Technology Transfer System in Thailand[1]

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1. Introduction

This paper is an overview of the technology transfer system in Thailand. The paper is organized into 6 sections. Definitions of relevant technical terms and conceptual frameworks are presented in Section 2 and 3, respectively, in order to give the readers some ideas what technology transfer means to the Thais. Section 4 reviews briefly the present status and problems of technology transfer in Thailand. Sections 5 and 6 outline the national technology transfer policy and legislative measures, respectively.

2. Definitions

It is the author's observation that agricultural scientists in developed and developing countries often attach different meanings to the same technical term. Common working definitions are therefore needed to eliminate this type of possible misunderstanding.

2.1. Technology

Technology refers to the practical knowledge of how something is made or done. In other words, technology is the practical application of science. According to Asia and Pacific Center for Technology Transfer or APCTT (Shariff, 1986), technology may reside (be embodied) in machine ("technoware"), knowledge ("inforware"), people ("humanware") and organization ("orgaware"). These four embodiments of technology interact dynamically (Ramanathan, 1996). For example, in the context of agricultural biotechnology, control of Phytophthora by Trichoderma, absorption of ethylene by chemical or biochemical agents, and transgenic cotton are a few examples of agricultural biotechnologies (MOSTE, 1996d).

2.2. Technological Capabilities

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Technological capability, coined by economists in the 1980s, refers to the ability to acquire (search, select, negotiate, procure, etc.), operate, adapt, design, and innovate a technology. (Kritayakirana, 1986)

2.3. Technology Transfer

In developed countries, people tend to think of technology transfer in the sense of "putting research results (from developed countries) to work in the field (of developing countries)" without any notion of technological capability changes on the recipient side.

In this paper, however, the term "technology transfer" refers to the movement of technology across national boundaries, whether inward or outward. (ESCAP 1992a, MOSTE 1996e) Technology is transferred from technology provider (source, donor) to technology recipient (acceptor). The transfer takes place if and only if there is an increase in technological capability of the technology recipient. Emphasis is placed on adaptive, design, and innovative capabilities as primary targets of technology transfer on the recipient side.

2.4. Technology Diffusion

"Technology diffusion" refers to the spread of technology inside a country. (ESCAP 1992a). Diffusion mechanisms as practiced in Thailand include setting up incentives for local manufacturing, securing grants for technology development and diffusion in local universities, holding provincial techno-fares and subsequently establishing a university or a technology transfer center at the site of each techno-fare, and establishing a folk-inventor program specialized for lay people.

2.5. Indigenous Technology

Any technology developed within the country, e.g. as a result of an R&D program, is called "indigenous technology."

Mechanism	Advantage	Disadvantage
Education abroad	Very important means of technology transfer	Costly: direct cost + opportunity cost, Long gestation period
Site visit and on-the-job training abroad	Can be very cost-effective	Lots of prior competence and purpose to absorb technology. Beware of cheap-labor fraud.
International cooperative Research Efforts		Usually focused more on transferring scientific information than technology.
Published literature	Relatively cheap transfer of scientific knowledge. Analysis of patent documents can produce invaluable insight.	May be out-of-date. Some may lack detail. Proprietary technologies may not be published at all.
Meetings, seminars, and colloquia	More up-to-date than publication. Good for transfer of scientific knowledge.	Travel fund needed. Proprietary technology may not be transferred.
Browsing the World Wide Web (WWW)	Extremely convenient to use. Can also be used to browse patent information	Proprietary technology may not be transferred.
Simple emulation of products or process	Reverse engineering can stimulate innovative capability.	May involve illegal activities
Turnkey operation	High quality, state-of-the-art technology, no need for skilled workers	Costly, minimal acquisition of know-how
Purchase of technological services	Enormous transfer through education	Transfer highly variable. Poor transfer if technology personnel are hired and the locals cannot absorb their know-how
Purchase of embodied technology		Pay more for technology in terms of cost/unit bought
Direct purchase of naked technology	Cut cost and efforts in R&D of complex, state-of-the-art.	No incentives to develop in-house technology
Licensing	Good for recipient with high absorbing capacity. Help reduce duplications of efforts.	Watch for terns in the license agreement.
Joint ventures	Share cost, technical marketing, production, and managerial skill.	Party of stronger technological capabilities may want to avoid transfer of proprietary technology.
Patent purchase	Help existing products, going into new lines, avoid patent infringement suits.	Recipient needs high absorptive capability.
In-house transfer to foreign subsidiaries	Transnational Corporations are major technology transfer agent. No concerns for national border and proprietary rights.	May be used to transfer profits out of developing countries.

