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DISCUSSION PAPER NO. 110

INSTITUTIONAL FACTORS AND THE GOVERNMENT POLICIES FOR APPROPRIATE TECHNOLOGIES IN SOUTHEAST ASIA - A FRAMEWORK OF EMPIRICAL STUDY -

by

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Institutional Factors And The Government Policies for Appropriate Technologies in Southeast Asia

- A Framework of Empirical Study -

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1. The purpose of the study

No technology will be adopted unless it is considered to be appropriate by someone. Different technologies may be appropriate or inappropriate depending on who views them and from what point of view he considers them: (a) individual entrepreneurs, (b) rested interest groups, (c) provincial governments responsible for areas of a country, (d) the central government agency in change of the national economy, (e) some international agency for some region in the world or (f) some organization for the world economy as a whole. The choice of technology is usually made by (a), (b), (c) or (d); (e) can also be relevant, for example, in ASEAN projects. In the future it may become increasingly necessary to consider the appropriateness of technology from the global point of view, notably in connection with the shortage of natural resources and farming land. [1] In the context of development economics, however, the basic point of view to judge the appropriateness of technology is the long-term development of a national economy, and the central

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1) In order to develop the world economy so that two-thirds of the world population in LDCs may be able to enjoy the welfare of a higher standard of living, it is not good enough for each nation to adopt a set of appropriate technologies only from its own point of view. It seems necessary and highly desirable to see the implications of enormously expanded demand for energy and food to the future technology in the world. It is also important to realise that many of industrial technologies, if they are used all over the world, often have the undesirable effects on the world climate or the ocean which may seriously disrupt the life and living of mankind. CO^2 produced by burning coal is one of the cases to remember. All the nations, including LDCs, OPEC and industrialised countries, therefore, must co-operate to develop and diffuse such technologies as appropriate for the global production and the environmental conditions. For the future of the world, it should be remembered, the technology which saves natural resources and land is very desirable beyond any immediate economic considerations.

national government is primarily responsible for preparation of development plan including the implementation of appropriate technology. The standard objective of development may be defined as the maximum steady growth of national output with the optimal use of labor, capital and natural resources. The long-term economic development can be achieved, however, only when it does not conflict with social and political development of the nation. Any technological innovation in a developing economy, therefore, must be carefully evaluated beforehand with respect not only to its micro-economic profitability but also to its long-term effects on the economy and the nation-state as a whole. The primary purpose of the present study is to classify the meaning of "appropriate technology" in this broad context and thereby contribute to the improvement of development planning practices and to the more successful implementation of plans with particular reference to Southeast Asia.

Many scholars have already pointed out that "appropriate technology" in a developing country should suit well not only the development objective of full employment of productive factors (notably labour) in the economy, but also the country's social, political, and cultural conditions. [1] The appropriateness of technology has to be judged, taking account of a wide range of endowments of the society. such as environmental conditions, people's viability and social requirement for equality of income and living conditions among the community members. All of these conditions of appropriateness can hardly be satisfied at the same time. The standard objective of development mentioned above may be too general to judge whether a certain technology should be introduced or not. Thus it is often required to define more sharply what objective or goal the technology is appropriate for.

The basic human needs approach, for example, defines the objective more narrowly in terms of some social groups like low income groups, small entreprises or certain regions rather than the nation as a whole. Appropriateness in this case is judged mainly according to the welfare of the group defined. The same approach sometimes re-

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1) A.S.Bhalla (ed.): Towards global action for appropriate technology, Oxford, Pergamon Press Ltd., 1979.

quires also the participation of wider range of population in production and distribution of output. The decentralized and more popular decision-making in technological innovation in this approach may be economically appropriate and basically compatible with the non-economic conditions of the region. It can be practically adopted, however, only where there is a large number of capable community leaders throughout the country. Such a "grass-root" approach to development may require also a long time-horizon to materialize the same degree of economic growth. If the goal of development is set within a limited time-horizon, this approach may have difficulty to be compatible with the standard development plan of most developing countries.

Thus, such a narrowly defined goal of development strategies must always be re-examined in the light of the over-all objective for the national economy. It must be remembered that adoption of modern technology often implies to change or even destroy certain aspects of traditional way of life, and that many regions in developing countries often have the old practices which are difficult to break.[1] The tension and conflicts between economic development and social and cultural tradition may not be mitigated or resolved just by choosing "appropriate technologies". The problems have wider relations with various aspects of socio-economic life in developing countries. The implementation of government policies to adopt an economically appropriate technology may sometimes be hindered by old institutional factors, but at the same time the old institutions may possibly have be changed to accept a new, economically desirable technology. Needless to say, to present an over-all discussion on the mutual interactions between technological innovations and institutional or cultural factors in Southeast Asian countries is beyond the scope of this paper. But it is the second purpose of this study to ascertain what institutional and cultural factors in Southeast Asia have made it difficult to propagate more quickly and widely such appropriate technologies as more employment-creating or poverty-eliminating and also to find the ways and means for overcoming these difficulties. It is often argued that the hasty introduction of minimum wage and

1) Ignacy Sachs: The Discovery of the Third World, Cambridge, Mass., MIT Press, 1976.

other labor legislations as well as other fiscal and monetary incentives for investments have been distorting the relative prices of labour and capital, and that this has been causing the use of inappropriate technologies in the developing world. The barriers to the choice of appropriate technologies in developing countries are, however, much more deep-seated. Appropriate technologies obviously change from one stage of economic development to another.[1] All the governments in Southeast Asia publish their development plans nearly every five years. The examination of industrial plans contained there-in and the changes of regulations on foreign investment seem to indicate their ideas of shifting appropriate technologies. Thesedocumentary studies must be undertaken, prior to more direct interviews with decision-makers themselves. The third purpose of this study is to obtain the first hand information on leading policy-makers'ideas of appropriateness of technological choices and thereby penetrate deeply into the heart of development planning along with the effort of nation-building. The present paper purports partly to offer a frame of reference in raising question to these decision-makers and influencial intellectuals in Indonesia, the Philippines and Thailand. The geographical scope of the introduction is, however, wider than the subsequent case study, and covers other Southeast Asian countries as well.

Choice of technologies is possible, of course, only when a menue of available technologies is known. This menue should include old technologies (even those which have become obsolete in the industrial world), as well as contemporary, new, and future technologies. They should include the traditional technologies in various areas

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1) On this subject, see H. Chenery and M. Syrquin: Patterns of development 1950-1970 (Oxford University Press, 1975); R. Weitz: From peasant to farmer: a revolutionary strategy for development (Columbia University Press, 1971); K. Griffin: The Political Economy of Agrarian Change (London, Macmillan, 1974); Bruce F. Johnston: "Agriculture and structural transformation in developing countries: a survey of research", in: Journal of Economic Literature, June 1970; and International Development Research Centre: Science and technology for development: main comparative report of the science and technology policy instrument project, Ottawa 1978.

within the country or other developing countries as well as developed countries. The agricultural sector, food-processing industries textile and other cottage industries, in developing countries have their own traditional technologies and craftsmanship. The local needs may be met more easily by modifying the traditional technologies.[1] The productivity of rice-farming in Japan, for example, increased in this way during the late 19th and early 20th centuries. In the developing world, however, there seem to be all kinds of socio-cultural and political factors which make the available information imperfect and the diffusion of knowledge and information hindered. The synthesis of modern technologies with indigenous techniques and creation of own technologies are hard to expect in these circumstances. It is the last objective of our study to examine such factors with a view to stimulating the generation of indigenous "appropriate technologies".

2. The process and pattern of technological innovation: choice, diffusion and generation

"Nature does not jump" is a basic principle of technological innovations in developing countries. When traditional technologies are skillfully integrated with modern and improved technologies in a more or less continuous manner, the transfer of technology can be most successfully achieved without causing the disruptive disturbances to the harmonious life of traditional society, and the choice of appropriate technologies in the broader context can be easily made without excessive intervention by government policies. The learning by doing becomes practical only in such cases. Otherwise traditional technologies are quickly extinguished, and people's living based thereupon are often seriously bewildered. Many of village industries were completely lost in most developing countries in this way.

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1) On the generation of appropriate technology in LDCs, see Herrera: "The technology and dissemination of appropriate technologies in developing countries", World Employment Programme Research Working Paper, WEP 2-22/WP 51 (Geneva, ILO, October 1979).

There are, on the other hand, many success stories of continuous shift from conventional to modern technologies.[1] One example in Southeast Asia is the Thai silk industry which produced a unique silk cloth by keeping traditional silk yarns and weaving but adopting modern designs suitable for the export market. As the sales increased, not only the design but also the techniques of spinning and weaving were improved, and Thai workers have gradually learned the technologies step by step.

The successful linkage of modern technologies with traditional ones seems more difficult for late-comers like contemporary LDC's for a number of reasons.

Firstly, the stocks of technologies accumulated over time in many developed countries are not necessarily all available at the present time, because many of them are already forgotten or, if not forgotten, few technicians with those technologies are any longer left. Secondly, the latest version of modern technologies to produce the close substitutes for conventional consumption goods are so advanced that the craftsmanship of old masters cannot help in learning these technologies. Too great a discrepancy between modern and conventional technologies requires the learning process to establish an institution of new educational means for young engineers, but it takes time. Among others, there is none to teach, so that best students must be sent abroad for training or foreign teachers must be invited. All these educational and training efforts must precede the learning of technologies and technological innovations in any developing country.

Hence, one should not expect that the careful adoption of appropriate technologies could be accomplished very easily or within a generation.

