners' own countries.

A recent list of IBEROEKA projects noted the involvement of almost 100 companies and over 30 scientific institutions. Almost half of those institutions were universities in Spain, Brazil, Portugal, Uruguay, Panama and Ecuador.
Source: UNCTAD 1998

THE AFRICAN VIRTUAL UNIVERSITY

The African Virtual University (AVU) is a first-of-its-kind interactive instructional telecommunication network established to serve the countries of Sub-Saharan Africa (SSA). The objective of the AVU is to build capacity and support economic development by leveraging the power of modern telecommunication technology to provide world-class quality education and training programs to students and professionals in sub-Saharan Africa.

The AVU seeks to achieve its objectives by harnessing the power of interactive satellite and computer-based technologies to share some of the highest quality academic faculty, library resources, and laboratory experiences available in the world. Using these technologies that provide the flexibility and cost-effectiveness of a virtual academic infrastructure, the AVU will be in a position to produce large numbers of scientifically and technologically literate professionals and support them with lifelong learning opportunities. The AVU can thereby contribute to overcoming the existing barriers of declining budgets, too few faculty, outdated equipment, and limited space and facilities that prevent increased access to higher education for a significant majority of students in SSA. The increase in the number of scientifically and technologically literate professionals will, as a consequence, better position countries in SSA to be part of the global information age and the new knowledge economy.

The AVU is currently in its pilot phase during which the virtual university concept is being implemented and tested in 14 English-speaking and 8 French-speaking universities across sub-Saharan Africa. The AVU will soon be transitioning to the operational phase when it will begin offering fully-fledged degrees in three disciplines of study – Computer Science, Computer Engineering and Electrical Engineering. The AVU also offers professional development training, executive business education, language instruction, information technologies training, and remedial instruction.

Since the beginning of its pilot phase, the AVU has broadcast over 2000 hours of instruction to over 9000 students in all regions of sub-Saharan Africa. This initiative has allowed AVU students to take courses given by professors from world-renowned educational institutions in Africa, North

America and Europe.

BIOTICA (ARGENTINA) AND SEMENTES AGROCERES (BRAZIL)

The partnership between Biotica and SA was orchestrated by the Brazilian-Argentinean Centre for Biotechnology (CABBIO), an association of firms and individuals which is jointly funded by the two governments but is privately run. Biotica is a small research-oriented firm specialising in vegetable micro propagation and new potato seed technology, while SA is a leading manufacturer of agricultural seeds and animal food in Brazil. The objective of the partnership was to develop, produce and market a new variety of potato seed using Biotica's knowledge and research capabilities and SA's financial resources and large-scale production and marketing competencies.

A new variety of potato was successfully developed and tested in Brazil, where it is accounting for 2% of the Brazilian market and competing successfully with imports from Europe. However, the relationship between the partners was not smooth, due to lack of awareness on the part of the small-scale partner about the business culture and different perspectives of achievements. While Biotica was more concerned with technical advance, management from SA tended to focus on financial results.

Source: Alcorta et al. 1998

BIOPHARMACEUTICALS IN LATIN AMERICA

The Cuban Government has identified work on biotechnology and its applications as a national priority. In 1986, it established the Centro de Ingeniería Genética y Biotecnología (CIGB) to work in different areas of genetic engineering and biotechnology research and production, including biopharmaceuticals, diagnostic kits and plant biotechnology. CIGB is a large institution with modern infrastructure, including its own plant, and has developed numerous vaccines and diagnostic kits, among other products. Other Cuban institutions also undertake research and production in biotechnology, including the Finlay Institute, which has developed vaccines for several diseases such as meningitis.

Although these institutes have developed strong R&D and industrial capacities, they have faced enormous barriers to marketing their products. Vaccines are generally acquired by government agencies on the basis of bidding procedures, and the Cuban producers faced the mistrust that is often associated with production originating in developing countries.

The Cuban institutions have entered into co-operation arrangements with ELEA SA, a large Argentine pharmaceutical company, in order to find commercial channels for their products. ELEA SA markets a wide range of products and has connections with several university research centres. Collaboration with the Cuban institutions would allow the company to expand its mix of products and thus consolidate its market position in Argentina, the 12th largest pharmaceutical market (by value of sales) in the world.

CIGB agreed to market various biopharmaceuticals it produced in Argentina exclusively through ELEA SA. The Finlay Institute agreed to produce its anti-meningococcical vaccine through ELEA SA for distribution and sale in Argentina. Although the agreement was centred on the marketing by one partner of products developed and produced by the other, the technical capacities and financial support of the ELEA SA allowed the Cuban partner to undertake tests on the vaccine in

Argentina that are likely to strengthen its market prospects elsewhere.
Source: UNCTAD 1998

REGIONAL AQUACULTURE PROGRAM (MEXICO)

A TCDC programming exercise involving 27 countries, 20 from the region and 7 from other areas, was held in Mexico City in 1989. At the conclusion of the meeting, 111 projects were agreed upon by participating countries, all of which were to be implemented within three years. The program included training, exchange of experts, exchange of fish species, and 11 priority projects.