Table 1: Mechanisms of Technology Transfer

The first six mechanisms involve education, research, reading and seminar participation. The next mechanism involves reverse engineering and emulation. The next group of three mechanisms involve primitive acquisition of bundled technology. The last five mechanisms involve more advanced modes of technology acquisition. Adapted from Frame (1983).

3. Conceptual Framework

3.1. Mechanisms of Technology Transfer

As seen in Table 1, various mechanisms exist to aid technology transfer. Advantages and disadvantages with respect to developing countries are also listed on the table.

Several mechanisms exist for gathering industrial information. These include education, literature reading, World Wide Web browsing, engagement in cooperative research, and participation in trade or professional meetings.

One way of technology transfer involves reverse engineering. Once the technology is known, improvements can be made to obtain better products or processes. Care must be taken, however, that intellectual property rights (mostly patent rights) are not infringed.

It is well-known that a majority of firms in developing countries rely on turnkey operation, purchase of technological services, or purchase of embodied technologies. These modes of transfer, however, offer little or sometimes highly variable degree of technology transfer in terms of technological capability increase in the technology recipient.

Several government agencies are responsible for controlling and promoting technology transfer. Thailand's Technology Transfer Center, established under the Ministry of Science Technology and Environment, plays a key, albeit limited, role in promoting technology transfer and licensing.

3.2. Constraints and Impact of Technology Transfer and Diffusion

During the past couple of decades, several models of technology transfer, diffusion, and development have been tested and used in Thailand. Built-in constraints (macro/micro) are capital, technology and trade barriers, and local condition such as manpower, absorptive capacity, social value, market and price structure, management experience, risk perception, firm's characteristics, technical infrastructure, etc.

The impacts of technology transfer and diffusion may be divided into business impact, impact on further development of technology and industry, and direct social benefits through the availability and utilization of technology or products of such technology.

3.3. Technology Transfer from Analysis of Patent Documents

During the past decade, intellectual property protection has been recognized by Thailand as forming a foundation for industrial development. A new wave of modern intellectual property laws drafting started in 1988. In 1992, the Department of Intellectual Property was established in the Ministry of Commerce. This Department takes the role of

Thailand's Patent & Trademark Office, as well as handles copyright matters. During the same period, scientists and engineers started to appreciate the value of patent documents. Various organizations offer patent search service for US and European patents, as well as Japanese Patent Abstracts.

Recently, it has been recognized that patent documents should be analyzed in groups of related patents (in addition to analyzing each individual patent one at a time) as practiced by private companies in industrialized countries like Japan and the US. Currently, the Intellectual Property Institute of Chulalongkorn University is performing a trial run using such methodology in four fields of industry: food, agricultural machinery, rubber, and space communication. The result of such analyses will help in business and R&D planning, i.e. in monitoring competitors' activity, finding the trend and niches in technology development, and competitively positioning the R&D and commercialization of each local firm. All these will help, directly or indirectly, to improve technology transfer.

4. Present Problems of Technology Transfer in Thailand

4.1. Economic Problems

For the past decade, Thailand has enjoyed a booming economy with fantastic growth. Two recognized problems were increasing unskilled and semi-skilled labor cost and the gross lack of science and technology manpower base. (TDRI, 1990) To be internationally competitive in the manufacturing sector, the country relied too heavily on cheap labor as opposed to accumulation of technology through technology transfer and research and development.

Recently, partly as a result of organized foreign capital speculation, and partly from gross negligence on the part of the Bank of Thailand, the bubble of that fantastic growth has collapsed. The government, in compliance with the guidelines set up by the International Monetary Fund (IMF), started a very tight spending policy, which inevitably limits direct and indirect assistance to the private sector in technology transfer.