Thirdly, late-comers have remained late-comers, good or bad, for some economic and non-economic reasons. Those reasons usually constitute the institutional and cultural factors which prevent new and foreign technologies from being accepted readily in conventional

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1) For some concrete cases and their significance, see S. Watanabe.

economic life of the traditional society. Often these barriers must be broken down in order to prepare the ground for accepting modern technologies. This requires a combination of courage, devices, ingenuity and cooperation. In other words, entrepreneurship and the society's support or cooperation are needed to break through. Whether the barriers are too hard or potential capacities are insufficient, many of developing countries remain underdeveloped because of the difficulties in overcoming these obstacles. This paper and the following empirical studies are the attempts to disentangle the complicated connections between the institutional factors and technological innovations in LDC's and to find suggestions of devising better government policies for implementing appropriate technologies.

Finally, despite the need of global action for implementing appropriate technology in LDC's, the possible bias and adverse effects of such an international cooperation are also inevitable. The financial and capital assistance tends to flow predominantly more to developing LDC's rather than the least underdeveloped countries.

The World Bank's World Bank Report, 1979 gives the external financing of developing countries in 1976 as follows:

(billion dollars)

	Low Income countries	Middle Income countries	All Developing countries
Net Factor Income	0	5	5
Official Grants	5	9	15
Medium & Long Term Loan at Market terms	4	45	49
Direct Investment	-1	-5	-6
Private Transfer	0	2	3
Total	8	56	64

(Source) World Development Report, 1979 p.7

About 87% of external financing sources are going to middle income countries. Especially the so-called NIC's (newly industrializing countries) such as Brasil, Mexico, Argentina, South Korea and Taiwan among non-Opect LDC's are obtaining more than 90% of private loans. This seems to give a warning to the optimistic perspective to the market mechanism in external financing the development of LDC's. The corrective measures are necessary to channel more financial resources to the suffering countries. But these financial loans must go along with technical assistance; otherwise, development cannot materialize itself. Special care must be taken in providing the technical aid, because the cooperation and action in technical fields seem necessarily to diminish or sometimes kill the initiative or the spirit of self-help among the elite engineers or entrepreneurs in LDC's and thereby hurt to foster the ingenuity which is essential to absorb foreign technologies and integrate them with conventional techniques. For these reasons, technological innovations in LDC's must be promoted with great care to reach eventually the generation of indigenous technologies which are economically appropriate and socially acceptable in each developing country. For this purpose, the process of search, adoption, adaptation and generation of desirable technologies must be clearly understood. It may be schematized as follows:[1)]

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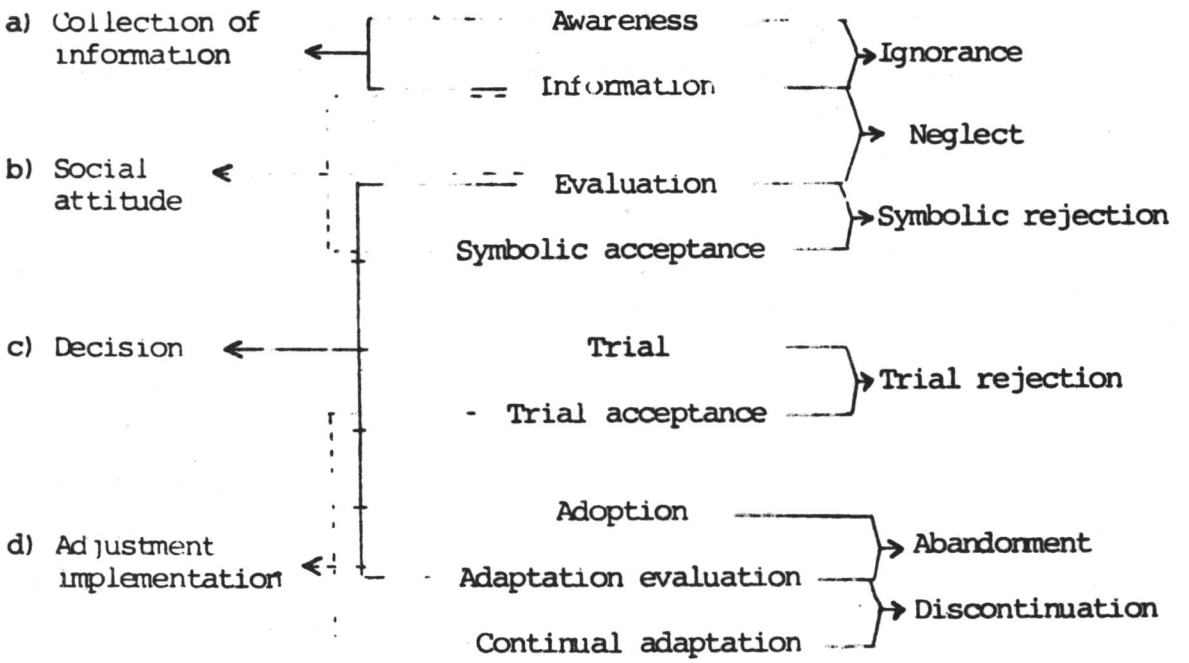
1) This scheme is a modification of the argument in: G. Klonglan and W. Coward: "The concept of symbolic adoption: a suggested interpretation", in Rural Sociology, 1970.



Each stage of this process will be discussed here with particular reference to the problems in Southeast Asian countries.

(a) Collection of information

The first step of technological innovations in any society is the awareness of technological gap between its own techniques and more advanced technologies outside. Unless enlightened individuals business groups or government officials take steps to collect the information of those modern technologies, the recognition of gap remains largely a knowledge in books or pamphlets. In many developing countries there are very few technicians or engineers who are capable of understanding the technological gap, and many of them remain ignorant of the significance of technological innovations to the economic development. In this case what is needed is to educate some leading figures about the importance of the problem and motivate them to take action in obtaining the information on more desirable technologies.

The information can be collected only by those who understand the problems of technology facing their national economy and can judge, more or less, the significance of information on various types of technologies. In developing countries short of capable technical personnel, however, the information base remains poor quite frequently because the real value of accessibility to information is not appreciated, and many pieces of precious information are neglected.

The shortage of capable technicians in Southeast Asian countries is very noticable, and yet the institutions of higher learning do not seem to emphasize the institutes of technology or vocational schools. How serious the shortage of technical experts in these countries is, must be inquired by the empirical studies. In recent years there is an indication that most countries have come to realize the importance of technological education. The establishment of an outstanding engineering institute of graduate level like the Asian Institute of Technology in Thailand by international cooperation is symbolic to admit this problem in the region.

The information can be obtained through various channels, but it is usually not free goods. It must be pursued with effort and cost. The success depends on the number and quality of communication channels to the suppliers of technological information. They may be books, scholars, experts, engineers or patents. The access to the desirable channels to these sources of supply by the personnel of LDC's is often very limited at either the supply or receiving end for various reasons. This obstacle can be reduced to some extent by means of government policies, cooperative efforts of private business organizations or global action of international organizations.[1] But the most important fact is that the information had better be obtained directly by the user of the technology. Then it will be readily put into practice. All other organizations' efforts are supplementary, and they can take the horses only to the riverside.

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1) See A.S. Bhalla, op.cit.

Table 1. Socio-Cultural Picture of East & Southeast Asia

	Religion	Ethnic	Ideol.	Soc.Str.	Former Col.	Eco.Assoc.
Japan	Shinto, B.	Japanese	FE	t	-	US
China	?	Chinese	Soc.	t	-	Japan
N. Korea	?	Korean	Soc.	t	Japan	?
S. Korea	C - B	Korean	FE	t	Japan	Jap,US
Taiwan	T - B	Chinese	FE	t	Japan	US,Jap
Hong Kong	T - B	Chinese	FE	t	Britain	Jap,US
Philipp.	Chr.	Tagalog.+	FE	s	US	Jap,US
Vietman	?	Vietnamese	Soc.	t	France	USSR
Laos	B	Laos	Soc.	s	France	USSR
Cambodia	B	Cambodian	Soc.	s	France	?
Thailand	B	Siamese+	FE	s	-	Jap,US
Burma	B	Burmese+	Soc.	s	Britain	Japan
Malaysia	I, T - B	Malay & Chinese+	FE	s,t	Britain	Jap,US,Br.
Singapore	T - B	Chinese	FE	t	Britain	Jap,US
Ind'sia	I, H - B	Javanese+	FE	s	Netherl.	Jap,US

* B : Buddhism, C : Confusianism, T : Taoism, Chr. : Christianity, I : Islam, H : Himduism

- EF : Free Enterprise, Soc. : Socialistic System, t : tight, s : soft.

One important element of communication channels is the mean of communication, particularly language. As Table 1 below shows, almost all the countries in Asia are former colonies of some developed countries now. The familiarity of former suzerain countries' language has determined Asian LDC's sources of information and channels. It is said that South Korea and Taiwan have had the advantage of having an access to ready-made technologies of small and medium enterprises in Japan and their managerial know-how by direct association, whereas the information from the United States through the mean of English language was more suitable for larger corporations.

(b) Social attitude

Information about new or foreign technologies must be evaluated in the light of the potential needs of the existing industries or the new industries to be established. This evaluation is not necessarily done purely on the basis of economic calculation. More often the prevailing attitude in one society towards technological innovations is primary and fundamental. It may be unbelievable that in early Meiji Japan a number of local people were prejudiced against railroads and refused to have the stations in the capitals of their feudal clans. As the results of such antiquated attitude those local towns very soon desolated. The 16th century Japan, Korea and China chose to close the doors to Western powers because they were so afraid of being contaminated by Christianity or conquered by colonialism. Burma at some stage seems to have shown a similar national attitude. The social attitudes in Asian countries towards foreign technologies at the present time are strongly influenced by the historical background, religions and social organizations. To give a bird's eye view of the situation in Asia the following Table 1 may be useful. Far Eastern countries are included in the table for the purpose of comparison.