MARINE BIODIVERSITY CO-OPERATION AMONG SMALL ISLAND DEVELOPING STATES

Twenty-two island States in the South Pacific, which share extensive marine resources, have participated in co-operative initiatives in marine biodiversity through such regional institutions as the South Pacific Commission, South Pacific Environment Programme, the Forum Fisheries Agency and the University of the South Pacific. The initiatives focus on training, research, support for policy-making and resource management. Approximately 10000 people per year are trained by the University of the South Pacific Marine Studies Programme. The Forum Fisheries Agency is aiding the countries of the South Pacific in managing their tuna resources. However, no information was available regarding the impacts of this programme.
Source: UN General Assembly 1999a

CAMBIOTEC: CAPACITY BUILDING IN AGRI-BIOTECHNOLOGY

The Canada-Latin America Initiative on Biotechnology for Sustainable Development (CamBioTec) was created in 1995 by the International Development Research Centre (IDRC) of Canada. This is an example of triangular cooperation, with one Northern partner and five Latin American partners. Its purpose is to facilitate the application of biotechnology in the agricultural and environmental sectors of selected Latin American countries. Capacity building represents one key aspect of the programme, covering technical and market information, skills in bioindustry innovation management, regulatory and promotional policies, and capacities to monitor and evaluate the risks and benefits of biotechnology.

CamBioTec operates as a network of six focal-point institutions: BIOTECanada, Instituto de Ingeniería at the Universidad Nacional Autónoma de México (UNAM), Foro Argentino de Biotecnología (FAB) in Argentina, Fundación Andina para el Desarrollo Tecnológico y Social (TECNOS) in Columbia, Comisión Nacional de Ciencia y Tecnología (CONICYT) in Chile, and Cuba's Centro de Ingeniería Genética y Biotecnología (CIGB). The project also involves national regulatory agencies of the countries, as well as several national and regional bioindustry associations and individual firms.

The capacity building involves general training activities such as seminars, courses, workshops, publications, and specific studies. The other dimensions of cooperation include the direct transfer of expertise and technology between the partner countries. CamBioTec has undertaken impact assessment of agri-food biotechnologies and legislation to access genetic resources. The programme also focuses on capacity building in biosafety information systems, biosafety regulatory systems and risk management skills, and public awareness of the risks and benefits of agri-food biotechnology products.

The approach for priority setting has so far been applied in Mexico, Argentina and Colombia. CamBioTec was externally reviewed in 1998. It was found that it is a valuable source of information and support to public policy in biotechnology, and was reported to be successful in building communications and relations between Canadian and Latin American firms. However, the evaluation found that the programme was perceived to be "biased" towards promoting greater support to Canadian firms, although this perception may simply be a function of the greater capacities initially brought to the partnership by the Canadian firms. In addition, the evaluation highlighted the weak institutional basis in some countries; insufficient socio-economic research and orientations for biotechnology; and low efforts at public awareness.
Source: Verástegui 1999

THIRD WORLD ACADEMY OF SCIENCES
The Third World Academy of Sciences is an international forum established in 1983 to promote basic and applied sciences in developing countries, facilitate contacts and exchanges among scientists from South, further relations between scientific institutions, and encourage research on major Third World problems.

The Academy offers a number of research grants, scholarships and fellowships to enable researchers to visit other scientific institutions within the South:

- Each year, five prizes of US$10000 are awarded for outstanding contributions to the advancement of basic sciences. Two prizes of this amount are awarded every other year for contributions to applied sciences in Agriculture and Technology.
- Research grants of up to US$10000 each are awarded for research projects in Biology, Chemistry, Math, and Physics. Between 1986 and 1993, approximately 110 grants per year were awarded to scientists from 64 countries.
- South-South Fellowships provide travel support for researcher to visit scientific institutions within the South for a minimum period of one month. This programme allows for over 300 such visits annually.
- The Associateship scheme allows researchers to visit centres of excellence in the South regularly.
- Short-term fellowships in basic sciences are offered which allow researchers to spend 1-3 months in a scientific laboratory abroad.
- The Academy also offers financial assistance to Academies and Research Councils in over 20 countries in the South to enable them to offer their own prizes and medals [amounts?].

In addition to offering grants and fellowships, the Third World Academy of Sciences also offers financial support to scientific institutions of the South for equipment and research materials. Institutions in the South can access funds of up to $1000 each for spare parts for scientific equipment. The Academy also provides libraries in the South with scientific publications donated by individuals or institutions in developed countries.

The Academy sponsored the establishment of the Third World Network of Scientific Organisations, a non-governmental alliance of over 140 scientific organisations from 74 countries in the South. Membership includes ministries of science and technology and higher education, science academies, research councils, among others. The goal of the Network is to assist in building political and scientific leadership in the South for science-based economic development, and in promoting South-South and North-South partnerships in science and technology.
Source: Third World Academy of Sciences 1999

III. ISSUES FOR THE FUTURE – THE NEW CONTEXT FOR SOUTH-SOUTH COOPERATION IN SCIENCE AND TECHNOLOGY IN THE 21ST CENTURY

GLOBALISATION AND THE NEW CONTEXT FOR SOUTH-SOUTH CO-OPERATION

Since the 1980s, major changes have been taking place within the international economic system, which is increasingly being shaped by globalisation and economic liberalisation. Rapid international mobility of most factors of production is taking place, with the exception of labour. Markets for money, finance and technology are becoming increasingly globally integrated, fuelled by technological advancement and movement towards a liberalised global trading regime. Within these global markets, transnational corporations based in the North predominate. The decisions made by private bodies thus have a more pronounced impact on world economic activity. The process of global integration has thus far been rapid but highly unregulated, causing increasing uncertainty, unpredictability and instability in the world economy (see Sagasti 1999).

It is argued that these changes accentuate the continued validity and relevance of TCDC as a means of assisting developing countries to participate effectively in the newly emerging economic order. The South needs to exploit their collective resources in order to acquire maximum countervailing power, speak with a united voice in making clear proposals, and press for global consensus on the goals and management of the new international system (South Commission 1990). However, this view of the South Commission (1990) contradicts its own conclusion:

> The countries of the South have failed to achieve [the required] solidarity. They have not been able to establish common priorities in keeping with the development interests of all, or to share technical and negotiating expertise, or to hold constructive South-South discussions in advance of negotiations, or even to develop a shared professional service to support them on matters under negotiation.

