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The Challenge to Enhancement of the Technological Level of Thailand

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# of Thai Industry

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I. Introduction

This paper makes a survey on the government system and policy for the enhancement of the technology level of Thai industry, and ways to develop worker skills. This report is based on research done in September 1997 and March 1998 in Thailand. According to Bangkok Post Jan. 23, 1998, Deputy Prime Minister Supachai said that creating an industrial economy with imported technology does not serve Thailand's long-term interests. Between 1976 and 1996, 35,000 applications for patents rights were filed in Thailand. By comparison, 564,000 patent and trademark applications were filed in 1996 alone in Japan. Thailand spent 25 billion baht on imported technology in 1996, while the value of technology exported was only 700 million baht.

Amidst the recent economic crisis, it is recognized among policy makers that Thailand should upgrade her capability in science and technology and also should level up the skill of entrepreneurs and employees. Accordingly, the author intends to explore the present situation of S & T issues, point out the difficulties of skill development and introduce some recommendations proposed by the Japanese experts who are in charge of technical cooperation projects.

II. Main Government Agencies for Promoting Science & Technology

The Ministry of Science, Technology and Environment is the main government organization, established in 1979, taking direct responsibility for the promotion of science and technology. Its main task is policy planning. The Office of the Permanent Secretary of this Ministry oversees some organizations such as the Office of Technology Promotion and Transfer, Thailand Institute of Science and Technological Research (TISTR) and National Research Council of Thailand (NRCT).

Besides these organizations, the Ministry has NSTDA as a more independent research

body.

Other ministries such as the Ministry of Agriculture, Ministry of Industry, Ministry of Health, Ministry of University Affairs, Ministry of Defense and Ministry of Transport and Communications are also related to the activities to promote S & T. NESDB and TDRI are also concerned bodies in policy planning and research.

II-1 Office of Technology Promotion and Transfer

In this office, there are two divisions that have about 30 researchers.

One is the Technology Transfer Center which deals with the international technology transfer. The other is Technology Promotion Division which deals with local technology development, such as the improvement of agricultural machinery. This is done by funding the research of professors of national university.

Outline of activities is as follows.

1. Cooperation with other Institutions

One is the contribution to the activities of the Association of Science and Technology of Thailand. Another is participation in the Asia Pacific Center for Transfer of Technology (APCTT) which has been under UN/ESCAP since 1983.

The strategy for technology transfer is as follows.

1) To promote foreign companies to invest in the following activities in order to transfer technology to Thai people : productions which require advanced technology: research and development: and the set up of technology training institutions in important areas.

2) To encourage the import of know-how together with import of high-technology machinery in order to support the learning and development of national technology.

3) To support experts and highly qualified personnel, both foreign and Thai living abroad, to work in research and academic projects in Thailand by revising rules and regulations to facilitate them in immigration procedure and obtaining work permit to work with the public and private sector.

2. Promotion of energy-saving and environmental protection

3. Public relations for S & T document service, exhibition and audio-visual materials.

4. Training course and seminar.

5. Network for information about technology transfer. On this matter, budget constraints are the most crucial area.

6. Support for R & D activities. Providing research funds for national universities and institutions. Loans for the private sector.

II-2 Thailand Institute of Scientific and Technological Research (TISTR)

This is a non-profit organization, established in 1963. Research division has focused on three subjects which are bio-technology, industrial material and energy/environment. Responding to the request from the government, main effort is directed to support export-oriented sectors, especially small and medium scale industries, or supporting industries to raise productivity, level-up of quality, amelioration of production process, environment protection. 80 percent of the budget comes from the government and the rest from provisions of services to the private sector.

The number of staff is 666. Many middle-class researchers had moved to the private sector in the boom era. Hence, the institute had asked professors to come to help. But, now it is difficult to do so because of the budget shortage.

One way out is to rely on the private sector, but officers claim that private companies stick to development of their own products. Officials also have the opinion that they don't want to follow the Malaysian mode which aims to acquire the most advanced technologies. The officials of TISTR claim that employment of most advanced technologies does not lead to economies of scale. They assert that Thailand should develop agro-based industries.