4.2. Technology Transfer Problems

4.2.1. Net Technology Consumer

Although importing technology is not necessarily bad for the economy, being a major net technology consumer is a problem common to many developing nations of which Thailand is no exception. Starting in 1985, the Technology Transfer Center under the Ministry of Science Technology and Energy annually published the Annual Technology Transfer Status of Thailand, which documented economic status, science and technology manpower status, foreign technology purchase, status on research and development, roles of organizations involved in technology transfer, technology transfer policy, investment and licensing recorded, etc. (MOSTE, 1985) Unfortunately, since the new Foreign Exchange Regulations (established in about 1995) do not keep track of technology payment balance, it is difficult to specify how bad the present situation is with regard to technology import, export, and balance.

Some of the imported technologies obviously go into production of value-added goods, services, or technologies for export. Nevertheless, the majority of technologies, especially the ones embedded in consumer goods, are consumed without generating inventions or even adaptation. As for production technology, many factories still prefer to use turnkey technology transfer mode for reason of short-term profit.

4.2.2. Lack of Capabilities to Select, Absorb, Diffuse, and Develop

Simply put, there is shortage of both quantity and quality of manpower to support effective technology transfer in various sectors.

The lack of selective capability leads to non-optimum technology choices. It is related to lack of information of competing technologies and their impacts. The lack of absorptive capability comes from lack of awareness on the technology recipient that effective technology transfer will take place only with active participation by both the donor and especially the recipient. Lack of adaptive, design, and innovative capabilities means local capabilities in industries seem to stop at operative capability.

Actually, adaptive, design, and innovative capabilities do exist in universities and research institutes but a lot of linkages will be needed to extend these capabilities to actual users in industries. Theoretical treatment of the subject as well as survey data in the fields of biotechnology, material technology and electronics and computer technology have been documented by Thailand Development Research Institute. (TDRI, 1992)

The overall situation in agriculture and agricultural industries is not much different from that in the manufacturing industry. Fertilizers, growth promotors, and pesticides are either imported or manufactured using foreign technology with little transfer beyond operative capability. Nevertheless, the Ministry of Agriculture has done a good job in development of new varieties of plants such as rice, corn, etc.

4.2.3. Lack of Information

Information includes supply source information, information on spare parts, technical information on the subject being studied, etc.

For the past several years, a few government and semi-government agencies have specialized as information sources. These include the Department of Intellectual Property (Ministry of Commerce), the Department of Science Service (Ministry of Science Technology and Environment), and Technology Information Access Center (TIAC, which is an office established under the National Science and Technology Development Agency, NSTDA, a semi-government agency affiliated with the Ministry of Science Technology and Environment).

4.2.4. Lack of Research Funding

In Thailand, most research work is done in universities and government research laboratories with supports from the public sector. Traditionally, most of the government research funding is in agricultural technology. In response to requests for more funding in other areas of technology during the past decade, the government significantly increased research funding through the National Science and Technology

Development Agency (NSTDA) and the Thailand Technology Fund (TRF) established under the Prime Minister's Office. Annual budgets of each of these agencies have been in the hundred million baht range over the past several years.

Now that the Thai Government is cutting back on spending, the government-sponsored fundings on research development and engineering (RD&E) are inevitably reduced.

4.3. Present Problems in Agricultural Technology Transfer

4.3.1. Major Problems in the Plant Sector

These problems include inappropriate variety selection and development, misuse of fertilizers and pest controls, inefficiency in planting and harvesting, and poor packaging.

4.3.2. Major Problems in the Animal Sector

Major problems include use of imported breeding stocks, inadequate disease control, and special problems related to harvest and post-harvest technologies.

5. National Technology Transfer Policy

Thailand's technology transfer policy is reflected in the comprehensive National Science and Technology Development Plan, 1997-2006 (MOSTE, 1996e), which covers (a) Science and Technology Manpower Plan, (b) Science and Technology Transfer Plan, (c) Research and Development Plan, and (d) Development of Science and Technology Infrastructure Plan.

The objectives of the present National Technology Transfer Policy are to accelerate the transfer of technology in manufacturing and service sectors in order to foster international competitiveness; to establish mechanisms necessary for sustained technology transfer and diffusion for quality of life; and to persuade investments in production and research and development in strategic sectors.

5.1. Goals

5.1.1. To develop absorptive, transfer, and innovative capabilities in the manufacturing sector, using clean technology in compliance with ISO 9000 and 14000.