If we acknowledge that achieving such solidarity has been difficult in the past, then presumably it will be even more difficult in the future, since the developing countries are becoming increasingly differentiated and heterogeneous with respect to levels of economic and social development, technological capacities, and extent of integration into the global economy. Some “have transformed their economies, made significant progress in harnessing science and technology to production, and are poised to compete effectively in the world economy. [Many] others remain backward and have registered virtually no progress since the 1960s" (Jalloh 1993, p.157).

The East-Asian NICs and other high-performing Asian economies, as well as some countries in Latin America, the Caribbean, the Middle East and North Africa have achieved high levels of economic growth, and have demonstrated enhanced capacity to respond to the new global challenges. Meanwhile, the smaller, poorer economies, with economic growth barely keeping pace with population growth, continue to experience problems of food insecurity, and have found themselves unable to take advantage of the opportunities presented by global changes. We suggest that the differentiation and fragmentation of economic interests among developing countries will make it more difficult for the South to maintain common positions across the board in future North-South dialogue.

As the colonial past becomes increasingly remote for most developing countries, “the conceptual basis of South-South co-operation which existed for nearly three decades now no longer exists” (Jalloh 1993, p.154). The ideology which once provided the vision and inspiration for South-South co-operation has deteriorated, and the concept now lacks a forceful ideology to sustain it.

Instead, it has become “almost impossible to find one unifying common interest which can bring them together…the strategy of South-South co-operation has to be built around clusters of common interests” (Gunatilleke 1993, p.252). In this vein, the Report of the South Commission (1990) began to develop a “strengthened rationale” for South-South co-operation. This rationale contained several key components representing new driving forces for co-operation: the emergence of new complementarities among the countries of the South; the existence of surplus capital in some countries which could be profitably invested in other countries of the South; and the need for joint-management of natural resources, as well as the need to deal with common problems such as the environment and harnessing science and technology.

Another factor which makes future South-South co-operation more difficult and challenging is the increased role of actors in the private and the civil sectors worldwide, which is promoted by the forces of globalisation and new technologies. Some of these actors, such as global TNCs and some NGOs may be seen to reduce the role of the state, but other firms, NGOs and experts can augment and supplement the actions of the state. But whether these actors are seen to be positive or negative, there is no alternative but to include them in some positive forms to help the South achieve its goals.

The above rationale suggests to us that the increasing diversity within the South will create new challenges for South-South co-operation if continued along a traditional outlook, but it also opens up new opportunities. The South now has a wider range of development experiences to draw on. The progress made by Korea, China and India, and the success of Latin American countries such as Brazil in following a more S&T-based strategy, can provide important lessons for the South. The more dynamic developing economies are in an effective position to share with other countries the techniques and experiences that have made them successful. Furthermore, the growing diversity of technological capacities between countries, and the corresponding wider range of manufactures and services available, opens up new opportunities for trade and technology transfer within the South.

While the “strengthened rationale” may establish a need and identify potential benefits of continued South-South co-operation, “the ideas are too technical and lack the power to inspire and move people in the way that the earlier motivating ideas for South-South co-operation did” (Jalloh 1993, p.155). Therefore, the development of a new vision is also important. We argue below that a new vision can emerge from many common issues and goals, and also that the opportunities provided by science and technology can provide an excellent rationale and vision for South-South co-operation.

GROWING IMPORTANCE OF SCIENCE AND TECHNOLOGY

The process of globalisation has been significantly bolstered by science and technology, which have greatly influenced the pace of economic and social development all over the world. There are many common examples of the economic impact of scientific and technological advances. However, we will present one case which is particularly telling: Nortel Networks’ recent US$3.25 billion acquisition of Florida’s Qtera Corp., a company which has been developing a cutting-edge technology for optical networking equipment, and which has only 75 employees and no commercial output or sales (Globe and Mail, December 16, 1999). This example clearly illustrates the growing importance of knowledge as an important entity or resource in its own right.

This single example can stand to illustrate how advances in science and technology can both open up new opportunities to developing countries and also represent a serious threat. The pace of scientific and technological change over the past few decades is such that the knowledge base required to retain a competitive position in the world economy is greatly expanding. With the increasing knowledge-intensity of production, the traditional sources of comparative advantage

are being eroded. Success in development is thus increasingly dependent on the ability to absorb and use scientific and technological knowledge. This widening knowledge gap "threatens to leave behind countries that do not have the capacity to utilise new technology, while enhancing the potential for sustainable development for those that do" (Sewell and Melcher 1993, p.162). For economic success, developing countries must rapidly build up their own capabilities in order to apply the new advances and make informed choices. Countries must be able to select those technologies most appropriate for their circumstances and conditions and adapt them to make them appropriate. The South must thus accelerate the pace of acquiring, adapting and using the stock of knowledge largely developed in the North while in the long run developing the ability to develop its own technologies suited to its needs.

At the same time as the knowledge base required to remain competitive is expanding, resources for science and technology, both financial and intellectual, are scarce, but more so in the South than in the North. Indeed, while roughly 40% of global GDP is in the countries of the South, they account for only 15% of the world's scientific publications and only 1-2% of the patents filed in Europe and the United States (UNESCO 1998). This disparity in scientific and technological capabilities highlights the continued importance for the South of co-operation with the countries of the North as a complement to South-South co-operation activities.

