

TECHNOLOGY TRANSFER THROUGH COOPERATION: Regional Linkages

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I. Introduction

A growing interdependence and complex and dynamic changes are the major features of modern economic, scientific and technological progress within a country and within the world community. In the scientific and technological domain, this growing interdependence should not be conceived as a one-way channel for the transmission of some specific types of knowledge from developed and industrialized countries to underdeveloped countries. On the contrary, present-day international relations in trade, science and technology demand mutual cooperation and joint efforts for the benefit of all the parties concerned. An efficient bilateral and multilateral mechanism at the international and regional levels, in the fields of technology, management, public services, planning, urban development, education and so on, can definitely change the present technological position of the developing countries.

At the regional level, scientific and technological cooperation among

neighboring countries may be carried out through joint programs and projects and thus determine the institutional framework for their activity. However, long-term inter-institutional activities of national research, consulting, and engineering organizations should be the basis for technical cooperation. It should be carried out through joint programs, projects, exchanges of information, personal training, and so forth. Such long-term activities may also serve as a basis for the establishment of a network of institutions in developing countries for joint programs in specific fields at the sub-regional, regional, and inter-regional levels. A number of examples already exist, and there is a growing awareness of the need to increase their number.¹⁾

However, the network of scientific and technological relations among states, public agencies, and firms still appears to be relatively unknown despite many studies in recent years.²⁾ This network is the sum of multivarious links, such as cooperation agreements between private firms or between public and private research institutions. Also, behind the work carried on in technical cooperation, we find governmental bodies (national or international), industrial or commercial enterprises, universities and non-profit-making organizations. Hence, any analysis of the scope, functions and mechanisms of international technical cooperation must be undertaken by a study of the linkages between different actors.³⁾ This study is, therefore, designed to analyze these linkages at the regional level. Our interest here is with the linkages between public and private research institutions, and particular attention has been paid to government policy. As a result, a number of suggestions and observations are covered.

II. Technical Cooperation: Definition

Cooperative research and development across national boundaries is not new, examples for the twentieth century are abundant. However, cooperation among companies increased at the same time as international competition intensified and as technology became more crucial for the competitiveness of firms especially in R&D-intensive sectors in industrialized countries.⁴⁾ Although technical cooperation can take different forms and mechanisms, it is necessary for the purpose of this study to exclude some areas of technology cooperation among nations. For example, technology transfer by means of multinational enterprise activities and indirect technical cooperation through exchanges and meetings of academic and professional societies are beyond the scope of this study.⁵⁾

This study is further limited by excluding agreements among companies for licensing of existing technology, acquisition of ownership of one firm by another, and production and marketing cooperation agreements. Thus, the rather narrow focus is on the cooperative research established between public and private enterprises in order to conduct research and development, develop new products or processes, or otherwise collaborate in technology-intensive activities wherein the interaction is intended to increase the productivity of the outcome. In this way the ultimate success of cooperative research depends to a large extent on the efficient and effective transfer of technology.

Therefore, cooperative research for technology transfer and development is an arrangement through which research institutions or companies, within one industry or different industries, jointly acquire technical knowledge. Such arrangements can exist with partners from a

number of sectors within the economy or even from other countries at international or regional levels.⁶⁾

III. Regional Industrial Cooperation

After the end of World War II, several countries, in an attempt to accelerate the pace of development, have tried to form regional groups. It is generally believed that regional cooperation can help to expand intra-regional and extra-regional trade and encourage economic growth and industrial and agricultural diversification. Thus over the past fifty years, more than a dozen customs and monetary unions, common markets and other regional cooperative arrangements have been proposed or established in Europe, Latin America, Africa, and Asia. Today, there are more than forty economic cooperation and integration schemes at the sub-regional, regional and inter-regional levels, embracing most of the developing countries in Africa, Asia, Latin America and the Middle East.⁷⁾

1. Benefits

The main rationale for the establishment of a regional group, such as EC, SAARC, and ASEAN, is to promote economic cooperation, especially in trade and industry. Regional cooperation is essential for improving the industrial production and processing capacities of developing countries. An enlargement of the insufficient production capacity of developing countries can best be brought about by a joint and cooperative use of their own productive capacity in industry, manufacturing, food and

agriculture. Joint production enterprises on a regional basis can contribute to fuller utilization of resources, managerial and technical skills, marketing and distribution capabilities.