II-3 National Science and Technology Development Agency (NSTDA)

NSTDA is a funding and research organization established under the "Science and Technology Development Act of 1991". NSTDA is an autonomous organization operating under the policy guidance of its Board, chaired by the Minister of Science, Technology and Environment. The creation of NSTDA effectively brings together under one roof a funding office and three national research centers formerly in the Ministry of Science, Technology and Environment, namely: Office of the Science and Technology Development Board (STDB), National Center of Genetic Engineering and Biotechnology (BIOTEC), National Metal and Materials Technology Center (MTEC) and National Electronics and Computer Technology Center (NECTEC).

NSTDA has the dual roles of both supporting and implementing S & T development. Support is given to both public and private sectors and includes research funding, information

services through the Technical Information Access Center (TIAC), institutional strengthening programs, and other activities that lead to the harnessing of appropriate S&T for social and economic benefit. It provides many scholarships, both local and overseas. NSTDA also carries out in-house research, development and engineering and provides a range of services such as technical services, consultancy, and training courses. A tripartite cooperation between the private sector (technology user), the academic institutions (technology generator) and NSTDA (facilitator) is the main aim of these activities. It is expected that many research projects funded or conducted by NSTDA will lead to commercialization derived from technology transaction, patents and investment. The private sector will gain from technology development, thus strengthening its capabilities and enabling it to be less susceptible to foreign dependence.

The Science & Technology Research & Development Park (Science Park) is under construction at the Rangsite site. NSTDA operates autonomously outside the normal framework of civil service and state enterprises. This has enabled NSTDA to operate more effectively to support and transfer technology for the development of industry, agriculture, natural resources, environment and the socio-economy. It will continue to provide these services until the private sector has sufficient maturity to conduct its own research.

BIOTEC has six mission areas, namely: (1) plants, animals and their product improvement, (2) environmental biotechnology (treatment of wastewater), (3) aquaculture (prawn farming), (4) medical biotechnology (tropical disease, medicinal plants,), (5) food biotechnology (fermentation technology, quality of food), (6) biodiversity.

MTEC covers technology areas such as the fields of metals, ceramics, polymers and design and manufacturing. Main focus is on the developing technological capability of supporting industries particularly those small and medium scale industries manufacturing and supplying parts and components to automotive, electronics and electrical appliance industries. Other industries which are also targeted by MTEC include agricultural machinery, industrial machinery, biomedical materials and devices and textiles.

NECTEC has missions in various fields of technology eg: software, telecommunication, computer, laser, electro-optics, computer network, industrial electronics, microelectronics and information technology management.

III. Activities in Upgrading of Skills and Productivity

III-1 Thailand Productivity Development Project (TPDP)

The Ministry of Industry has decided to accelerate the nation's industrialization program through productivity development. In 1994, the MOI and Japan International Cooperation Agency (JICA) signed an agreement to implement technical cooperation program titled "Thailand Productivity Development Project (TPDP). In 1994, the government approved the establishment of an autonomous institute, the Thailand Productivity Institute (FTPI), to execute the Project. This project will finish its five year term in February 1999. Japanese experts were assigned by JICA to provide guidance, assistance and advice on productivity development to the country through the transfer of Japanese experience and technologies in the following areas:

1) Consulting skills

Counterparts are learning skills on simple diagnoses, practical approaches to "In-company Productivity Movement ", practical and integrated application of various productivity tools, such as, PDCA, 5S, IE, QC, Suggestion System, QCC, TPM, JIT, TQM, etc. through classroom training and OJT at model companies.

2) Human Resource Development and Labor-management Relations

The expert gives guidance, assistance and advice to counterparts on practical productivity movement and human resource management.

3) Productivity Promotion Survey

Experts provide guidance, assistance and advice to counterparts to develop methods of planning, editing and publication of various promotional materials on "Productivity Movement".

FTPI has 110 staff. The focus is on promotion of SME for acquisition of international competitiveness. Under the privatization policy, only 20 percent of the budget come from the government with the rest to be earned through its own activities. The target is to nurture 42 officers. 270 companies are contributing as members. The experts insist that consulting in waste saving activities has reduced production cost by millions of baht. So far, the activities cover promotion for production technique, training and extension service. To meet the increasing needs for marketing and financing, it is hoped that the activities will cover a broader base.