For the countries of the South, there is a strong case for co-operation in order to make more effective and efficient use of scarce resources. This is particularly true for activities such as research and development that require a critical mass in order to function effectively. According to the South Commission Report (1990), most developing countries devote no more than 0.5% of their national income to R&D, compared to the 2-3% allocated by developed countries. Pooling of research resources would bring developing countries closer to meeting the critical minimum of investment required, as well as minimising duplication of efforts in some areas. In addition to allowing developing countries to reach the minimum thresholds, co-operation can also increase the scale economies of the required efforts. The South Centre (1993) suggests that "with the increasing importance of economies of scale and expenditure on research and development, South-South co-operation may well become the most cost-effective means for the South to reach the new frontiers of science and technology".

A second reason for co-operation in science and technology concerns the existence of common problems within the South. Science and technology are likely to be key factors in solving problems such as specific diseases and food security. Some such problems have little direct impact on the countries of the North, and are thus unlikely to be dealt with in the North's scientific research. Scientific and technical co-operation in these areas within the South could be extremely valuable in finding and disseminating effective solutions to these problems.
Not only does co-operation augment the efforts and inputs, it can bring alternative perspectives and approaches to the solution. Furthermore, co-operation allows for greater scope for the resulting applications and innovations and thus potentially greater rewards. Finally, it is worthwhile to add that knowledge has the wonderful feature that it is not subject to the laws of scarcity. Knowledge that is shared does not reduce the value of the original knowledge but often increases it by expanding its boundaries and applicability, although this does not always apply to individual private owners of knowledge who have the objectives of securing monopoly profits from patents and know-how, nor does this mean that the movement of knowledge and its new applications are without cost. But in an ironic development where IPR issues have become more

troubling and contentious, the new developments in knowledge and innovations are increasingly making the older paradigm of the economics of scarcity, which has dominated our thinking and is more relevant to more traditional products and economy, obsolete (Peter Drucker, interview in the Globe and Mail, 5 January 2000).

Worldwide, as the rate of technological change has increased and the range of knowledge required for specific innovations has expanded, there is a rapid growth in the need for strategic alliances and network structures to increase the pool of knowledge available for achieving goals

and to reduce the risks to each individual partner. Alliances and networks can take many different forms and involve different types of actors, such as producers, competitors, suppliers, universities and research institutions, in different combinations for different purposes. All such efforts can increase transaction costs, but if well managed are found to increase the rate of successful innovation. We submit that the participation of the South in such alliances and networks remains weak, and that where they exist the networks are almost wholly driven by Northern partners, and propose that there is considerable value to increased Southern driven networks, with and without Northern partners.

NEEDS OF THE SOUTH

Even though we have remarked on the increasing diversity of the South, there still remain a number of common needs that can provide a framework for co-operation. These needs should be combined with the new opportunities and threats to provide a framework for overall priorities for any future agenda for South-South co-operation. For convenience we have tried to place them below under some labels such as environment, poverty, and technologies such as biotechnologies, information and communications, and so on. But in reality many of these converge in many ways, and some in completely new ways. For instance, the environmental issues include the many resources available from the environment, including the special bioresources in which the South is particularly rich in quantity, quality and diversity. These are important for new directions such as biological and natural basis for raw materials, for energy, for medicines and other purposes. Improved use of bio-resources can address several other needs, such as poverty alleviation, sustainable development and energy shortages, and each of these directions can be promoted by the new advances in biotechnologies, information, communications, computation and so on. So depending on the purpose, one could list some items in needs or technological opportunities, but what is more important in priority setting is to recognise that many of these themes emerge from several different dimensions. For now, we use the labels below as starting points only for the discussions on priority setting.

Environment

The environmental hazards faced by developing countries are numerous. Key threats include the continuous degradation of cultivated land; desertification in arid and semi-arid zones; tropical deforestation; threats to fish stocks from over-fishing and waste dumping; the release of noxious gases and the discharge of untreated industrial effluents; and severe squalor and pollution in large cities (South Commission 1990). As the population of the South continues to grow, and as the wealth of the South increases and consumption levels rise, further pressures on the environment are inevitable.

These increasing environmental stresses in the South are linked to a number of factors. Rapid population growth in developing countries, largely the result of improved health and nutrition, places increasing pressure on natural resources. The pressures of feeding an expanding population have in some countries led to shortening or abandonment of traditional crop rotation cycles, such that land is cultivated without respite and soil becomes depleted. The

need for additional agricultural land begets deforestation, aggravated by commercial ventures seeking new sources of timber. The consequences of over-exploitation of agricultural land and deforestation include severe erosion and water run-offs which damage natural water regimes, increased risk of floods and landslides, and the extinction of many species of plants and animals. Industrialisation and economic growth are responsible for many environmental dangers in developing countries, as in the industrialised world. Air pollution caused by emissions from fossil fuel combustion is a growing problem, as is the contamination of water resources caused by uncontrolled disposal of industrial wastes. A continued rapid rural-urban migration in the countries of the South will create new and growing demands for housing, roads, transport, and energy. Enormous resources will be required for these, and new and innovative ways of providing these services at lower financial and environmental costs are urgently needed.
The tasks of managing shared resources and dealing with common environmental problems require collective action within the South, as appropriate environmental strategies must be sensitive to the effects of domestic actions on neighbouring countries. Areas calling for close cooperation between groups of developing countries include the management of shared water resources, management of irrigation systems, energy generation and conservation, and the prevention of floods and erosion.