Joint regional planning for resource development can help diversify the industrial resource base, and help coordinate the varying technology and skill levels, the differing socio-political circumstances, and the diverse administrative experiences of member countries. Moreover, joint regional action is especially fruitful for improving industrial production capabilities in: (1) formulating an investment code that offers preferential treatment for regional businesses by way of long-term loans, investment guarantees, and assured markets for end-products; and (2) promoting joint ventures among developing countries involving the supply of raw material, location of plants, and pooling of technical and managerial skills.

Furthermore, regional cooperation offers the best chance of controlling the import of foreign technology and creating endogenous technological capacities. Collective action on the regional level can not only strengthen the bargaining power of developing countries vis-a-vis multinationals, but can also enable the cooperating countries to consult with each other on regional needs. In this regard, industrial regional cooperation can bring together countries with diverse capabilities in particular sectors such as heavy equipment, light manufacturing, food, and services.

As far as the control and transfer of technology is concerned, regional regulatory actions may include such issues as taxation, equity control, limitation of activities of foreign enterprises, regulation of the terms and conditions of the transfer of technology, and the elimination of

restrictive business practices. With regard to creating endogenous technology, regional cooperation may include research and development, the exchange of skills, the creation of technology banks, and cooperation in field testing, adaptation, evaluation, and demonstration through regionally linked local and national technology centers.⁸⁾

2. Constraints

Although a large number of common technological problems among developing countries offer potential opportunities for mutually beneficial and effective bilateral as well as multilateral cooperation, there are still several constraints for their collaborations. In the conventional sense "cooperation" misrepresents the relationship between participants. What underlies the relationship is competition and underneath are a number of hard economic realities. For example, no country assists or cooperates with another and expects nothing out of the relationship, nor improves the relative competitive advantage of the latter at its own expense, nor loses their competitive advantage in a market or product without gaining at least a corresponding advantage in another market or product. Therefore, the competitive dimension must be fully recognized and a complementarity of goals should be the essential criteria for effective "cooperation."

Furthermore, the constraints posed by the lack of (1) input requirements for technology development, and (2) the basis for interaction and reciprocity, are intensified in many cooperative efforts by the lack of organizational capacity. All these problems underscore the need for defining a scope and for identifying relevant mechanisms for complementarity in each instance of cooperation in matters related to

science and technology development.⁹⁾

IV. Building Regional Linkages

In view of the constraints and inherent problems which might exist in any regional grouping, it is necessary to set up effective linkages between institutions of member countries. Thus effective regional networks are required which should support a holistic approach to the promotion of innovation, taking into account the infrastructural, socio-political, financial and manpower factors pertaining to the region. In addition, any future regional development policy must give consideration to inter-regional networks supporting innovation and new technology. Also, advances in new technology may give rise to new and more severe forms of competition between regions and countries. This danger should be confronted through strategies of cooperative relations conducive to a positive effect on the international level.

Therefore, the major objectives which should underline the industrial/technological cooperation in any regional grouping should be: (1) to accelerate industrial development in the region, (2) to develop a more balanced industrial sector in the member countries, and (3) to promote integration which should be the long-term objective of mutual cooperation. Underlying all these objectives is the conviction that industrial cooperation, just any other form of regional cooperation, should be viewed as a means to increase the economic welfare of the people, and not as an end in itself. Thus the interests of all industrialists, big or small, should be taken into account. For this reason, governments

should make a determined effort to create a favorable environment which will promote private initiative and which emphasizes the promotion of a large number of small and medium enterprises instead of a few large ones.