According to the Plan, both agricultural and industrial sectors must retain competitiveness with respect to cost and quality. Technology transfer must be linked to mega-projects in the production and public-service sectors. Technology transfer in a few selected key industries will be promoted. Radiation technology will be used to preserve agricultural goods as well as in high value-added export industries. These activities will need manpower with expertise in searching, assessing, and receiving technology that will be transferred form abroad.

5.1.2. To establish agencies and mechanisms to transfer and develop new technologies in the capital and provincial areas.

Professional societies and technical consultants in each industry will be utilized as executing agencies and/or mechanisms. Infrastructure in remote areas, such as technology news feed and intellectual property information will be established during the next decade.

5.1.3. To establish fiscal and monetary policies that promote the manufacturing and service sectors to acquire, transfer, and develop technologies.

Adequate funding for science and technology development is crucial. Technology development banks and tax incentives will be used to encourage technology transfer.

5.2. Strategies and Measures

5.2.1. Priority Setting

An specialized organization will be responsible for technology information survey, determination of short, medium, and long-term target industries, as well as conducting monitoring and follow-up activities. Methodology for technology assessment will be developed for use in the planning of target industries. White-paper on technology transfer will be assembled with the help of the public and the private sectors. The government will take advantage of information technology to disseminate technological information to the people.

5.2.2. Awareness in Government

The Plan includes campaign funding for seminars for high-ranking government executives and members of Parliament to appreciate the necessity of technology transfer.

5.2.3. Manpower Preparation

Emphases will be placed in curriculum redesign, with multilateral cooperation on technology and technology management. This will naturally demand more foreign language technical education. Both foreign and Thai consulting firms will be promoted.

5.2.4. Attract Transnational Companies to Thailand

Measures that will be used include elimination of double-taxation for transnational companies and their employees, reduction or elimination of corporate income tax as well as taxes on royalty payments, and investment promotional incentives for transnational companies which establishes research and training centers in Thailand.

5.2.5. Utilize Megaprojects

Government's megaprojects, e.g. on public infrastructure, will be required to include technology transfer to Thai personnel as well as to use Thai consulting firms.

5.2.6. Incentives for Thai and foreign experts

Experts from foreign countries as well as Thai experts living in a foreign country will be eligible for incentives such as special treatment for visa application, reduction or elimination in personal income tax, reduction of personal income tax for experts in fields with national priority.

5.2.7. Incentives to Create Training Institutes

Government funding will be provided for institutes with technical training. Corporate income tax for these institutes will be exempted. Donations to these institutes will be tax-deductible.

5.2.8. Diffusion Mechanisms

Promotion will be given to industries which uses local raw materials. Provincial universities will be supported to become technology transfer centers. Science and Technology organizations will be encouraged to work with local, folk-inventors to develop and diffuse indigenous technologies.

5.2.9. Utilize Intellectual Property System

Responsible agencies for intellectual property management will be promoted to a more professional level. Services must seek users and not the other way around. Private firms will be encourage to take the most advantage out of the new intellectual property system.

5.2.10. Promote Science and Technology Culture

Science and technology-based culture will be promoted in the society where most people still believe in superstition.

6. Legislative Instruments

In order for the National Technology Transfer Policy to be realized in practical terms, laws and regulations are needed to implement these policies. Some of the necessary laws and regulations are now in place. Others are in the drafting process. A few, unfortunately, are still on the wish-list.

6.1. Screening Measures for Modern Technology

Certain laws have the effect of screening for modern technologies. (Vongkiatkachorn, 1985)

6.1.1. Alien Business Law (National Executive Council Announcement No. 281 of December 24, 1972)

According to this law, before foreign entrepreneurs are issued permits to engage in a business on the "Control List," they need to convince the authorities that their proposed business requires technology that Thai people do not have.

6.1.2. Investment Promotion Act of 1977

Promoted projects have to be technologically sound as well as economically sound. The law provides the government with screening controls for both technology and payment fees.

6.1.3. Immigration Act of 1979

Applicants for immigrant visas must have academic and professional abilities, among other requirements, while applicants for non-immigrant visas must come to Thailand, among other things, for the purpose of scientific research in a research institution in the Kingdom.

6.1.4. Working of Alien Act of 1978

Applicant for work in Thailand must show the authority that their expertise is necessary and not available in Thailand.

6.1.5. Industrial Product Standards Act of 1968

This law sets out a framework for industrial product standards.