The entrepreneurial characteristics and social attitude towards innovations vary considerably from one society to another in Southeast Asia. Nevertheless, there are some common factors as well as differences. Two common factors are fairly important in determining the social attitude towards technological innovations in these countries; namely, nationalism and the role of overseas Chinese in Southeast Asia.

(i) Nationalism.

Except for Thailand, all the countries in this region started their nation-building after the Second World War, and it still remains their utmost concern, more vital than economic development. The national pride or nationalism often comes before considerations about economic development of the country. The Asian version of nationalism often involves a strong sentiment of anti-colonialism and a conscious effort of historical and cultural identity as a nation even among the intellectuals who are educated in the West or the western way. As the recent Iranian revolution shows, it is not unusual that anti-colonialism leads to chauvinistic radicalism which simply repels anything western, particularly the western ordinary way of business by the name of capitalism. This prejudice often extends to modern technologies whether they are economically appropriate for the national economy or not. In such cases western technologies are symbolically rejected. There are many historical incidents of this type. They seem to demonstrate that the incidents are caused by most dissatisfied social groups like farmers or strongly critical and frustrated groups like students. Sometimes prejudice is based on utter ignorance and misunderstanding of modern technology or superstitious reaction to something which old common sense cannot figure out. An episode of Shin-pu-ren (Holy wind group) which objected to the use of electricity in the late 19th century Japan is one of those cases.

Even if the social attitude is not so extreme, it is very common that the conventional customs cannot easily be modified to accept

the modern technologies. For the old conventions have been established through the historical process of choosing the best and safest customs and techniques among those available in the traditional circumstance. They often contain the wisdom of ancestors, so that resistance to hasty adoption of recently developed technologies are sometimes justified. Thai farmers' hesitation to accept High Yielding Varieties of rice of IRRI type in the Chao Praya basin is the case in point. This new type of rice was not more productive, as later scientific investigations revealed, unless more fertilizers are used which most farmers could not afford, and also it was easily damaged by blight and insects. Enlightened nationalism is the one needed to make a careful choice of western technologies without loosing the classical harmony of cultural identity and national unification.

In connection with the matter of appropriate technology, what is more important is not the negative aspect of nationalism but rather the positive attitude. It is symbolic acceptance rather than rejection. An obvious example is that many developing countries need some symbols for national unification. For this reason monumental projects like excessively large steel mills or petro-chemical plants are often preferred to more modest, economically appropriate projects. A petro-chemical plant in Thailand was of such a nature, and a reconsideration concluded to give it up later. For similar reason giant enterprises like Pertamina (National Oil Corporation) in Indonesia plays a role of providing the nation not only with the economic resources to support the government but also with the national pride to symbolize the global scale of the new nation's wealth, although it simply succeeded the colonial power's properties. Such a concentration of capital and economic power in the midst of poverty tends to give the choice of industries and technologies a bias towards the directions of too much regional concentration of economic power and capital-intesiveness. Appropriate technologies from the view-point of national economy seem difficult to be materialiyed by such large corporations.

(11) Overseas Chinese

The economic role of overseas Chinese in Southeast Asia is very significant, although the degree of importance and its nature differs from one country to another. One notable fact is that modern industries of considerable scale are predominantly the joint ventures of established corporations from developed countries with overseas Chinese as partners. In recent years the governments of Malaysia and Indonesia adopted the policies called "Bumi Putra" which give the preferential treatment to indigenous ethnic people over the people of Chinese origin. In Thailand government policies are oriented towards integration of different ethnic groups including Chinese Thais. In Indonesia there are some provincial areas where some indigenous ethnic groups like Bataks in North Sumatra, Aceh in Aceh Province or Minangkabou in West Sumatra control the economic activities. In the Philippines a few large family concerns with Spanish background used to dominate the industrial and financial activities. With these special cases admitted, it is still true in Southeast Asia that overseas Chinese, estimated about 15 to 20 millions including those in Singapore, continue to dominate at least the commercial activities in Southeast Asia.

One public opinion survey conducted by a Swiss research corporation at the request of Japan Trade Center in 1972 revealed the following ordering as the countries to be rejected or boycotted in Thailand, Indonesia and Hong Kong:

	(1)	(2)	(3)	(4)
Thailand	Japan	China	U.S.	West Germany
Indonesia	China	Japan	U.K.	U.S.
Hong Kong	Japan	U.S.	U.K.	China

(Source) Quoted from S. Ichimura, In the Stream of History, Sobun-sha, Tokyo, 1977.

Their economic behavior and the indigenous ethnic groups' reaction to oversea Chinese activities color distinctively the economies of Southeast Asia, for example, from Latin American economies where there is not such an ethnic group uniquely oriented towards economic gains. It is true that overseas Chinese are becoming increasingly integrated with the native population.[1] The misfortunes in the past, therefore, are unlikely to be repeated, but the potential conflicts between indigenous groups' nationalism and overseas Chinese is an important institutional factor which influences the social attitude and decision-making towards technical innovations in Southeast Asia.

When the native ethnic groups' nationalistic sentiment was stirred up in Burma, Indonesia, Malaysia, Laos, Cambodia and Viet Nam, the governments of these countries took radical measures hastily to purge overseas Chinese out of the countries. Similar experiences have been repeated in the past.

The ethical centralization of those countries not only purged overseas Chinese businessmen but also, even now, officially or unofficially restrict their participation in the military and police services and the high ranks of political and civil services. It may be natural therefore many of them to be unable to identify themselves with the new nations. The restrictions on private business transactions, academic and journalistic activities are not so strict. Nevertheless, the time horizon of overseas Chinese' economic calculation tends to be short, and they prefer the quick turn-over of capital to productive but slow round-about methods. They are forced to recognize their politically unstable positions and play a game more safely than the native businessmen.

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1) T. Hibino: Kakyō (Overseas Chinese), (Tokyo, NHK Book 1977) and idem: "Kakyō no Kazoku Seikatsu" (The family life of overseas Chinese), Cultura Asiatica, March 1975.

This characteristic may be not only due to their minority position in Southeast Asia excepting Singapore but also due to their spiritual background, namely Confucianism and Taoism, which may be less economic minded in comparison with Calvinism or similar spiritual traditions.[1)]

There are some evidences to this effect. The Singapore economy, which has reached such a high standard of living as 3.000 US dollars per capita, does not show any sign of developing truely manufacturing industries as yet. Those who became the partners with Japanese joint-ventures definitely like to remain in charge of sales and do not show any interest in manufacturing. Most partners insist receiving high dividends rather than accumulating the internal funds of corporations.[2)] They do not identify themselves with the corporations. They do not welcome to open their company's shares to the public. They do not seem to have any historic experiences in trusting the permanent continuity of non-personified organizations like corporations or extending their faith beyond their kins or persons from the same province. They do not wish to share the corporate profit with utter strangers but concentrate the benefit within their family circles. Moreover, they diversify the investments.

Not to put all the eggs in one basket is typically a behavior for safety or risk aversion. With this type of behavior pattern overseas Chinese would not try to undertake the innovations in risky business. In other words, they are unlikely to be adventurous in establishing their own enterprises and tend to be the followers rather than the leaders of industrial innovations. This behavior pattern of overseas Chinese businessmen is bound to have great impact on the general pattern of industrial and technological development in Southeast Asia.

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1) cf. Max Weber, Confucianism and Taoism, James L. Peacock and A. Thomas Kirsch, The human direction, an evolutionary approach to social and cultural anthropology, New York, Appleton-Century crafts, 1970.

2) cf. S. Ichimura (ed.), Nippon kigyo in Asia (Japanese joint-ventures in Asia), Toyokeizai Shimpo Sha, 1980.

In the context of appropriate technology, allocation of capital and human resources tend to be biased towards trade and commerce, and more basic manufacturing industries which require round-about production will be neglected. Particularly the lack of respect to engineers and manual work among Chinese and Southeast Asian intellectuals is unfavorable for promoting technological innovations based on long-term investment. There are, however, some signs of improvement in this respect. In most countries some technological institutes have recently been established, and the Asian Institute of Technology in Bangkok, for instance, began producing internationally recognized engineers and receiving an excellent group of graduate students from all over the Asian countries. More and more appropriate technologies will be chosen and adopted, and the technologies more approptiate for respective countries will be developed by those engineered in their own institutes. But it will take some time. In the process one still has to pay attention to the bias caused by the value judgement influenced by overseas Chinese and their associate.

(c) Decision

A small number of leaders, either in government offices or in the private sector, must make a decision to accept a new technology for a trial and then adopt it. This decision-making requires the so-called entrepreneurial spirits. How such spirits are regarded in the society influences the decision. Unless economic "deliberateness" in Alfred Marshall's terminology or "rationality of calculation" in Max Weber's terminology is prevailing among the leaders in the society, entrepreneurs are not likely to appear and take economically rational but more or less risky undertakings in the uncertain world of a developing economy. Still less likely are they to venture into a trial of new, unknown technologies.

Brief remarks are already made on this matter with particular reference to overseas Chinese above. It is not yet known how the ethical codes of Southeast Asian religions or spiritual traditions are related to this entrepreneurship. As much as we could, some observations are summarized below. Some other aspects of economic

ethical codes are also important, directly or indirectly, in determining a choice of technologies. Industriousness, thrift and generous transfer are the three aspects of consumers or households' economic ethics, as contrasted with entrepreneurship for producers mentioned above.

Apart from Christianity in the Philippines, two religious traditions in Southeast Asia are not well-known, namely Theravada Buddhism and Islam. Needless to say, Theravada Buddhism in Thailand and Islam in Indonesia as well as Cathoricism in the Philippines have their own local characteristics, so that their relevance to the economic decision-making in Southeast Asia must be studied on the basis of very careful observation of local decision-makers and their behaviors. Some information is offered here on relatively unknown Theravada Buddhism and Islam in Indonesia.