1. Regional Networks

One of the important strategies of regional industrial/technological cooperation should be to promote technology development and self-reliance by stimulating R&D activities on specific topics of interest to countries of a region and by involving them in a network of their institutions. By network we mean "a chain of interconnected persons or operations."¹⁰ There are, of course, many networks in the sense of chains of interconnected persons or operations which cooperate with each other. It is also clear that if one wants to speak about a network, the interconnection between its members should have a purpose. Depending on the purpose, many networks are possible between associated members.¹¹

For example, on the regional level it is possible to build networks by a variety of linkages among institutions using different formulas. In this way, regional cooperation can take such forms as: (1) participation of member states in regional projects undertaken by regional organizations; (2) joint projects between state members; (3) technical assistance projects from one member state to another; (4) joint projects among institutions (such as public or private research institutions or universities); and (5) participation of member states in regional projects of international organizations. Thus, it is important to mobilize all the actors for the successful implementation of the projects. Moreover, it is also important to ensure that a proper transfer of skills and know-how as well as research results occurs within the network. Therefore, in this way

a network is the exchange of experiences, methods and implementation of tools analyzing both successes and failures.

From an operational point of view it could be expected that on a regional or sub-regional basis all member states would be involved in regional or sub-regional institutes either by providing inputs or being the recipients of services. In practice, however, many regional institutes have a very limited regional reach, and in a number of cases their functions are mostly nationally oriented.¹²⁾ Therefore, the most visible manifestation of regional cooperation can be found in the establishment of so-called regional centers or institutes. Such institutions have been established in nearly all areas of development for different purposes and in different regions.¹³⁾ However, the purpose of this paper is not to evaluate the activities carried out under projects of regional cooperation in the area of technology, but rather to identify new approaches to regional cooperation.

For this purpose we would like to emphasize that cooperative projects (consortium research and projects) among states are a distinct form of regional cooperation under which indigenous capacities are developed through an inter-linking of national activities. The activities provided through inter-linkage may originate from certain national activities located in one or more countries and supplement, complement and develop other activities located elsewhere in the region. Such activities can of course be supported by outside assistance.

The philosophy underlying cooperative research and technology projects is the conviction that improvement of indigenous capacity can also be effected through the totality of expertise and capacity in the region which is spread over a number of countries. This approach has a

number of advantages over other approaches: (1) it reduces duplication of effort and thus allows for saving of financial resources; (2) it brings together circles engaged in similar efforts; (3) it allows for specialization of national nuclei, as well as for division of labor in areas of interest to a number of countries; (4) it constitutes a system for transfer of technology within the region (intra-regional transfer); and (5) if the cooperative project is coupled with outside technical assistance allows for greater adaptation to local conditions, since national experiences are contributing or leading factors.

The actual activities composing the cooperative programs or projects, may differ from field to field depending on national activities and national needs. The mechanisms for cooperative action are also determined by the type of activity. However, it is important to recognize the different objectives, environments and institutional structures of the actors in a research partnership or network. It is also clear that the extent of regional coordination depends upon the institutional framework of the country and the effective linkages among regional members. Therefore, in the network approach we should expect that a regional public organization act as a central network for local public and private research institutions. At the same time this regional center should build a regional network with offices in other countries of the region (Figure 1).

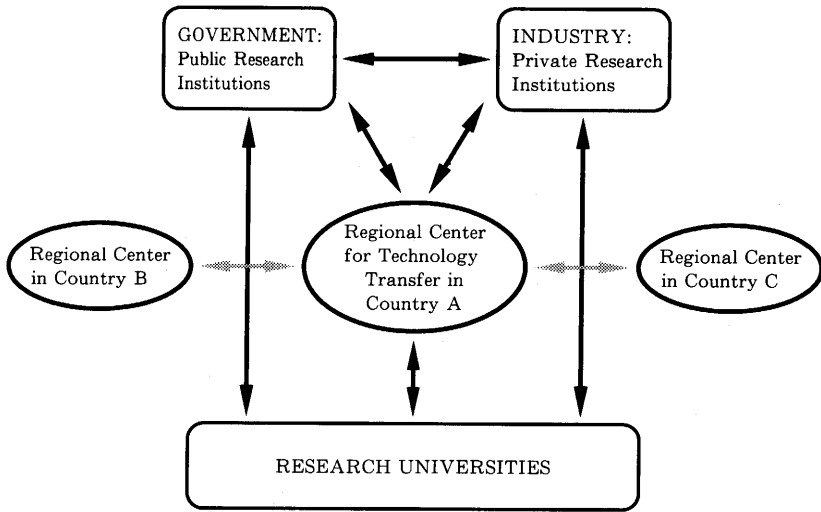


Figure 1 : Interaction and Linkages between Public & Private Research Institutes with Regional Center