III-2 Setting-up of new institutions

Each Thai industry has been forced to adapt to compete in the global market place. For example, the textile industry has contributed considerably to industrialization, but it should adapt to fierce competition with new rivals and is facing a shift to higher value-added products. The food industry is also one of the main export industries and is being forced to upgrade the quality of its products. Both sectors have set up institutes to prepare for industrial development. Recently, the National Food Institute awarded Hazard Analysis Critical Control Point (HACCP) to seven food manufacturers. HACCP is required by many food-importing countries. The Institute aims to have 600 plants nationwide meeting the HACCP standard by the year 2000.

According to the Bangkok Post on February 2nd 1998, the Ministry of Industry hopes to build on the success of the Food and Textile institutes. The new bodies would cover the vehicle, electrical and electronic and industrial design sectors, each of which would receive US $ 1 million. The money would be drawn from the World Bank and Asian Development Bank. The new institutes were expected to coordinate work between the state and private sectors.

III-3 Government planning to develop industrial competence

In order to overcome the economic crisis, the National Science and Technology Committee chaired by the Science, Technology and Environment Minister has drafted a plan to develop industrial competence. The main concept is the allocation of 15 billion baht into an industrial competence development fund as part of the industrial development and exporting business fund which the Finance Ministry is processing to set up with help from the World Bank and Asian Development Bank. The plan for this fund is to jointly invest with the private sector to develop technology for potential industries which will be fundamental in manufacturing processes, management and marketing. This project proposes three urgent projects.

1) Project to develop technology for 6,000 factories in three years.
2) Project to upgrade management of 3,000 small- and medium-sized industrial factories to meet export standards in four years.
3) Project to train 60,000 workers over the next three years (cf. Bangkok Post, December 7, 1997).

At the end of 1997, the Ministry of Industry designed the Industrial Master Plan for Restructuring to cope with declining exports. They pointed out the following weaknesses of

Thai industry.

1) Thai industry utilizes old technology which causes low efficiency, low quality and low profitability.
2) Managers have insufficient knowledge about management, marketing and product innovation.
3) The workforce has only an elementary education.
4) Materials and parts / components for products are imported.
5) Most Thai export goods are low and medium level products. Thai firms undertake subcontracting and have not yet established their own brand.

The policy for restructuring consists of the following items.

1) To produce medium- and high-class products, technology and machines should be renovated and quality control should be improved.
2) To reduce cost and delivery time, production process and management should be improved.
3) To raise the level of knowledge and ability of management and employees in order to introduce new technology.
4) To build cooperative relation with foreign companies in order to access new markets and new technologies.
5) To support the introduction of technology to reduce industrial waste.

To restructure the industrial sector, it is considered necessary to employ macro / sectoral experts, systems / process experts and operation experts.

The basic plan is as follows.

1) Plan 1: To improve productivity and production processes, through hiring experts, training of factory managers, installment of equipment and bench-marking systems and evaluations. Number of targeted factories for 5 years is 2,000. Targeted sectors are food, textile, footwear and leather products, furniture, ceramics, machines, plastic products, electronics parts, automobile parts, gems and jewelry.
2) Plan 2: To renovate production technology and machines, through credit facilities for renovation of machines, hiring experts, training of factory managers, bench-marking systems and evaluations. Number of targeted factories for 5 years is 300. Targeted sectors are food, textile, footwear, furniture, ceramics, machines, plastic products, electronics parts, automobile parts, gems and jewelry.

3) Plan 3: To enhance the ability of craftsman working in promising industries through training. Number of targeted workers is 120,000. Targeted sectors are textile, sports shoes, furniture, ceramics, electronics parts, automobile parts, CAD/CAM operators, cutters, turners, type-setters and IT operators.
4) Plan 4: To foster small and medium scale industry in rural areas and support the linkage between large scale industry and small and medium scale industry.
5) Plan 5: To develop high-class products, diversification of products and support of sales activities in global markets through inauguration of product design center, hiring of experts, training of design and marketing managers.
6) Plan 6: To support s shift of production units to rural areas.
7) Plan 7: To support foreign investment into sectors having advanced technology.
8) Plan 8: To shift from polluting industry and introduce technology to remove pollutants.

This plan needs 1,000 experts as a whole. The government uses soft loans and the company must employ experts on its own account. The Japanese government sent one expert as an adviser to this plan.