6.2. Applications of Technology

Some technology, particularly information technology, may require special laws or amendments in order to allow practical applications. An example is the paperless system of Electronic Data Interchange (EDI), which requires amendments in the law of evidence.

6.3. Promotion of Technology Transfer

Measures to promote effective technology transfer should be built into laws and regulations related to government procurement, especially in mega-projects. All of them are still on the author's wish list. They are the results of the mechanisms mentioned in section 5.2.5.

6.4. Protection of Intellectual Property Rights

At present, Thailand has enacted most of the intellectual property laws as required by the World Trade Organization (WTO).

On the literary and artistic side, The Copyright Act of 1978 was amended in 1994 to include computer programs

On the industrial property side, Thailand has the Patent Act of 1979 amended in 1993 and the Trademark Act in place. In the works are Laws on the protection of integrated circuit layout design, trade secret, geographical indications, and plant varieties.

6.5. Gathering of Information and Statistics

This set of laws serve to gather information on investment, royalty transfer, licensing agreements, etc. Examples are the Exchange Control Act (administered by the Bank of Thailand), the Investment Promotion Act (administered by the Board of Investment) as well as the Alien Business Act (administered by the Department of Commercial Registration, Ministry of Commerce).

7. Future Outlook

Given the economic turmoil that Thailand is now facing, there is a growlingly perceived need to strenghten Thailand's technology transfer system as a platform for the economic rebound that is expected to take place in Thailand in a couple of years from now. In the author's opinion, the most difficult problem facing the Thai Government is how to encourage private industries to invest in active technology transfer practices in order to increase technological capabilities for the long-term while financially surviving in the short term. Meanwhile, laws and regulations will need to be established in order to implement the biodiversity convention that Thailand is expected to ratify some time during 1998. These laws and regulations will address the fair balance between access to local genetic resources and technology transfer from more advanced nations. The evolution of the technology transfer system in Thailand is therefore still on-going, with a possibility of bright outlook ..... if Governments don't change too often.

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Notes by the Author:

This paper was presented by invitation from Dr. Fred Erbisch of Michigan State University. The program looked like this:

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                              Wednesday, April 30

Plenary Session V: Developing and Accessing Agricultural Biotechnologies: International,
US, and Developing Country Issues, Perspectives and Experiences

Moderator:      Dr. Florence Wambugu

Dr. Fred Erbisch, Director, Technology Transfer Office, Michigan State University, East
Lansing, Michigan, USA
"Transferring Agricultural Biotechnology: US Public/private Sector Perspectives"

Professor John Barton, Stanford University School of Law, Palo Alto, California, USA
"International Intellectual Property Issues: GATT and the Biodiversity Convention"

Mr. Rene Ma. M. Villa, University of the Philippines (invited)
"Intellectual Property and Technology Transfer in the Philippines"

Dr. Lerson Tanasugarn, Director, Intellectual Property Research Institute, Bangkok,
Thailand
"The Technology Transfer System in Thailand"

Dr. Florence Wambugu, Director, AfriNet, International Service for the Nairobi, Kenya
(invited)
"Technology Transfer in Africa: Challenges and Opportunities"

Dr. Quentin Kubicek, Trade Policy Liaison, Biotechnology and Scientific Services, Animal
and Plant Health Inspection Service, USDA
"Trade in Conventional and Biotechnology Agricultural Products"

Refreshment Break

Discussion

Lunch
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During the discussion period that immediately followed the presentation, the author had an opportunity to clarity a question from the audience and to point out the confusion with regard to the meaning of “technology transfer.” In the capitalistic (mostly western) societies, technology transfer is deemed successful when one selects a plant from a developing country, modifies certain genes of that plant so as to produce more or better biochemical compounds, and sends the genetically modified plant back to be grown in the country-of-origin. In certain cases the genetically modified plant could be grown anywhere in the world in order to extract and further modify such biochemical compounds to be sent back for sale in the country-of-origin. Intellectual property protection of the GMO plant and its chemical products is routinely sought both in the country-of-genetic modification, country-of-production, and, if possible, the country-of-origin. The agricultural (or pharmaceutical) company then proudly acclaims its success in transferring technology to the third-world countries. Nevertheless, people in third-world countries do not view these examples as technology transfers. To be called technology transfer, there must be transfer of technological capabilities as defined in Section 2.3 of the paper.