It is also important, at the national level, to promote the active participation of the productive sector for identifying development-oriented projects. Therefore the objective of the regional center should be: (1) functioning as the center for a network of public and private national research institutions; (2) assisting in identifying the technological needs of the countries; (3) facilitating in the collection, analysis and dissemination of information on technologies; (4) assisting in evaluating, selecting technology, and in negotiating technology agreements; and (5) organizing the exchange of relevant information and experience. On the whole the center should coordinate the efforts of the cooperating parties at three main stages: (a) the decision-making stage; (b) the implementation stage; and (c) the utilization stage. In this way it may be possible to

provide a mechanism for regional technological cooperation, coordination and integration.¹⁴⁰

2. Policy Framework

Government policy-makers may also have an interest in fostering regional technical cooperation. In this respect, a science and technology policy is considered an essential element in foreign policy. Scientific exchange and technological transfer are frequently agreed upon between governments to demonstrate their close relations and to document their intentions to cooperate in certain fields of mutual interest. Such treaties are signed predominantly in fields that do not necessarily have a commercial bias. However, industry has different roles, motivations, and perspectives than a government. Therefore, it is important that the projects chosen satisfy this most difficult form of cooperation in order that they may be successful.

Government and industry are two very different partners, each of whom has a unique contribution to offer. Government can offer the ability to cooperate with other governments, as well as financial assistance. Industry in turn has flexibility, management skills, and technical judgment. The motivations for entering into cooperation are also different for the two partners: with governments, the motive is predominantly political; with industries, the motive is commercial. Therefore, as explained above, there is a need for an institutional framework to coordinate and to establish linkages between the official level (i.e. government), and the private sector (i.e. industry), and at the same time to foster the regional industrial cooperation.

In addition, member countries of the region should show enthusiasm

in joining institutional networks and promoting their activities. However, it is possible to enhance the usefulness of these networks by the policies outlined below:

- (1) Governments may give priority to network projects while financing science and technology activities in their countries.
- (2) Regional governments of the countries in the region could make a decision that network activity under local regional institutions should be promoted in the national interest and that scientists and technologists be allowed to exchange their information freely.
- (3) Governments could instruct institutions involved in the networks to give priority to the network activities and to keep the regional institution informed of the developments on a regular basis.
- (4) Governments may make a policy decision that, irrespective of the contribution made by a particular institution to the activities of the network, technology developed and information generated should be shared without payment, among network members. The question of payment should arise only when the technology is sold to countries and organizations outside the network.
- (5) The institutions involved in the network may nominate a person who will be in constant touch with regional institutions, feeding them the information available from the institution in his country and receiving in turn information from the regional center. This would help to establish a mechanism for availability of needed data and information.

Other policies for promoting regional industrial cooperation which are worth considering are: strengthening cooperation, at the regional level, between small- and medium-sized industries; encouraging active participation of the private sector by increasing its role; enhancing

managerial skills, export capability and other technological capabilities in industrial production of regional entrepreneurs; establishing regional training centers in areas of particular interest to the region and developing needed manpower; and establishing regional data banks for available technologies, etc.¹⁵⁾

If the above decisions could be made at the government level, then network activity under the local regional center would become more effective and would better serve the interests of the countries involved. Furthermore, the realization of these efforts together with a regional cooperative effort should provide considerable opportunities at the regional level for technology transfer, development and the reduction of costs.

V. Concluding Remarks

Concerns about the rapid globalization of science and technology and its implications for economic development will occupy an important place on the agenda of policy-makers for technology transfer and development. Perhaps the strategy of regional cooperation among developing countries can play a major role in furthering the goals and objectives of the political leaders and industrialists in matters related to economic as well as industrial development. The general strategy here is to exploit mutual benefits, multiply joint complementarities and promote joint convergences. Under these policies, collaborative efforts on the technological capability enhancements of the region are certainly areas that the member countries would like to explore.

As this study has shown, the dynamic linkages of national institutions with the regional level is a basic requirement for effective transfer of technology. In contrast to the traditional method of technology transfer — in which technology was often transferred from a large multinational firm to a small local partner — the new type of cooperative research and development often involves an intensive technological cooperation from all the participants. In general, in this method of transfer, partners join to take advantage of the complementary nature of each partner's development skills. Therefore, this process requires institutional networks in order to facilitate the interaction among public and private research institutes with similar technical and entrepreneurial agents.