III-4 Japanese cooperation for promotion of supporting industries

Japanese JETRO is implementing the Promotion Program of Supporting Industries. The objective of this program is to promote and develop supporting industries to be able to supply parts and components to assemblers or set makers such as automobile industry or electronics / electrical industry. Counterparts are the Bureau of Supporting Industries Development (BSID) under the Department of Industrial Promotion (DIP) and two related associations under BSID's supervision, those are Thai Tool and Die Industry Association and Thai Foundrymen's Society. The project started in fiscal year 1994 and is expected to bear result.

There are many schemes as follows.

1) Dispatching Japanese technical experts to survey the situation in supporting industries and offer consultation and guidance to components / parts manufacturers, including organizing related seminars. In 1997, there were dispatch of 1 expert in the field of stamping dies (visit 5 factories, organize 1 seminar), 1 expert in the field of plastic injection molds (visit 8 factories, organize 1 seminar) and 2 experts in the field of steel casting and computer & OA components (visit 2 Japanese assembly makers and 7 local computer & OA components, instruct BSID officials.

2) Inviting Thai experts to Japan. SI Training Program in Japan (3 trainees, 6 days, visit factories of green sand mold / steel casting, train for casting design, molding, solubility, finishing and inspection).
3) Holding exhibitions, workshop to meet requirements of assemblers / set makers. In November 1997, the Thai Metalecs Exhibition was held displaying products of Parts company. There were not many cases to make a deal but this attempt could be understood as giving a chance to provide technical consultancy services and provide entrepreneurs opportunities for technology, business and investment.

The person in charge of this program reveals some comments. The visiting period of experts is usually one or two weeks that is not long enough to effectively advise local firms. BSID, a counterpart of this program, has not enough power in the business circle because many large companies do not join the Association. To make matters worse, Thai entrepreneurs are reluctant to share know-how. This would be a serious obstacle for expanding the activities of the Association and also for the spread of knowledge that is obtained from training project.

IV. Role of the Private Sector

IV-1 Slow pace of technology transfer

The issue of technology transfer has a long story. Every Japanese manager has complaints here. Dr.Anupap(1995) argues that the electrical appliance industry has been developed for 30 years by Japanese companies but the technology which has been transferred is limited to process improvement in companies wholly owned by Japanese, not in joint ventures. The reason is the lack of pressure from competition and the insufficiency of government support for technology development.

Now, the situation has changed. After the rise in the Yen, Japanese companies are considering transferring R&D activities to Singapore or Malaysia for mature products. This trend will be seen also in Thailand. In general, at new product launch, many Japanese staffs are sent to prepare the new project, because product innovation is done in Japan. Then, the number of Japanese technicians will diminish gradually. The Thai side feels that the speed of transfer is too slow. Thus, both sides feel difficulties in the issue of technology transfer.

IV-2 Activities to upgrade capability in private sector

Japanese managers complain of a high turn-over rate among employees. One reason is slow promotion because of the seniority system. In general, Japanese company is inclined to force workers to acquire firm-specific skill and often fails. But now, the attitude of employees seems to change and they like to stay. So, managers feel that it is a good opportunity to train employees.

Mr.Yoneya(1998), JETRO adviser, has noted his findings as follows. Most Japanese set-makers purchase parts from Japanese companies, not from Thai companies. For example, as it is concerned with the parts of personal computer, as a high-tech products, 99% of them are ordered from Japanese makers. They buy only carton, cushion and printings in the local market. In low-end goods, like small-sized TV, they buy only 10 to 20% of parts from Thai parts makers. The reason is as follows.

1) The level of Thai makers has not reached to be able to produce in a large quantity and in a uniform quality. Even though they utilize new machines, ability for production management is low. Ability to implement quality control is low and defective rates are high. The ability to foresee problems is weak and not quality conscious.
2) Most Thai managers think that it doesn't matter to reject defectives through testing, if it is found. They don't think that they never make defective (zero defect). Skilled operator pursues quality control but ordinary worker has no sense. Quality control should be done through system, not by man.
3) Thai managers never worry about loss of market share, if they deliver products to customers behind schedule.
4) They repeat the same mistake.
5) They are too slow to launch new products.

The crucial point is that Thai entrepreneurs do not understand the concept of "customer-satisfaction" ("The customer is always right"). So far, Thailand has enjoyed high rate of growth and do not need to take pains. They prefer to engage in businesses like finance, distribution or real estates.

Mr.Yoneya recommends introduction of tools for customer satisfaction which have been developed in western countries and Japan.

