

Managing Technology Transfer in Agricultural Biotechnology

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This paper describes strategies for managing technology transfer in agricultural technologies including biotechnology adopted by the International Cooperation Center for Agricultural Education (ICCAE). ICCAE is a Japanese international center for human resource development with the major objective to help resolve agricultural issues in developing countries through agricultural research and education via international cooperation. These strategies include: strengthening higher education and research system in agriculture in developing countries, formulation and development of consortium and networks among universities/research institutions in and outside Japan, training of young researchers from cooperating countries, development and implementation of technology transfer projects, and development and utilization of human resource database.

The challenge to developing countries such as most of SouthEast Asia, is to access and mobilize biotechnology for their own objectives. Japanese agencies and institutions have been involved in activities to assist developing countries in this regard. This paper describes the strategies adopted by the International Cooperation Center for Agricultural Education (ICCAE) based in Nagoya University, Japan in managing transfer of agricultural technologies including biotechnology.

Creation of Biotechnology Industry in Japan

In July 1999, Ministry of Education, Science, Sports, and Culture (MOE); the Ministry of International Trade and Industry; Ministry of Health and Welfare; Ministry of Agriculture, Forestry, and Fisheries (MAFF); and Science and Technology Authority, released their joint action plan for industrialization of biotechnology in Japan. They recognized that 1) biotechnology is the technology that would change human life in the 21st century by overcoming food and environmental issues, 2) biotechnology would influence the global competitive power of the industry and offer new business opportunities with high quality of job sites, and 3) competition on patenting genes would become intensified and a delay in becoming a major player in this area would mean losing a foothold in the industry.

The joint action plan for industrialization of biotechnology and its development includes the following :

1. Improvement of foundation for creation of biotech industry.
 - a) Accelerated promotion of basic and fundamental study on genome analysis. As the country's leader in the rice genome project, Japan aims to complete analyzing all genomic sequences of rice by 2008 and officially announce the data to the public; determine the locations of about 20,000

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of cDNA sequences on the genomes by 2003; and isolate useful genes from rice by new methods, like micro array and elucidate their functions.

- b) Enhancement of intellectual foundation and promotion of network. Towards this goal, the agricultural gene bank will be updated and revitalized in order to establish an efficient system of collection, classification/identification, storage, and supply of biological gene resources and linking of databases among national institutes and universities and opening these to the public.
2. Promotion of technology development and enhancement of industrialization support.
 - a) Promotion of technology development for practical use. This aims to contribute to overcoming environment, energy and food problems using biotechnology. Technology development in research areas of genetics, molecular biology and microbiology that are expected to create new businesses, could be promoted by gathering research power from non-government services and by working closely with national institutes and universities.
 - b) Expansion of fund support for industrialization of biotechnologies.
 3. Establishment and strengthening of social aspects of biotechnology.
 - a) Build up of appropriate research development systems conducive to original basic research. Basic research results are easily industrialized in biotechnology area. The new action plan has emphasized the need to promote original basic researches by increasing competitive research funds for basic research in universities and national institutes.
 - b) Establishment of effective technology transfer system
 - c) Securing biosafety and rationalization of regulation. This will entail updating and improving safety guidelines on recombinant DNA technology considering the past and immediate experiences on the development and commercialization of genetically modified organisms (GMOs). The ministries should mutually utilize the results of the studies on biosafety and promote their release to the public.
 - d) Protection of intellectual properties
 4. Promotion of public acceptance.

The public should be informed of the value of research and development to generate technologies, research results and technologies developed, and the contributions of biotechnology to society through meetings, symposia, and multimedia.

The ICCAE

There are five international cooperation centers in five main areas: Primary Education in Hiroshima University established in 1996; Agricultural Education in Nagoya University in April 1999; Medicine at the University of Tokyo in April 2000; Technology and Sociology to be opened in 2001 and 2002, respectively.

ICCAE is the international center for human resource development to resolve agricultural issues in developing countries through agricultural research and education via international cooperation. It cooperates with international organizations and Japanese universities and organizations to develop cooperative work towards overcoming agricultural problems from the farmer level, as in extension studies, to the biotechnology level.

ICCAE has two divisions: one for project development and the other, for network-cooperation development. Activities under the Division for Project Development include development of project proposals for human resource development, analyses and evaluation of Japan International Cooperation Agency (JICA), university and non government organization (NGO) developmental projects in agriculture, dispatch of experts overseas and training of young researchers from cooperating countries. ICCAE is now involved in the following studies: 1) strengthening of higher education system at the Faculty of Agriculture, Namibia University in Africa; 2) development of a human development center at the African Institute for Capacity Development based in Jomo Kenyatta University of Agriculture and Technology, in cooperation with seven other universities in Kenya, Tanzania, and Uganda; 3) developing an agricultural curriculum for high schools in Paraguay; 4) development of a higher education and research system at the Royal University of Agriculture in Cambodia; and 5) transfer of biotechnology to the Southeast Asian countries.

The Division of Network Cooperation Development is in charge of 1) development of coordination method and utilization of database; 2) development of project management ; 3) formulation of consortiums and networks with universities and institutes in and outside of Japan and 4) training of experts. ICCAE has more than 2000 researchers in its database who can be tapped to work overseas as experts for various projects.

As a center of all universities in the agricultural area, ICCAE which is directly under the Ministry of Education (MOE), communicates and collaborates with all Japanese universities, JICA and MAFF including the Japan International Research Center for Agricultural Sciences (JIRCAS) for international cooperative studies. ICCAE provides data on human resources to MOE as well as universities, JICA, MAFF and international research institutes, and discusses candidates for the projects from which MOE or others, selects.

Further, ICCAE has a visiting fellowship system to invite researchers from overseas for cooperative study. For the year 2000, ICCAE is inviting three researchers from China, Cambodia and SEAMEO SEARCA in the Philippines. ICCAE hopes to develop consortium or cooperative linkages with various organizations worldwide.

Current Project of ICCAE on Technology Transfer of Biotechnology

With increasing population and decreasing agricultural lands, utilization of marginal lands such as saline areas for food production is an important area of research and biotechnology application for developing countries. Through modern biotechnology, it may be possible to transfer genes conferring salt tolerance to major crops such as rice. In cooperation with Japanese universities, ICCAE is in search of young researchers from Vietnam to study the transfer of the salt tolerance genes to a rice variety for the Mekong Delta. Researchers from various universities and institutes such as Canto University, Cuu Long Delta Rice Institute, Hanoi Agricultural University, Center of Biotechnology in Hanoi National University are now being considered for this project.

Key Issues to Succeed

One key issue to succeed in this technology transfer scheme is that the home institution of the successful candidate should be adequate to enable the returning researcher to teach as well as conduct research. This will also, to a large extent, minimize the possibility of immigration of the researcher to Japan or other industrialized country.

However, in cases where the home institutions lack certain facilities for experiments or analyses, it is envisioned that the researcher can make brief visits to Japan or perhaps Singapore for such purposes considering the high cost of the purchase and maintenance of certain biotechnology equipment.

Another key issue is the improvement and updating of regulations on biosafety, food safety, intellectual property rights and other relevant regulations in Southeast Asian countries to enable safe and acceptable movement of GMOs and technology transfer.

ICCAE is working with universities, institutes and authorities in and outside Japan to transfer biotechnology to Asia and assist in the updating of various regulations covering biotechnology and its products.