As a result the network is a product of interaction and is the framework within which the interaction takes place but it is also the result of exchanges between the actors. In this approach it is possible to create and encourage exchanges between different technical areas. This can be in the form of technical meetings, bilateral agreements, programs of joint teamwork among interested or similar institutions, active involvement in regional programs and projects, and so on. The ultimate aim is to develop, enrich and fertilize the cooperative relationships among developing countries. For this purpose it is necessary to promote a policy of goodwill and the creation of a climate whereby common or similar problems may be successfully resolved through using the knowledge and experiences of other countries and through stimulative measures in order to expand cooperation.

NOTES

- 1) There are, for example, several arrangements established in various parts of the world ranging from the Central Customs and Economic Union and the Economic Community of West African States in Africa to the Andean Common Market and the Latin America Free Trade Area.
- 2) See, for example, D. Charles & J. Howells, *Technology Transfer in Europe: Public and Private Networks*, London: Belhaven Press, 1992. Also, A. N. Link & G. Tassej (eds.), *Cooperative Research and Development: The Industry-University-Government Relationship*, Boston: Kluwer, 1989.
- 3) Actors are those who participate in activities and can be companies, an institution, governments, or companies constituting a coalition.
- 4) Importance of the cooperative activities has been emphasized in many sources, see for instance, W. J. Murphy, *R&D Cooperation among Marketplace Competitors*, New York: Quorum Books, 1991.
- 5) For the various mechanisms of international technical cooperation, see, H. I. Fusfeld & C. S. Haklisch (eds.), *Industrial Productivity and International Technical Cooperation*, New York: Pergamon, 1982.
- 6) This definition corresponds to the definition of cooperative research in, A. N. Link & L. L. Bauer, *Cooperative Research in US Manufacturing: Assessing Policy Initiatives and Corporate Strategies*, Massachusetts: Lexington Books, 1989.
- 7) There are, for example, schemes such as the South Asian Association for Regional Cooperation (SAARC), the Association of Southeast Asian Nations (ASEAN), the Central American Common Market (ANCOM), the Latin American Integration Association (LAIA), etc. In the developed countries, the most well-known regional group is the European Community (EC). See also, footnote 1.
- 8) For the advantages of regional cooperation see, E. Laszlo, *Regional Cooperation among Developing Countries*, New York: Pergamon, 1981.
- 9) In practice there are many problems in the successful implementation of joint industrial projects and schemes. For the case of ASEAN, see C. P.

- Lim & J. W. Suh (eds.), *ASEAN Industrial Cooperation: Future Perspectives and an Alternative Scheme*, Kuala Lumpur: Asian and Pacific Development Center, 1988. Also, H. Esmara, *ASEAN Economic Cooperation: A New Perspective*, Singapore: Chopmen, 1988.
- 10) This definition is according to the *Oxford Dictionary*.
 - 11) For instance, for European public and private networks, see, D. Charles & J. Howells, *op. cit.* Also for the dynamics of networks, especially from the general perspective of the firm, see, H. Hakansson, *Industrial Technological Development: A Network Approach*, London: Croom Helm, 1987.
 - 12) For example, in the case of ASEAN, P. Chan, has mentioned that, “. . . national priorities always override regional priorities and perceived regional benefits are subsidiary to national interest.” in Esmara, *op. cit.*, p. 12.
 - 13) For institutional arrangements in ASEAN, see, C. P. Lim, *op. cit.* For the case of Europe, see, *Science and Technology Policy: Review and Outlook 1991*, Paris: OECD, 1992.
 - 14) See, also, C. V. S. Ratnam, “Regional and Institutional Cooperation in Formulating S and T Policies,” in R. Lalkaka & W. Mingyu (eds.), *Managing Science Policy and Technology Acquisition: Strategies for China and a Changing World*, Dublin: Tycooly, 1984.
 - 15) For regional policy development in Europe, see, J. Allesch, *Regional Development in Europe: Recent Initiatives and Experiences*, Berlin: Walter de Gruyter, 1989.

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