(i) Theravada Buddhism

Theravada Buddhism in Thailand is almost like Christianity in Europe in the medieval age. It permeates through every aspect of people's life and national politics. At the same time it is a solid base of nationalism along with King and historical prestige of having been the only independent state in Southeast Asia. Its strong identificaiton with the nation, combined with a strong anti-colonialism in Southeast Asia, tends to make this religion go along with some kind of "statism", if not socialism. In Cambodia and Burma it has been very common to talk about Buddhistic socialism or Dhama socialism: material side by Marxism but spiritual side by Buddhism was a politically naive belief of many Cambodians.[1] But this demonstrates that socialism against capitalism and Buddhism against westernization can be combined so readily in the mind of many Southeast Asian Buddhists.

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1) Y. Ishii: "Buddhism and Socialism in Southeast Asia", in K. Yanagawa (ed.): Gendai-Shakai to Syūkyō (Contemporary society and religion), Institute for the Study of Eastern Philosophy. 1978; Y. Ishii: "Buddhism and nationalism in Thailand", in T. Takahashi (ed.): Tōnan Asia no nationalism to Shūkyō. (Nationalism and religions in Southeast Asia) (Tokyo, Institute of Developing Economies, 1973); K. Mizuno: "Family and religion in Thailand", Cultura Asiatica, March, 1975.

As a result of this hasty conclusion, the rational calculation or careful deliberateness which is a core of capitalistic spirits has not been understood properly, and entrepreneurship as a basis of free private enterprise is something hard for Theravada Buddhist to understand. Their attitude towards innovations seems to be less than enthusiastic.

According to the studies undertaken by Kyoto University group about the cultural values cherished by Thai farmers[1], industriousness and thrift are both highly respected. But this does not seem to lead to ambition by accumulating wealth. Most Thais seem to accept their social positions as given. They interprete a Thai proverb: "know oneself or one's position" as meaning that this rigid status in the society must be accepted. It almost resembles the Hinduist belief that everybody belongs to a certain caste and can be reborn in a higher caste only by obeying the law of the caste. It remains to be seen in our empirical studies to what extent these beliefs are really held by the ordinary people now.

The teachings of Theravada Buddhism are such that the believers are not expected to undertake anything positive or creative for spiritual relief. Some argue that something like Protestants' reform may be needed[2]. Until such reform is accomplished, Thai leaders will tend to await benevolent seigniors - in this case foreign entrepreneurs - who come to Thailand for their own benefits. If foreign corporations do not invest enough, then Thai officials will ask why investment is not made, and may adopt some new economic policies. But the indigenous Thais are unlikely to establish their own businesses and undertake the adventurous enterprises by themselves.

1) S. Ichimura, Y. Mizuno et al, "The Socio-Economic Behavior of Peasants in Central Java and Central Thailand - A Summary Report South East Asian Studies, Vol. 12, No. 3, Dec. 1974, pp. 322-343

2) Prasert Yamklinfung: "Family, religion and socio-economic change in Thailand", East Asian Cultural Studies, 1974.

It is true that they emphasize the value of benevolence and sympathy with the poor but this teaching does not seem to motivate the Thai intellectuals towards business enterprises nor capital accumulation. The teachings in Theravada Buddhism about ethical codes of economic behavior must be ascertained in our empirical studies. The peaceful coexistence of benevolence and social hierarchy may be admitted to a great extent, but profit-making is largely denied. How these values are placed in Thai business communities is really an empirical question to be investigated.

At the same time, however, it must be noted that indigenous Thais have been more innovative in the rural sector, where a number of important intermediate technologies have been developed combining traditional local technologies with small pumping motors and cultivating machines. We have to examine what encouraged these innovations. It is well known that the government ministries played a significant role in promoting agricultural technological innovations, but that Thai individual farmers have not necessarily responded easily to the government recommendations. According to the aforementioned survey by Kyoto University group, there seems to be a significant difference in the response to government recommendations between Thai farmers and Indonesian farmers. The following Table 2 shows this difference in adopting new high-yielding varieties of rice in both countries. Clearly, the re-

Table 2

Reasons for adopting recommended varieties

	Reason / Villages	A	B	C	D	E	F	
Thailand	Pathum Thani	2(.04)	17(.35)	24(.49)	3(.06)		5(.10)	49
	Ayuttaya	2(.08)	8(.32)	10(.40)	1(.04)	2(.08)	2(.08)	25
	Saraburi	1(1.00)						
Indonesia	Klaten	4(.22)	11(.61)	6(.33)		7(.39)	1(.06)	18
	Demak	5(.38)	7(.54)	8(.61)	2(.15)	1(.08)	2(.15)	13
	Gading	5(.20)	6(.24)	16(.64)	2(.08)		3(.12)	25

A: It is worth trying any variety which is new.
B: Recommended by the governmentor village heads.
C: Seeing results of neighbors.
D: Seeing results of surrounding villages.
E: Seeing results of extention farms or village seeds plots.
F: Other.

* Multiple answers are permitted.

commendations by the government are more faithfully followed by Indonesian farmers than Thai farmers. Another remarkable fact in this table is that Thai villages have a few inquisitive farmers less in number than Indonesian villages at the first moment of introduction of new HYV of rice. These persons served as pioneers in introducing the recommended varieties, whereas other villages followed them. This pattern can be seen from Table 2. Nevertheless, the adoption and adaptation of IRRI variety to Thailand were earlier mainly due to the effort on the part of Thai government's Ministry of Agriculture.

The Thai government has always taken an initiative also in promoting foreign investment to Thailand as well. A contrast of the passive attitude of the Thai private sector and the positive policy-making in the government sector is also another factor to be looked into. This seems to fit into the well-known Tobata thesis which analysed Japanese agricultural development by admitting the government's role as an innovator.[1] Since government offices often make decisions on technological innovations, the influence of religious values on government policies must be also studied. In particular, their policies on income distribution and towards religious groups are economically and politically important. They have certainly the implications for technological choice. If religious leaders urge more egalitarian principles in income distribution or social justice in eliminating extreme misery in the society, this will force the government to move the policies in

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1) Keizo Tsuchiya, "Tonan Ajia no Nogyo Hatten to Tobata Riron," (Agricultural development and the Tobata thesis) South East Asian Studies, Sept., 1979.

that direction. The interaction between government officials' thinkings and the religious groups could be ascertained only by the first hand investigations.

(ii) Islam in Indonesia

Islam as a religion is even more anti-modernistic than Theravada Buddhism[1]. But its historical functions were not anti-economic. It advocated egalitarianism and promoted urbanisation and commercial activities. Trade was regarded as a way of proving one's creed and piety. Thus Islam gives support to adventurous trading. In the same kind of spirit, innovations in manufacturing can be undertaken but there is no clear indication in Indonesia that these Islamic ideas have promoted the technological innovations, nor that Moslems in Java are more actively engaged in commerce than those in other creeds. Although the situations in Sumatra are different and Moslems there are more puritanical, the influence of religion on economic activities is hard to discern from the one of other institutional and cultural factors like the ethnic characteristics. The Bataks who are more than 90% Protestants have proven to be very innovating in economic activities and did not permit the infiltration of overseas Chinese into their territory of North Sumatra. In general, however, one can say, Moslems in Southeast Asia are not so pious as those in Middle East. They tend to be syncretic with Hinduism and Buddhism. The effects of Islam on economic activities are also mixed with those of nationalism and other institutional factors, as we shall discuss below. It may be added here, however, that inspite of the complete difference in religion between Thai farmers and Indonesian farmers, there are many similar behaviours among them. This may be due to the common factors in their family kinships, social organisations and rice-growing farming necessities. We shall discuss this problem in the next section.

The argument to follows is, however, related to this mixture of religion with other cultural factors which is very unique to Indonesia. It may be called the religio-socio-political-mix in modern times of Indonesia. It is a central institutional factor underlying the underdevelopment and difficulty of nation-building in Indonesia.

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1) Masao Mori: "The Modern Age to Moslems", Chūō-Koron, December 1978; Clifford Geertz: "Religious change and social order in Suharto's Indonesia", Asia, autumn, 1972.

The modern times of Indonesia from the last quarter up of the 19th Century to the present may be divided into three phases[1]:

1. The period up to the early 1920's, when a "spiritual balance of power" existed among various groups like Indio-Javanese syncretism, the would-be Islamic orthodoxy of trading classis, some of the better-off peasants, and most of the heterogeneous outer islanders. This balance was workable under the aegis of Dutch colonial power.

2. The period from the first World War to 1965, which may be characterized by the politicisation and the use of all sorts of voluntary organisations - labour, farm, youth, women, school, charitable - clustering around the political parties.[2] Despite the great effort of the government, all the attemps to establish some kind of new social order in Indonesia had failed by 1965, and the situation exploded - the coup and the massacres. This is indeed a precedent to the Iranian revolution in the Islamic nation.

3. The period from 1965 to the present, which has the features:
   (a) the army domination of government and weakening of the party system and
   (b) development of an equally genuine "restructuring" of religio-cultural life both institutionally and in terms of contents.

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1) Cf. Clifford Geertz: "Religious change and social order in Suharto's Indonesia", Asia, autumn, 1972; Harry Benda: The crescent and the rising sun: Indonesian Islam under the Japanese occupation, 1942-1945 (The Hague, 1958).

2) They are grouped into the four main ideological groups of post-independence politics in Indonesia: radical nationalist (PNI), reformist Moslem (Masjumi), traditionalist Moslem (NU) and radical populist (PKI). It was this system that Sukarno tried to synthesize with his Pantjasila - NASAKOM - guided democracy expressive politics. There was a certain degree of trend gathering threads into these four main bundles, but at the same time there was a fragmentation of heterogeneous and conflicting groupings with Sukarno at first and, more and more the army later, holding the whole system at the centre.