Another case of technology transfer is related to mold-making. During a period of rapid economic growth, mold production cannot catch up with market demands. Now, automated

machines, such as CNC wire cut, EDM, CNC machining center, NC milling and CAD/CAM can be available in order to assure the precision. But making of dies and molds still depends largely on manual labor especially in the case of trouble. The Thai molding industry started only 15 years ago. Thailand is outstanding in producing molds for vehicle parts. The Thai government affords this industry top priority to give promotion with specially granted privileges. The difficulties lie in the fact that it needs 3-5 years for operator to be properly trained. Now the problem is that orders from assemblers of automobiles have fallen significantly. The Japanese manager considers that this is a good chance to train employees.

IV-3 Setting-up of training institutes in the private sector

There are many attempts to supply qualified human resources to the private sector. Technology Training Co. has established the Laem Chabang School of Engineering in Chonburi. Australia's Swinburne University of Technology is a partner of this joint venture which will provide full-time vocational education and training diploma programs in electrical, electronic and mechanical engineering, information technology and English-language studies. Graduates are able to receive both a Swinburne technology award and a higher vocational certificate from Ministry of Education of Thailand. 27 students began studying in February and it is projected that the campus will reach full capacity in five or six years.

The Thai-German Institute which is a non-profit organization financed by both the Thai and German governments opened in February 1998. It can help by training people in harnessing innovative technologies. The Co-director said that knowledge of modern technology and how to apply it are a key to improving product quality. Craftsmanship is no longer defined in the traditional sense.

IV-4 Promotion of R&D in the private sector

Many schemes are available to promote R&D in the private sector (see Guidebook, 1997).

1) Financial assistance:

The National Research Council of Thailand (NRCT) provides research grants to the public and private sectors in 10 areas in natural science and social science.

NSTDA offers funding to support research and development in 3 fields. NSTDA in conjunction with 3 banks have provided low interest loans and grants to support R&D in the private sector.

Thailand Research Fund (TRF) supports research projects on S & T.

The Health Systems Research Institute allocates supports research on public health.

Office of the Permanent Secretary under the Ministry of Science, Technology and Environment provides grants and low interest loans to support R&D.

2) Tax incentives:

Tax incentives are given to promote R&D in the private sector as follows. 200% tax deduction for R&D expenditures from income taxes, 40% tax depreciation for R&D machinery and equipment and tax exemption or 5% deduction for R&D equipment and materials.

3) Technical assistance:

Following assistance is given for R&D promotion in the private sector. Technical support on R&D and technology management, standards testing and quality control services and Industrial consulting services

V. Conclusion

The Proceedings of APEC Symposium on Technology Foresight (held in Chiang Mai, 10-13, June, 1997) identifies the direction of Thailand's science and technology development trends. It cites the obstacles as follows.

1) Lack of well-qualified and high potential personnel in S & T.
2) Lack of good planning for S & T.
3) Lack of equipment and capital funds.
4) Lack of efficient organization with good entrepreneurial innovation management for R&D.
5) Lack of strong basic knowledge in science to be implemented for R&D.

There are some conditions that make technology development feasible. One is the social ability to develop or absorb the new technology. It is pointed out that the level of education of workers is quite low. Another one is the accumulation of activities for technology development. Except for certain sectors or big companies, Thai industry has not enough experience to develop its own technology. Moreover, the role of the government or private sector or foreign suppliers is essential.

So far, efforts have been made towards the improvement .of production process to reduce the capital and labor, but not in the innovation of new products. One reason is that

industrialization has depended heavily on the foreign investment. Now the channel of technology transfer shifts from the assembly process to parts making process. It makes Thai industrialists, especially small and medium scale ones take the utmost pains in order to meet the demand of assemblers. Many tools are available for them to develop their skills in production management.

R&D issue is more difficult now to be tackled. In Japan, most of the cost for R&D is financed by the private sector. The financial support to private sectors from government is small. In Thailand, at present, government can not afford to bear the financial burden because of the financial crisis. Anyway, government should have the policy to awaken the interest toward S&T among society. At the industrial revolution period, an inventor could make a fortune by his invention. Japanese craftsman succeeded in applying scientific knowledge to business. Although Baht devaluation will boost competitiveness in low-end export-market in the short-run, the enhancement of the technology level is becoming an essential task to be tackled seriously and business managers should be aware of this issue.

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