Knowledge and experience regarding the management of common resources, especially in similar ecosystems, could be extremely valuable to other countries and regions facing similar challenges. Similarly, there is great scope for co-operation in pollution control and the management of offshore oil exploration in regional seas or coastal areas. Co-operation in the use of remote-sensing techniques to assess natural resources and in the use of the resulting data would also be valuable, as the South is presently heavily dependent on the North in this area.
One vital area for South-South co-operation is the energy sector. Many people in developing countries are not yet connected to grid electricity, and the supply is not secure for many of those who are connected. The availability of energy is critical for economic and industrial development, but the production and consumption of energy is a key cause of environmental degradation. The emerging consensus on the role of fossil fuels in promoting global warming is likely to put new pressures on the South. In order to evolve a sustainable pattern of development in the long-term, it will become extremely important for developing countries to find ways of increasing the energy supply from renewable sources and improving energy efficiency in industry, agriculture and transport. The South's capacities in the energy sector are significant, as a number of developing countries, including Brazil, China, India, Mauritius, Nepal and South Africa are now in leadership positions in the area of renewable energy (SU/TCDC 1998a). Pooling of the South's resources in energy research and arriving at negotiated agreements on responses to global warming could be expected to provide significant benefits for all concerned.

Developing countries have so far allowed the North to take the initiative in raising environmental issues and proposing action. The countries of the South need to develop a comprehensive position on environment and development in order to ensure that their interests are more adequately represented in the global environmental agenda. A common position is also crucial for more effective participation in negotiations with the North on the development and sharing of technologies for energy conservation and pollution control.

Poverty

The environmental problems in the South described above are intimately connected to poverty, of which they are both a cause and a consequence. Taken by itself, the vast majority of the poor still live in the South. More than one billion people in developing countries are living in absolute poverty, with a per capita income below US$1 per day, no access to clean water and insufficient income to buy enough food to sustain their energy (UN General Assembly 1999b; World Bank).

Development experience since the 1950s has shown that a rapidly expanding economy is a necessary condition, though by no means sufficient by itself, in order to improve the well-being of the people of the South and satisfy their basic needs. While only rapid development can provide jobs for the growing labour force in the South and create the resources needed to satisfy requirements for food, shelter, health, and education, it does not follow, nor is it possible in many cases, for the South to follow the same industrialisation path historically taken by the North. Growth can reduce poverty only if complemented by specific economic and social policies to that end, including the redistribution of scarce productive assets such as land, the development of human resources through mass education, particularly in science and technology, and strong efforts to curb population growth (South Commission 1990).

People, Livelihoods and Employment

The people of the South and their improved welfare constitute the reasons for seeking to achieve the higher developmental goals. Any welfare improvement strategy must aim to increase the capacity of people to earn a reasonable and improved standard of living, which requires the creation of new and more productive employment opportunities in both rural and urban areas. Today in most countries of the South, the majority of people live in rural areas and so agricultural development, increased agricultural productivity and increased use of bio-resources are one obvious area for attention. At the same time, the South will see large migrations of rural populations to urban centres in the near future. The next twenty-five years will see the emergence of over 60 cities in the South with populations of over ten million. All these people will need jobs, shelter, supplies of energy, water, sewerage, transportation and so on. Of course during the same time, the present large cities such as Beijing, Lagos, Mumbai and Sao Paulo will also grow further. A whole set of issues will need to be tackled successfully if the urban centres are not to become increasingly chaotic, polluted and dysfunctional.

Small and medium-sized enterprises (SMEs) have a high potential for stimulating economic growth in developing countries, providing significant employment with low investment requirements and high utilisation of local raw materials. The experience of some Asian countries shows that SMEs create more jobs per unit of capital invested than larger enterprises (Ngom 1996). Furthermore, since SMEs are often located in both urban and rural areas, they can contribute significantly to improving the livelihood in both. Many new technologies provide ways to improve the performance and efficiency of SMEs and others provide for new economic activities that can be undertaken by small-scale enterprises. Historically, SMEs have played an important role in the process of industrialisation in market economies. The countries of the South would be wise to tap the potential of SMEs for job creation, while simultaneously recognising that SMEs are only one aspect of successful industrialisation.

India’s involvement in small-scale industries with other developing countries highlights the value of South-South co-operation in SME promotion. The National Small Scale Industries Corporation of India has extensive experience in providing technical assistance for SME development in developing countries in Asia, Latin America, and particularly in Africa. The assistance takes the form of study tours, assessments for SME development, training in skill upgrades and entrepreneurship development, and technology exhibitions to facilitate technology transfer and knowledge dissemination. Over 165 projects totalling US$18 million have been conducted with 18 countries in Africa and 6 in Asia (UN General Assembly 1999a).

Health and Disease

The populations of the developing world are burdened by a number of diseases whose transmission depends upon a warm climate, including malaria, hookworm, and schistosomiasis. Malaria is estimated to kill between 1 million and 2.5 million people per year, and is heavily

concentrated in the poorest tropical countries, particularly within sub-Saharan Africa, due to climate and ecological conditions. However, the development of a malaria vaccine appears not to be high on the agendas of the international community. A study by the Wellcome Trust found that only US$80 million per year is spent on malaria research, with only a small fraction of that spent on vaccines. The large pharmaceutical firms of the North believe there is no market in malaria, as a potential vaccine would be costly to develop and may not produce financial rewards for its developers if copied by international agencies or other private firms. In general, individual developing countries often do not have the financial means to develop a malaria vaccine alone (Sachs 1999). As always this generalisation has to be more nuanced as we acknowledge that a US government laboratory is currently testing a malaria vaccine, that Venezuela has developed and is testing a vaccine for Rotavirus. But it is obvious that both these efforts and their successes can be increased with greater co-operation.