Throughout these three phases there have always been some kind of tension between two processes of nation building. One process is the constitution of civil government or bureaucracy and another is the establishment of cultural identity as one nation. The former is the political aspect of nation building (nationalism), whereas the latter is the cultural aspect of nation building (nationalism). In a pluralistic society like Indonesia, national unification is particularly difficult in these two aspects. Particularly since 1965 there has been the steering of government by the standard cooperation of army-technocracy on the one hand and the crystalising denominational-mysticism pattern on the other. The tension between the two seems to be mounting. The Indonesian Government's policies have often been guided by the need to resolve the various types of tension between the two. Policies pertaining to the choice of technologies can not escape from such political considerations. Often the rested interests of the social groups representing some business interests guide the government policies in granting concessions to foreign joint-ventures or organising national projects, because the stability of government and its support party GOLKAR depends critically on the balance among these groups.

The recent emphasis of government economic policies on the development of employment-creating small enterprises and social justice in income distribution and regionally balanced growth is largely due to the necessity of reducing the socio-political tension which has been pointed out by religious leaders as well as economists. These leaders are often associated with Islamic churches and Islamic parties.

Apart from the influence of religio-political complex on policy-making in Indonesia, the effect of Islamic belief on economic behaviour is also noticable. A survey of socio-economic behaviour of peasants in central Java and Thailand quoted above clarifed the characteristics of Indonesians in contrast to those of Thai farmers. By collecting the proverbs and mottoes that the farmers vividly remember, the survey revealed some differences in the cultural premise of Theravada Buddhism and Islam. Particularly, when getting rich is in question, Thai farmers quote the expressions like "working hard" and "not to do anything luxurious", whereas Indonesian replies are more

typical in quoting "working hard" and "luck". Generally speaking Thais are rather pragmatic and Javanese are rather fatalistic. Indonesians tend to regard "hard-working" tiself as something valuable to which God will bestow happiness on them.

Thus one of the important but delicate differences in the cultural premises in Java and Thailand, which must have to do with the religeous differences, is concerned with the notion of "luck". To Thais "luck" is a consequence of their effort; to Indonesians "luck" is the judgement of God. One may say that Thais can be more easily motivated to act economically, whereas Indonesians must be motivated rather idealistically to achieve some economic goals. The international choice of appropriate technologies may be more difficult in Indonesia.

(d) Adjustment/Implementation

Once dicision is amde to adopt a new technology, the next step is to put it into practice. This implementation of a new technology must be undertaken by a private enterprise or a government institution which is capable of doing so. Unlike pure sciences like mathematics and theoretical physics or individualistic sciences like many branches of medical-science, technologies can be absorbed only by some organisations which are equiped with some capital and personnel. Implementation of a new technology also requires some modification or adjustment of the original to the local conditions. This is particularly the case where foreign technologies are important from industrialised countries, as they are usually unsuitable to the conditions and needs of importing developing countries. The need of capital is well-known, but the role to be played by personnel and social organisations is not always understood. For any technological innovation, the active agents who discover, adopt, and imitate the new technology are essential. Since some of them must do so before others, they must be strongly motivated. The motives may be for: (a) an individual, (b) an enterprise, (c) an industry, (d) the society, or (e) the nation. Individuals sometimes identify themselves with the entities like (b) to (e) and try to act for the sake of them. To some extent one can argue that the problem of "inapproriate technologies" arises from the gap between the individual entrepreneurs' and interest

groups' choice on the one hand and the optimal choice from the social and national point of view. If therefore, innovative individuals as well as interest groups are more public-minded, the implementation of appropriate technologies will be easier. How an innovator identifies himself with the need of a group or community rather than his personal desire depends on his perception of his role in the society. Egoistic individuals can hardly perceive any role above their family level. Strong motivation seems to come from a good balance of individual motives and his sense of duty to public interests from (b) to (e). But to establish or inscribe such a public-mindedness into the mind of leading individuals or civil servants is indeed a fundamental problem of nation-building. How decision-makers are confronted with this difficult task in the midst of political corruption[1] is really a subject to investigate. This problem is very closely related to those of social organisations to be discussed in the next section.

Meritocracy must permeate into the mind of Southeast Asian leaders Only then the understanding of entrepreneurship, business, deliberateness and expediency will be recognized as different from sheer money-making. Particularly important are how many civil servants and businessmen become very responsible for the realization of objectives and the performance of works. This is a sense of responsibility and duty beyond the one vis à vis family and community. In this connection it is crutial whether the country has some social class which can produce such leaders. The samurai class in Japan produced many leading businessmen as well as politians and generals in Meiji Japan[2], whereas most Southeast Asian countries have not had the worrior classes in history. The political leaders in Independence movement do not necessarily turn themselves into the successful entrepreneurs. According to a study in the Philippines[3], the capable businessmen come from

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1) Masashi Nishihara (ed.): "Tōnan Aisa no Seiji-teki Fuhai" (Political corruptions in Southeast Asia), Tokyo, Sobun-sha, 1976.

2) S. Ichimura, "Japanese entrepreneurship in early stage of economic development," The Pacific Profile, 1974.

3) J.J. Carroll, "Filipino entrepreneurship manufacturing," in F. Lynch and A. de Guzman (ed.), Four Readings on Philippines Values, 1973.

all social calsses but with increasing difficulty in originating from the poorer class after the second World War. They usually establish themselves as successful merchants and then become entrepreneurs. C. Geertz studied Indonesian businessmen before the intervention of economic activities by colonial power became serious and certified that there are clearly the indigenous cultural bases to foster entrepreneurship in Indonesia.[1] Moreover, implementation and adjustment have a problem of diffusion, because some innovators adopt and others follow. This process of technology diffusion in the economic system as a whole has another aspect; that is, the composition of the society's members with different attitudes and capacities. It goes without saying that the more entrepreneurial members there are in one society, the more rapid the diffusion of modern technology in the society will be. The more rapidly modern technology is absorbed and integrated with the traditional sectors of the society, the better chances will be open to generating indigenously the appropriate technology in the society itself.

Even since the classic works of Tarde on imitation and Ryan-Gross on diffusion of hybrid seed corn, it has been recognized that there is a certain standard pattern of diffusing new technology, namely, the diffusion pattern follows an S-shaped curve.[2] This is due to the fact that initially only a few adopt the innovation; having seen their success more adopt; and the rate of adoption accelerates. Finally, as the number of potential adopters begins to be exhausted, the rate of diffusion declines.

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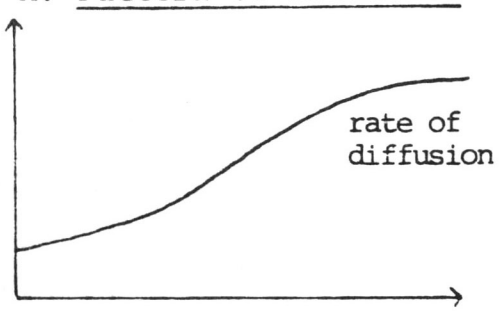
1) Clifford Geertz, Peddlers and princes, The University of Chicago Press, 1963.

2) The same argument seems to underlie the recent works on technology gap of Posner, product cycles of R. Vernon & G.C. Hufbauer or Akamatsu's "flying goose" pattern of development stages. Cf. Gabriel Tarde, The Laws of Imitation, Holt, Rhinchart and Winston, N.Y. 1903; M.V. Posner, "International Trade and Technical Change", Oxford Economic Papers, 1961; Reymond Vernon, "International Investment and International Trade in the Product Cycle", Quarterly Journal of Economics, 1966; G.C. Hufbauer, Synthetic Materials and the Theory of International Trade, London 1966; Kaname Akamatsu, Sekai Keizai Ron (The World Economy), Kunimoto Shoten, Tokyo 1965;

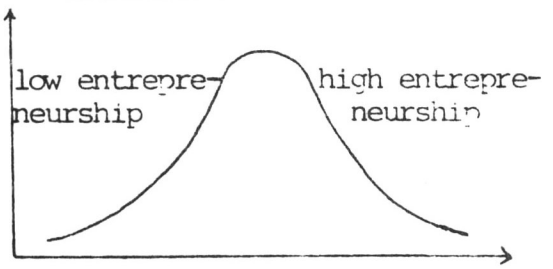
-cont. p. 29 -

Diagram (A) shows a pattern of S-shaped diffusion and diagram (B) gives the underlying distribution of entrepreneurial ability among the members of the community. If the distribution is more concentrated around the mean, the sharply rising portion of S-shaped curve will be sharper; namely, the diffusion will start slowly but once it starts spreading, it will do so within very short span of time. The country like Japan seems to have shown this pattern of diffusion in many cases. If, however, the distribution is more dispersed, the increasing part

A: Pattern of diffusion



B: Distribution of entrepreneurship



of S-curve is gradual, and the cath-up pattern will be slow and moderate. The slow process of technology diffusion in Southeast Asia must have something to do with this distribution of entrepreneurial capacity in the population.

There seem to be two approaches to identify this distribution and thereby obtain some information on the pattern of technology diffusion. One is the direct method of survey; another is the indirect method of econometric estimation. Two examples of the first kind and one example of the second kind are briefly quoted here. The survey of Thai and Indonesian peasants already quoted above showed a certain pattern of distribution of innovativeness in Table 2. The same survey also included one more question requiring the answer about the interviewee's response to government recommendations. Table 3 shows this result.

-Footnote continued from p. 28 -

see also an excellent article by Kiyoshi Kojima included in his book: Kiyoshi Kojima, Sekai Boeki To Takokuseki Kigyo (The World Trade and Multinational Corporations), Sobun Sha, Tokyo 1972, Chap III, Conditions for Success in Import Substitution and Export Promotion - Flying Goose Argument and Product Cycles.

Table 3: Attitude towards a new variety recommended by the government

	Reason / Villages	A	B	C	D	E	Responses
Thailand	Pathum Thani	37(.76)		6(.14)		5(.10)	49
	Ayuttaya	17(.52)		12(.36)	3(.09)	1(.03)	33
	Saraburi	11(.27)		28(.68)	2(.05)		41
Indonesia	Klaten	11(.37)	10(.33)	12(.40)			30
	Demak	8(.24)	2(.06)	20(.61)	4(.12)	4(.12)	33
	Gading	6(.20)	16(.53)	6(.20)	3(.10)		30

A: I would try to plant it before anybody else.

B: I would try to plant it after the test at village seeds plots.

C: I would try to plant it if somebody else succeeds.

D: I would not be interested in it.

E: Others.

* Multiple answers are permitted.

On the basis of these two question, those who showed innovative attitude in both were counted. They are: Klaten (4), Demak (3), Gading (5); Pathum Thani (2), Ayuttaya (2), Saraburi (0). From these observations, one could conjecture that the diffusion of HYV rice may be, in the order of speed, Gading-Klaten-Demak in Thailand and Pathum Thani--Ayuttaya-Saraburi.

The same survey also asked the questions to test the aforesaid conjectures; namely, how many years before the interview the interviewers obtained the information on recommended varieties and actually adopted them. Table 4 summaries the average year past for information, adoption and the time lag.

Table 4: Information, adoption and the time-lag

	Information	Adoption	Time-lag
Pathum Thani	3.66	3.04	0,63
Ayuttaya	8.76	7.24	1.52
Saraburi	-	-	-
Klaten	2.28	1.61	0.67
Demak	2.38	1.15	1.23
Gading	9.12	8.24	0.88

* Responses in Saraburi were too few.

This table confimrs the theoretical conjecture, except for Gading, which is a new settlement and must be excluded for comparison. Similar surveys may be designed for adaption of industrial innovations in one or two industries to obtain some insight of similar nature.

Another example is the questionnaire survey of the managerial personnel in Japanese joint ventures in Southeast Asia conducted by a team of Japanese scholars headed by the present author. The findings are published as a monograph.[1] In particular the managerial abilities of native senior officials in Japanese joint ventures are evaluated according to the criterion of each individual respondent. Needless to say, this is very subjective and limited only to Japanese joint ventures, so that the following table should be by no means taken as an evaluation of objective nature or any scientific value. Nevertheless, it seems to show some characteristics of the managerial ability among Southeast Asian senior personnel. In this survey managerial ability is considered as consisting of four aspects of capability: (a) sense of duty, (b) leadership, (c) comprehensive grasp of surrounding conditions, and (d) judgement. Each respondent was asked to evaluate the managerial abilities of senior officials in their corporations in terms of three ranks; A, B and C. The standard of evaluation was to compare the native staffs' abilities with the average Japanese managers in similar positions whose are placed to rank between

1) Shinichi Ichimura, Nippon Kigyo in Asia (Japanese Joint-Ventures in Asia), Toyo-Keizai Shinpo Sha, Tokyo, 1980. Particularly relevant is its Chap. 2: How Japanese style management must be modified.

A and B. Table 5 gives the percentage distribution of respondents who gave each ranking for one aspect of ability in each country and ASEAN countries as a whole.

Table 5: An Evaluation of Managerial Capability

		Indonesia	Malaysia	Singapore	Thailand	Philippines	ASEAN
Duty	A		2.5	10.4	1.6		2.9
	B	40.9	55.0	62.5	50.0	29.6	48.6
	C	59.1	42.5	27.1	48.4	70.4	48.6
Comprehension	A			6.3	3.1		2.0
	B	16.7	50.0	45.8	35.9	18.5	33.1
	C	83.3	50.0	47.9	60.9	81.5	64.1
Judgement	A	2.0		5.0	4.2		3.7
	B	52.2	31.8	62.5	75.0	54.7	40.7
	C	45.7	68.2	32.5	20.8	45.3	55.7
Leadership	A	2.9			6.3	3.1	7.4
	B	58.8	53.0	65.0	56.3	65.6	51.9
	C	38.4	47.0	35.0	37.5	31.3	40.7

Source: S. Ichimura, op.cit. p. 46.

To simplify the presentation, the next table gives a weighted average point to each country with respect to each aspect of capability by given points 5 to A, 3 to B and 1 to C. Among

	Indonesia	Malaysia	Singapore	Thailand	Philippines	ASEAN
Duty	1.82	2.20	2.87	2.06	1.59	2.09
Comprehension	1.33	2.00	2.17	1.84	1.37	1.74
Judgement	1.64	2.45	2.67	2.09	1.96	2.22
Leadership	2.06	2.30	2.38	2.44	2.33	2.29

the four aspects, the ability of comprehensive grasp of surrounding conditions seems to have the most to be desired. This may be rather important in adoption and adaptation of appropriate technologies.

This must be particularly observable in Indonesia and the Philippines. These two countries, followed by Thailand, show also somewhat lower scores in the ability of judgement. How these observations on managerial capacities are related to technological innovations must be further investigated. The trial example is different in nature. A number of quantitative studies on industrial innovations, mostly in developed countries, have appeared in recent years. One formulation offered by E. Mansfield may have some applicability even to developing countries.[1] He defines $\lambda_i(t)$ as the proportion of firms in the i-th industry which use only at time t but not before then. This $\lambda_i(t)$ plotted in the same way as diagram A above would look similar. Mansfield offered a hypothesis that $\lambda_i(t)$ is a function of the fraction of firms which already adopted: $\lambda_i(t-1)$, the profitability of the innovation, the cost of the innovation and other unspecified factors lumped together. Thus by estimating an equation like:

$$\lambda_i(t) = F[\lambda_i(t-1),\ \pi_i,\ C_i,\ D_i]$$

where π=profit, C=cost, D=other factors to be specified, he tested a number of hypothesis over different periods, industries and even some innovations. An interesting point is that from the shape of relation between $\lambda_i(t)$ and $\lambda_i(t-1)$ over the diffusion period one can infer the pattern of distribution of entrepreneurship in that industry. An international comparison may give an insight into the latent talents of entrepreneurs in different LDC's. By applying variance or factor analyses, some hypotheses may be tested, concerning similarities and dissimilarities among the countries.

Partial modification of imported technologies or admustment in the process of implementing new technologies in most LDC's is the first step in generating indigenous technologies which are truely appropriate for the national economy. Only when the economic needs of the country are met by the technologies developed by the experts of the country, self-help is complete and appropriateness of technology becomes perfect. Some problems of generating own technologies will be discussed in the last section.

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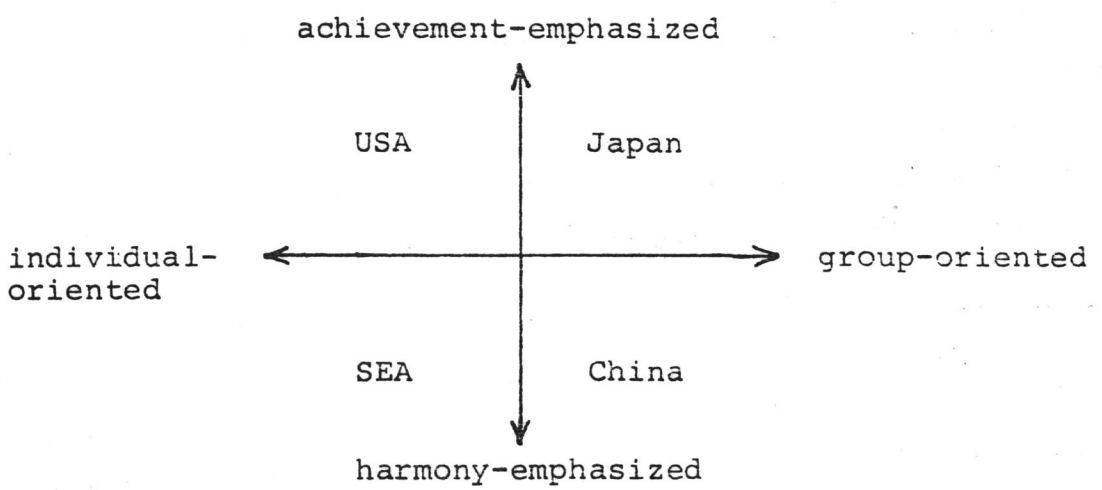
1) Edwin Mansfield: The Economics of Technical Change, Norton & Co., New York, 1968; ibid., Industrial Research and Technological Innovation: An econometric analysis, Longmans, Green & Co., New York,

3. Social organisation, bureaucracy and market

The decision-makers always act in a social organisation, so that the nature of the organisation influences the process of decision-making and implementation of policies. The organisational structure of various social groups in Southeast Asia is rather mixed. The so-called "loosely structured" society (K.M. Embree)[1] or "soft" society (G. Myrdal) seems to characterize the bilateral societies of the Siamese, Laotians, Cambodians, Malays and Javanese with considerable variations among themselves, although the bilateral societies are not necessarily "soft". It contrasts with the "tight" societies of Japanese, Korean, Chinese and Vietnamese. One may add a few Indonesian ethnic groups like Bataks and Menankabaus in Sumatra to "tight" groups. Such an organisational characteristic of social groups has important influence on the degree of their social cohesion, in either a bureaucratic or a business organisation. In contrast to Japanese or Euro-American organisations, the "soft" Southeast Asian organisation may be characterized schematically as follows:[2]



1) J.F. Embree: "Thailand: a loosely structured social system", in: American Anthropologist, Vol. 52, 1950: and Hans-Dieter Evers (ed.): Loosely structured social systems, Thailand in comparative perspective (New Haven, Yale University), Southeast Asia Studies, Cultural Report Series, No. 9, 1969.

2) Masuo Kuchiba: "Introduction: Problems and Approaches from Comparative Perspective", in: M. Kuchiba (ed.), International comparative study of rice-growing villages in Asia, Report to the Toyota Foundation, 1979.