Although the AIDS virus has infected over 33 million people all over the world, the UN estimated in 1998 that two-thirds of the world's infected population are sub-Saharan Africans. Roughly 95% of worldwide HIV cases are in the developing world. The rich countries of the North are using drug treatments to attempt to control the disease. However, these treatments are far too expensive for the poorest countries to afford. What little vaccine research is conducted is dramatically underfunded and tends to focus on the specific viral strains and patterns of transmission prevalent in North America and Europe (Sachs 1999). The countries of the South thus cannot expect to benefit much from the AIDS research conducted in the North without their own efforts, individually and collectively.

POSSIBILITIES

While the needs of the South provide one side of the matrix of any possible emphasis of effort, the possibilities provided by new developments in science and technology and new capacities provide another side of the matrix.

New technologies

There are some key areas of scientific research and technological innovation which are widely applicable and in which joint activity would generate significant benefits, including biotechnology, new materials, and microelectronics. These new technologies are difficult to develop, requiring substantial investments in R&D, but are easy to imitate and use in production processes once innovations have been developed. As such, these technologies offer vast opportunities for developing countries to accelerate their economic progress and leapfrog over intermediate levels of technology (South Commission 1990).

Biotechnology
As a result of rapid population growth, continuing growth in the demand for food within developing countries can be expected in the years to come. As the area of agricultural land per head diminishes and stresses on soil and the ecosystems continue to mount, biotechnology may become vital for ensuring long-term food security. Biotechnology has the potential to improve the productivity of the South's farming systems, reduce the quantity of chemicals used in agriculture, lower the cost of raw materials, and reduce some of the negative environmental impacts of conventional production methods (South Commission 1990; Verástegui 1999).
Biotechnology and agricultural research is a prime area for South-South co-operation. Within regions and sub-regions, countries have common genetic bases and ecosystems. As such, they face many common problems, and research results could be widely applicable between countries. Since research in this area is complex and costly, countries should pool their resources and work jointly on projects of common interest, such as genetic enhancing centres

and gene banks.

However, the development and application of biotechnology brings with it a multitude of challenges. The commercialisation of biotechnology requires increasingly transsectoral capabilities, including knowledge of biosafety and intellectual property rights issues. It is increasingly clear that developing countries need to establish suitable regulatory systems, assess and manage the health and environmental risks of such products, and tackle issues of public education (Verástegui 1999).

Microelectronics and ICT

The pace of industrialisation can be greatly enhanced by efficient, rapid and cost-effective information flows, which are increasingly becoming possible due to advances in information and communication technologies. The possibilities offered by the so-called information revolution are widespread. The ease and low cost of compiling and transmitting information has made it possible to unbundle production processes and spread out production plants to many locations. This opens the scope for large corporations, particularly Northern TNCs, to subcontract production processes or parts thereof to small and medium enterprises in developing countries.

Advances in information technology have also made information about technology choices easier and faster to access. Electronic knowledge-networking permits better access to and fuller assessment of technologies already in the public domain, as well as allowing diffusion of information concerning “best practices” in energy technology, pollution control, and clean manufacturing.

Many of the rapidly industrialising countries of the South are competing successfully with the North in software development and data management techniques. There are many well known cases, for example: Korea’s progress in several areas of ICTs; the provision in some ASEAN countries of a basis for the manufacture of hardware and electronic components, and the development of high speed communications corridors; China’s well-established competencies in several areas of manufacturing; and India’s successful growth of a large software sector. We need not elaborate on these here. We may simply conclude that these non-uniform capabilities, if they can be combined in and for specific applications and for developing certain innovations, can provide a much more powerful set of inputs for innovation than if the opportunities are only pursued in isolation.

Engineering and Design

Engineering and design is another area in which co-operation can be extremely valuable, as the engineering design service function cuts across all production sectors. Many large design and construction firms in countries such as the Republic of Korea, India, China and Brazil have become exporters of construction services to other developing countries, particularly for infrastructural projects. In exporting these services, firms from developing countries have set up joint ventures and subcontracting arrangements with partners in other developing countries. However, little is known about the impact of this form of co-operation (UNCTAD 1998).

Leapfrogging

It was stated above that the various advances in science and technology combined with the rapid change in information and communication technology have the potential to greatly increase access to knowledge and sharing of information about technology choices. Access to such information allows developing countries the opportunity to “leapfrog” directly to “frontier” technologies and applications rather than reproducing the outmoded physical and technological

paths used historically in the industrial countries. Professor Kayanja (1999) notes that obsolete technologies are more likely to be found in the South, which reiterates the importance of leapfrogging to the technological frontier: “Recirculating dinosaurian technologies simply because they are relevant to the South is an evolutionary blind alley which must be avoided at all costs.”

The countries of the South may have possibilities for leapfrogging in both traditional areas such as energy production and pulp and paper mills and completely new areas such as microelectronics, wireless and satellite communications, and remote sensing applications. Leaping to the frontiers of productivity innovation can allow developing countries to gain comparative advantages [6] and avoid repeating the mistakes made in the North, and can result in the use of technologies that are cleaner, more effective, and less costly than outmoded technologies.

The possibilities for leapfrogging are particularly pertinent with respect to the problems of environmental degradation. Technology choices “allow countries to avoid choosing between environment and development,” as the South has technological options that the industrialised

[6] Carlota Perez provided a more detailed discussion of some of these issues in Seoul.

countries did not have when going through their own industrialisation (Choucri 1998, p.41). Developing countries have the opportunity to avoid the polluting development path followed in the North by incorporating cleaner and more energy efficient technologies into their process of development sooner rather than later.