When compared with Japan, the bilateral society of Southeast Asia can be said to be strongly individual-oriented but not as strongly as that of America. The dyadic harmonious relations are valued highly between individuals in Southeast Asia so that the value of performance or achievements is not as much emphasized as that of Japan or America. Again, in Southeast Asia, although particularistic dyadic relations and harmonious relations are highly valued, they do not have the strong group-oriented character of kins as in China or of families and villages as in Japan. These characteristics seem to be closely related to the peculiar character of a village community in most Southeast Asian ethnic groups, and they permeate into any social organisations in business or government offices.

The implications of this characteristic for economic development are very important. The following remark by M. Kuchiba may be applicable with slight modifications to business or government organisations and their functions.

A need for a multipurpose farmers' cooperative is emphasized in Southeast Asia, but it is not formed smoothly. In Japan the self-governing body of a hamlet is often capitalized to be the basis of the sub-unit of a cooperative organisation. In this way the identical nature of the group is clearly recognised. The loyalty to the village becomes at the same time the loyalty to the cooperative organisation. Therefore, a resignation from a cooperative organisation can easily mean disloyalty to the village and even though joining is easy, withdrawal is difficult. Again the strength of this type of group-orientedness may become a hindrance for implementing an improvement policy such as field consolidation which covers a broad farming area. In the case of Southeast Asia, joining a cooperative organisation is a personal matter and joining and withdrawal are simple. The social foundations for membership recruitment,entrenchment and perpetuation are weak.

The problem of agricultural extension, too, has relation to the native character of a village community. If there is an efficient organisation in the village it is simple to take advantage of its resources but when there is none, then a second thought is necessary in a program of propagating efficient farming.

In other words, the degree of social cohesion in social organisations in Southeast Asia tends to be weak, and the coercion of rules and regulations upon the members by organisations is even weaker. This reduces the efficiency of communication and makes it more difficult to calculate the consequences of deliberate action within organisations. The teamwork is harder, and the organisation tends to be compartmentalized. The operational efficiency of an organisation may be maintained only up to a certain size. Beyond that limit, efficiency will decline quickly. As modern technology often requires an increasingly larger scale of institution to apply it, the characteristic of soft society mentioned here poses a serious hindrance, because the optimum size of the firm in the economic sense is small.

In order to carry out a large scale of operation in any field, what Max Weber called bureaucracy in the broad sense is essential. The soft society does not offer the historic experiences needed to organise the personnel in this bureaucratic fashion. If, therefore, Southeast Asian organisations are expanded, as they often have to be, either in private enterprises or government offices, they tend to be fragmented and coordination of departmental activities become almost impossible. This is often observed in social organisations in Southeast Asia as well as many LDC's. Thus the cohesion of strict organisational order, even if repeated enforced, gradually inclines to be loose, so that the works are often left unaccomplished with no serious punishment. Unless a task is really pressed for execution, it is likely to remain incomplete. Under such circumstances, planning or preliminary studies needed to implement the policies for adopting appropriate technologies are often prepared inappropriately. This organisational problem is often combined with the shortage of key personnel at critical points of works to be done. For these reasons implementation of a plan often encounters unexpected difficulties, which requires quick and adequate revision of the plan. This requires flexibility in modifying the original plan, which is by no means easy. The resulting confusion sometimes leads to abandonment of the whole plan. All these considerations imply that "appropriate technology" in this context is the one which does not require a large size of

organisation and tight administration to work as a group.[1] From this point of view the policies to promote the development of small and medium sizes of enterprises must be strongly supported.

The efficiency of an organisation is also conditioned by some other factors, above all, by the ethnic balance. Harsja Bachtiar in Indonesia points out[2] that it is the expensive process to establish bureaucracy of a new nation while keeping such a balance. It is a requirement of national unification discussed earlier in this paper. Indeed, any decisions of government to implement appropriate technology can hardly be free from the political effects of such decisions for various social or ethnic groups. All these considerations condition the working of organisation.

Lastly, the role of the military in supplying the personnel in bureaucracy andparties is extremely important in any country in this part of the world. We must carefully examine the socio-economic and political implications.[3]

The most fundamental problem in organizing the national economy is, of course, whether it is organised as free, private enterprise system or socialist system. In East and Southeast Asia, South Korea, Taiwan, Hong Kong, Singapore, Thailand, Malaysia and the Philippines as well as Japan are organised on the principle of free private enterprise, are growing very fast, whereas the countries like North Korea, Vietnam, Burma, Laos, Cambodia as well as China are organised socialistically and seem to have the mixed achievements. But in this study our focus will be limited only to those under free private enterprise system, although the problems

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1) R.K. Merton, A.P. Gray, B. Hockey, H.C. Selvin (ed.): Reader in bureaucracy, New York, The Free Press, 1952.

2) H.W. Bachtiar: "Bureaucracy and nation formation", Kejalcinam dan Perdjuangan, 1972.

3) This is an important problem but so hard to know the facts, so that we shall not deal with it here. Cf. R.T. Holt and J.E. Tuner: The political basis of economic development, Nostrand, 1966; and Harsja W. Bachtiar: "The legitimacy of the Indonesian military as a national institution", 1972.

of appropriate technologies must be investigated for socialist economies by all means. It would be interesting to ask how the difference in the economic system influences the choice of technology and the patterns of technological change. In our study, which will be confined to Indonesia, the Philippines and Thailand, however, this question will not be dealt with.

The market mechanism which is the core of free competition in private enterprise system is usually restricted in its working due to the poor infrastructure.

First of all, the efficiency of market mechanism presupposes the external economy which depends on the improvement of communication and transportation system, ware-houses, harbors, airports, financial institutions, postal savings etc. The economic efficiency of private enterprises also depend on the supply of public utilities like electric power, gas, water, air transport, railroad etc. which are either very inadequately offered by the public sector or cannot be trusted in most developing countries. The adoption of technologies to improve these facilities and thereby achieve the external economy may be regarded very appropriate. The working of market mechanism not only depends on the physical facilities but also the human factors handling them. If, for instance, the language barriers or sentimental antagonism among different ethnic groups within a country make it difficult to deal with each other, the market size will become small and the diffusion of technologies will be hampered. Hence, overcoming these obstacles is to facilitate the automatic diffusion of appropriate technologies through market mechanism.

Secondly, the pricing system for technology in the broad sense must effectively work, so that the proper value may be given to the effort of technological innovations. It is important to admit the proper payment of royalties for technological patents, training instructions and managerial skills to those who offer from abroad or within. In Southeast Asia very little have been done to institutionalize the regulations on these technical matters.

Thirdly, the choice of technologies on the part of private enterprises reguires the reliable functioning of government taxation and permission. It is an usual complaint of private enterprises that the tax rates are not known before-hand and changed capriciously, and that the government permission takes too much time and often unpredictable. As a result, private enterprises are forced to prepare unusually large stocks of materials and sum of working capital. This decreases the efficiency of capital in the countries where shortage of capital is the main cause of technological innovations. The effort of the government to remedy these deficiencies will improve the implementation of appropriate technologies in the private sector.

Lastly, the regulations on foreign capital have great relevance to the continuous adoption of appropriate technologies for the long period. As some countries do, the share of foreign capital is not only restricted up to 50% at the beginning but also required to reduce step by step to zero, say, over 15 years. Under such regulations, no foreign partners will keep improving the technologies over 15 years, so that even after 15 years the joint-ventures may continue profitably to maintain the business. Instead, towards the end of 15 years they may establish the new joint-ventures in a nearby country and introduce tha new technology there. Unless the native partners in the first joint-ventures are capable of innovating new technologies and successfully compete with the second joint-ventures, they may not be able to stay in business. In order, therefore, to maintain a metabolic renewal of appropriate technologies within an established enterprise, it is an absolute prerequisite for both foreign and native partners to trust each other and maintain the permanent existence of the joint corporation at least before the technological innovations can be indigenously generated.

Some concrete case studies of workings of market mechanism in Southeast Asia may be quoted here. Many of the institutions which may be taken for granted in developed economies are not available in most LDC's. As the results, for instance, savings cannot be channeled to investors. Even in today's central Java

and Thailand, much of savings do not take the form of bank deposit. The Kyoto University survey revealed the following forms of saving in Thailand and Indonesia.[1] It is, therefore, very important to improve the institutions of market mechanism for the purpose of implementing appropriate technologies in LDC's.

Table 6: Form of Savings

	Klaten	Demak	Gading	Pathum Thani	Ayuttaya	Saraburi
Cash	O	◎	O	O	◎	
Bank deposit				O	◎	◎
Precious metals and stones	◎	O	◎			O
Land	O	O	O		O	O
Cattle and fowls		O	◎			
Paddy or dried cassava	O	◎	O			
Boat or motor-cycles	O	◎				
Lending					O	
Mutual aid			O			

◎ indicates high percentage.

4. Choice of industry and technology

Within the broad institutional framework of the aforementioned social attitude and behavior patterns, decision-makers at the levels of government offices, industry, enterprise and plants (or establishments) take steps in adopting and implementing the technologies which they consider appropriate.

The government officials preparing a national development plan (or a reginal development plan) are usually concerned with the choice of (a) industries, (b) ownership of enterprises, (c) location and scale of plants, and (d) technology or capital equipments to be installed.

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1) Shinichi Ichimura & K. Mizuno, op. cit.

As for the choice of industries, the first consideration should be what pattern of economic structure is appropriate for the country. The mostimportant institutional issue in this connection relates to the coordination of various ministries and agencies. Unless the ministry or agency in charge of this coordination has the full support of the political leader, no systematic and rational choice of sectoral and industrial compositions can be expectec. As we discussed in §2 in details, political considerations often distort the optimal development plan to maximize the employment opportunities or reduce the income differentials among various social classes or regions.