Reaping the benefits of leapfrogging, however, requires that countries have access to networks of technological knowledge in order to acquire knowledge about “best practices,” technology options, and strategies. What is needed is not only the passive infrastructure and administrative capacities to acquire scientific and technological knowledge, but also appropriate institutional mechanisms for exploiting the available knowledge and facilitating technological change and active participation in many of these networks.

We could expand to cover many other possibilities and provide more details of what is possible in each area. We can also expand to illustrate that all these technological changes are not just affecting some esoteric high technology areas of economic activities but are influencing and can be used more effectively in many traditional activities. We have not dealt at length with the idea that the new developments in science and technology not only bring with them promises but also carry major threats to the people of the South. Without an appropriate and increased response, not only will the South fail to take advantage of opportunities, but the traditional space of the South will also shrink and it will be increasingly at threat from the backwash of technological developments elsewhere, as shown by the recent discussions in Montreal in the trade of GMO products, seeds and food. We believe that not making more appropriate use of these possibilities by the South will be the single most important factor retarding the South in achieving the many goals toward which the people of the South and their representatives aspire. As we had anticipated, many more opportunities and threats were presented by the distinguished participants, and so we move on here to provide some framework for the possible future strategies and plans, which is the ultimate objective of the UNDP in organising this conference.

IV. TOWARDS A STRATEGY AND FUTURE DIRECTION

We have argued that any long-term agenda will need to be embedded in a larger vision, a vision that is challenging, that has the support of many in the South and is in consonance with their aspirations and goals. Beyond that there must be an overall strategy and framework. This is important, as there are many issues, problems, needs, opportunities and ultimately a variety of actors with different responsibilities, capacities and objectives. An overall strategy and framework allows different actors to undertake their actions within a common and mutually supportive fashion. If these are worked out, and even if they are not, for developing any action plans one needs to consider not only the specific actions required but also issues of institutions, structures and mechanisms, resources, and finally systems of measuring whether there is appropriate and adequate progress in achieving the goals set out. We have laid out some points below which were intended to provide a basis for discussions at the Seoul Forum. These were further elaborated in the Seoul Accord, which appears in Appendix A in its final form and in Appendix B as the Zero Draft. While the final form was agreed upon by the participants at the Seoul Forum as a more concise statement which could be presented to the G77, the Zero Draft may be a more useful resource for developing national policies and programmes.

VISION

We have argued that a new vision for South-South co-operation is needed. The old ideology on which co-operation was based has largely disappeared, and new rationales such as that suggested by the South Commission lack a political rallying cry and the power to motivate and inspire the people of the South. The new vision should encompass a number of key elements and principles, including sustainable development; the preservation of natural and human heritage; ‘people-centred’ development and grassroots participation; and a view of co-operation as a complementary agenda to the new-found global emphasis on competition. In creating this new vision it must be remembered that idealism alone is not enough, but must rather be “tempered by a degree of practicality [and] matched by commitment to action” (Jalloh 1993, p.157).

STRATEGY

An overall strategy for South-South co-operation in science and technology should start by focussing on the smaller activities and programmes already existing, building on bilateral and regional arrangements and expanding into more cross-regional activities. Since it is almost impossible to find one unifying common interest which can bring together all the countries of the South, the strategy of South-South co-operation should be built around clusters of common interests: ”The global programme of South-South co-operation would have to be constructed from components for each of which a group of countries would take the lead in response to a compelling need arising from their own national interests in the programme” (Gunatilleke 1993, p.252). Work would be required in identifying the special interest groups for each component and designing the appropriate institutional framework to implement such a programme of cooperation. One possible model for such a process is that of functional multilateralism, the negotiation of a series of agreements on a number of pressing issues. Functional multilateralism involves many players coming to the bargaining table at the same time, with the actors shifting over time and according to issue under consideration[7]. However, some issues and countries may be left out in

[7] See Sagasti (1999) for discussion of co-operation in the form of flexible networks focussing on specific themes.

this form of co-operation, especially smaller poorer countries, and so this model will need to be supplemented with strategies for more disadvantaged groups. Functional multilateralism can also be effective in discussions and negotiations involving both the North and the South, putting

Southern governments on an equal footing with developed nations since their participation is seen as essential to the process. Another means of involving the North is through triangular cooperation arrangements, in which co-operation activities between countries of the South are financed by Northern partner countries. Possible mechanisms for such arrangements need to be considered, as well as the role of international agencies, which can often provide useful convening mechanisms.

International co-operation requires, as a prerequisite, that individual partner countries have a minimum of capacity, and thus that they undertake some minimum of national activities in science and technology. Areas where individual national effort is required include the integration of S&T into national development plans, with carefully selected sectoral priorities backed by adequate resources; increased spending on R&D from current levels[8]; according higher priority to all educational activities; placing greater stress on education in basic sciences and effective systems of research; strengthening links between production units and R&D centres; and creating special facilities such as venture capital funds for entrepreneurs harnessing new technologies for productive use.

The overall strategy should be need-based, focussing on applying science and technology to meeting the needs of the countries of the South and solving common problems. Effort should be made to identify areas of scientific research and technological innovation which are of immediate concern to the South and in which joint activity would be expected to generate significant nearterm benefits. Examples of such areas include agriculture, renewable energy, tropical diseases, biotechnology, and information and communications technologies, among many others. The strategy should also focus on the expansion of educational links within the South, with accent on scientific, technical and vocational courses, as well as the development of managerial and entrepreneurial skills. This could include establishing a network of Centres of Educational Excellence; expansion of fellowships and scholarships; exchanges of staff and teaching materials; and developing programmes of collaborative research.

In the current context of economic reforms which gives an increasing role to the private sector and the market, South-South co-operation needs to expand to include more market-driven actors. The new strategy must therefore include ways of incorporating actors who have not yet been widely involved in South-South co-operation activities. Productive enterprises, both public and private, can contribute to overcoming the South's knowledge gap by promoting technical change and encouraging enterprise and innovation. Possible areas of focus include joint production arrangements and R&D with transnational corporations from both North and South; promotion of small and medium enterprises; setting up consortia of consultancy and design firms; and promoting links between research institutions and productive enterprises to enhance the commercial use of research results. NGOs and other civil society may also have an important role in future co-operation activities.

Relatively easier areas of science and technology co-operation to be developed would be classical "low" technology, comprising older technologies with low science inputs. This is followed by applied sciences, if capabilities in basic sciences are available. The last area is typically science-based high technology, which is harder and more expensive to develop.

[8] Several authors have recommended a doubling of R&D spending for the South as a whole to bring it close to 1% of GNP (Goldemberg 1993; South Commission 1990). Korea has currently achieved a level of over 2.5% of GDP.

There is an imperative for greater follow-up, monitoring and evaluation of South-South cooperation activities. The practical assessment of projects and programmes must be improved in order to clearly identify achievements. Efforts must be made to promote the value of and need for South-South co-operation, building on those achievements and communicating success stories to different stakeholders, particularly policymakers in order to justify the allocation of resources for further co-operative activities.

ACTIONS

From this overall strategic framework, several possible recommended actions for the South can be drawn. We will outline a handful of these[9], but this is by no means intended to serve as a comprehensive list.

At the national level, stronger education and on-the-job training in science and technology, combined with a more effective research system, is needed in order for Southern countries to develop their own capabilities. Internationally, co-operation in education and training remains an under-utilised mechanism for South-South co-operation. Although a few countries have undertaken large programmes of student exchange, the overall movement of students between developing countries remains small. To combat this, existing bilateral programs should be expanded with a millennium fund for South-South exchanges of students and practitioners. Various mechanisms for offering scholarships in order to encourage expansion of the South-South flow of students can be considered, including setting up a foundation for this purpose or working with existing institutions such as the Third World Academy of Sciences (TWAS). As well, a network of Centres of Educational Excellence should be established in order to maximise the use of existing universities and technical colleges of high standing in the South. Teleconferencing can be used as a means of delivery for educational programmes in order to make courses more available to students from all over the South. The pilot African Virtual University project which was described previously in this report is an example of how advances in ICT can be used to facilitate educational collaboration in this manner.

In addition to increasing the pool of scientifically and technically qualified personnel, it is also important to develop systems to utilise them more effectively. A network of Centres of Research and Technological Excellence in the South should be established and strengthened for advanced research, particularly in areas of high technology and environmental sciences. This could start slowly by appointing one or two such centres in more advanced developing countries and establishing regional centres on a pilot basis. Directories and databases of experts and institutions in the South can help to facilitate collaboration, and existing ones should thus be linked in order to arrive at a broad overview of what is taking place in terms of research. Specific topics should be defined for further development and work on a South-South basis, for example in health, in biotechnology, and in policy. Collaborative research programmes could be undertaken at regional and inter-regional levels in both conventional areas such as agriculture and energy and new areas of technology such as biotechnology and micro-electronics. Such research programmes must be complemented by links with productive enterprises that could lead to greater commercial use of research results.

National policies for Science and Technology should be developed and/or updated in all countries of the South. Each country's S&T policy should have an openness to South-South cooperation, and could include policies regarding common needs of the South such as affordable and effective vaccines

Special attention must be paid to the impacts of changing systems of intellectual property rights (IPR) for the South. The North is trying to further strengthen IPR systems to enlarge the

[9] These are drawn from such sources as the South Commission Report, the South Centre (1993),

and the working group sessions held at the Forum in Seoul.

monopolistic rights of their technology sellers. This issue is of particular importance in areas such as agriculture and pharmaceuticals, where patenting may threaten the South's ownership of its bio-resource base and traditional knowledge and methods. The countries of the South would benefit from establishing a common position and strategy on the revisions needed in trade-related intellectual property rights (TRIPs) in order to promote their own socio-economic interests.
We have argued that more monitoring and follow-up of South-South co-operation activities is required. On this front, an overview should be prepared of what is being done by the UN development system in support of science and technology in the South.

MECHANISMS

Much more analysis of mechanisms for South-South co-operation is needed in order to identify and evaluate existing mechanisms and determine whether new ones are needed. Possible mechanisms may be permanent or semi-permanent, and could consist of networks or project specific institutions, among other possibilities. The strengths and potentials of existing institutions should be analysed and more fully exploited. At the same time, structures and new institutions will be needed, and this need must be balanced with financial constraints. Continuing and systematic work in this area is required.

RESOURCES

There is unanimous agreement that a lack of resources has been the critical shortcoming of South-South co-operation activities to date. Thus a key issue for the future is how to secure adequate resources for the implementation and follow-up of proposed programmes and actions. While UNDP's allocations for TCDC have increased gradually over time, there is still considerable scope for improvement in this area. National resources earmarked for co-operation programmes can and should be increased, although this raises a number of questions: Should it be a percentage of national resource allocations? If so, what percentage? Is there any desirable indicative figure? Certainly the richer and more advanced countries of the South should take the initiative in providing financial support for co-operation in science and technology. Other possible mechanisms for securing financial resources for South-South co-operation include triangular arrangements with the countries of the North or with the richer Southern countries, and funding arrangements with the private sector. The possible role for multilateral banks should also be considered.

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