At this level of decision-making on development strategies, the ideological problem of Physiocrat vs Mercantilist often arises: the principle of "agriculture first" fighting against that of "industrialisation first".[1] This choice is an important choice of policies both in offering employment opportunities and basic human needs to the majority of population as well as maintaining the balance between urban and rural lives. Agriculture and rural development should not be underrated in the choice of technologies.

What is more directly related to the problem of appropriate technology, however, is the choice of industries within the manufacturing sector. As is well-known,[2] there is a certain standard pattern of growth for different manufacturing industries depending on the scale of national economy and per capita income. Just to exemplify the argument, two examples of the textile industry and basic metals are shown here.

It is very important to observe the similarity and difference in the growth pattern in large, small manufacturing and small primary countries. Unless the country's officials clearly have this kind of pattern appropriate for their own country in mind at each stage of development, the appropriate choice of industries cannot be made. Their decisions are, however, made very often not on

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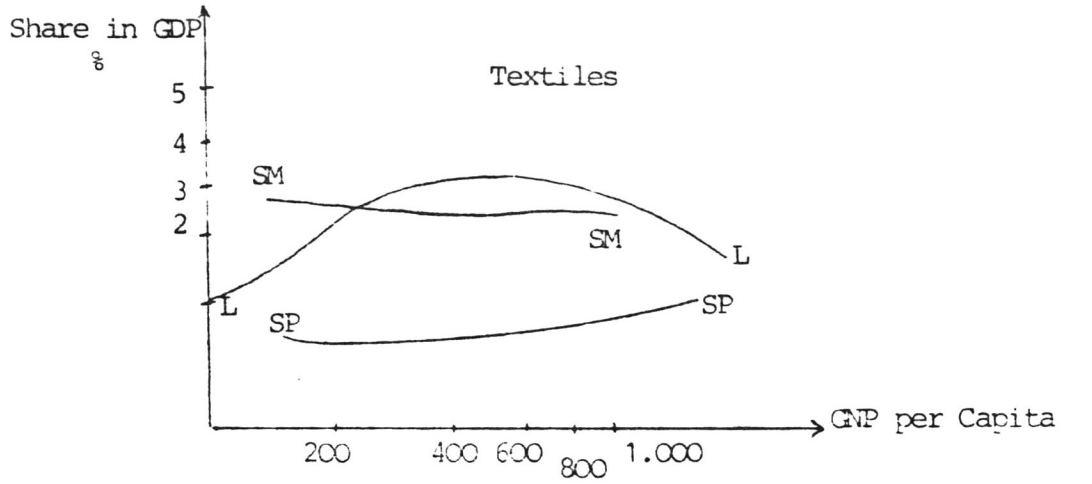
1) I. Livingstone: "Agriculture versus industry in economic development", in: Journal of African Studies, March 1968.

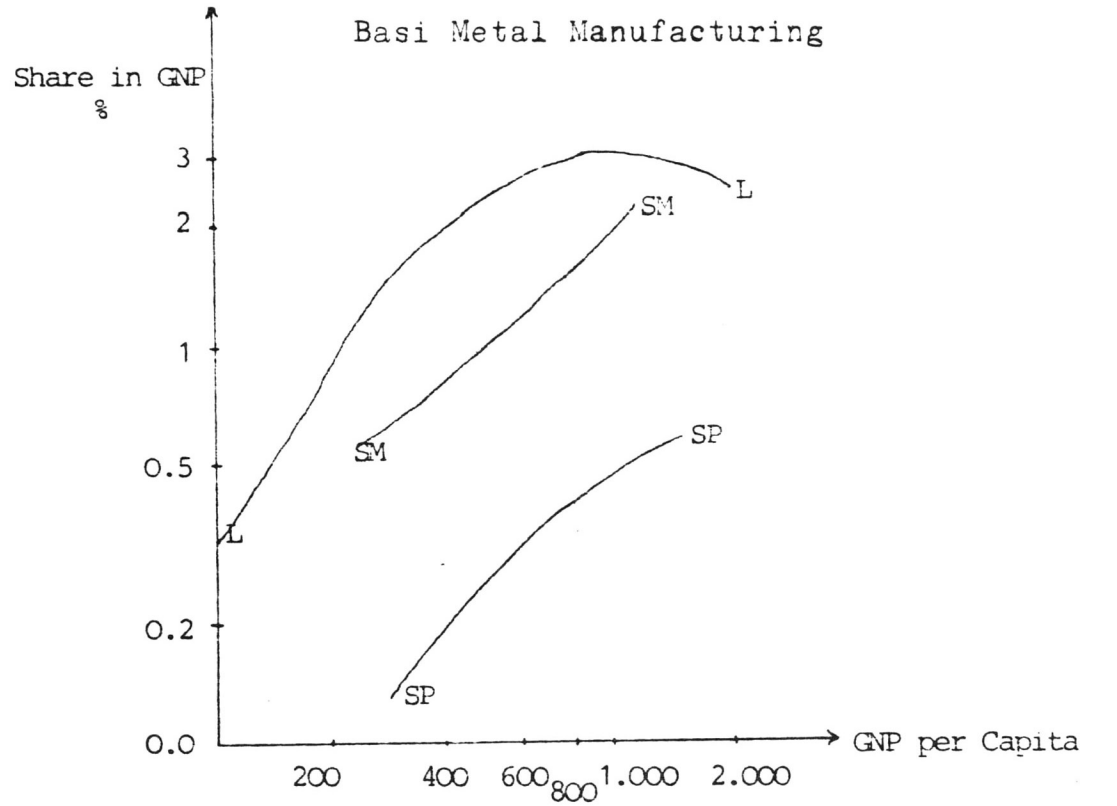
2) H. Chenery and M. Syrquin, op.cit.

the basis of such rational considerations but under the influence of socio-political ones we have already mentioned.

The pattern of ownership of enterprises in developing countries is considerably influenced by the government regulations on foreign investment, minimum wage, labour unions, etc. For instance, in the Philippines all the foreign investments below 30 p.c. of the total paid-in capital of joint ventures are automatically permitted. If the share is more than 30 p.c., however, the permission is not given easily, unless the joint ventures are of pioneering types. In Thailand, the share of foreign capital must usually be kept below 50 p.c. These regulations are to control the domination of foreign influence and foster the steady growth of indigenous entrepreneurs and domestic industries. Obviously, they reflect the value system of the society.

Table 7: The shares of textiles and basic metal manufacturing industries in GDP by the patterns of the economy and by the level of per capita income





Note: L stands for large countries,
SM for small manufacturing countries and
SP for small primary product producers.

Source: H. Chenery and L. Taylor, "Development patterns among countries and over time", in Review of Economics and Statistics, November, 1968. See also H. Chenery and M. Syrquin, op. cit.

Whatever the criteria used in the decision-making may be, the foreign-local ownership composition and the government regulations on it have an important bearing on the choice of technology and technological development, because the technology to be chosen is quite likely to be the one most easily accessible to the investor. Foreign investors will bring in the technologies they are using in their home countries. One of the main issues to be studied in our field work should be to obtain the first hand information, the effects of government policies on foreign investment and the subsequent choice of technologies.

The government policies on foreign investment are determined in the ways and criteria to give the permit to the applications from the domestic or foreign companies. Screening the applications and choosing specific corporations or projects is the primary task of the Committee of Foreign Investment. The criterion actually applied must be empirically found out, but several criteria may be listed; i.e. "first in first", "the most modern", the best company at home, the political or personal connections between decision-makers and the investors, and so on. Apart from these intuitive ad hoc criteria, the implications or effects of introducing a certain industry or enterprise must be evaluated according to the objectives of government development plan. What objectives are the immediate concern of planners must be questioned. A list of possible answers may be given here; namely, the optimal use of natural and human resources, to earn more net foreign exchange, to increase the government revenue or to consolidate the economic basis of political leadership. The government officials must evaluate the long-term contribution of an applying enterprise in the light of these objectives. How these are practised is the one to be investigated. In connection with the choice of enterprise, the role of multinational corporations must be also considered, because their contributions in transferring modern technology to LDC in the recent years are very great. But the enormous scale of economic activities often scare the responsible politicians and officials who must think of nationalistic

reaction to multinational corporations at the domestic front.[1] The pros and cons of multinationals, however, must be carefully studied. In Southeast Asia, unlike Latin America, the sentiment against multinational corporations has not been arisen, probably because they have not invested in a large scale as yet, except for petroleum majors in Indonesia. This, however, is no guarantee to expect no trouble in the future.

Ownership may pose, in addition, another problem in terms of ethnic groups. In Malaysia and Indonesia, Bumi Putra policies give priority to indigenous ethnic groups in all kinds of economic activities and education. This weill certainly contribute to the generation of techniques appropriate for the traditional sector and reduce the dualism in the economy. For example, by supporting the participation of indigenous ethnic people in international

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1) There are many works which admit the merits of foreign investment and multinational corporations. For example, ECLA, ECLA and Analysis of Latin American Development, Santiago de Chile, 1968; Paul Prebisch, Hacia una dinamica del desarrollo latinoamericano, Mexico, 1963; H.W. Singer, The Strategy of International Development, London, 1975; H.W. Singer,"Appropriate Technology for a Basic Human Needs Strategy", IDR, no. 2, 1977.
But at the same time there are also very many critical works on multinational corporations particularly in Latin America. For examole, J.N. Bhagwati, (ed.) Economics and World Order, London, 1972.
Theotonio Dos Santos, "The Structure of Dependence", American Economic Review, May 1970; K. Gough and H.P. Sharma (ed.), Imperialism and Revolution in South Asia, New Yor, 1973; A.K. Bagchi, "Foreign Capital and Economic Development in India: A Schematical View", 1973; J.D. Craft et al. (ed.), "Dependence and Underdevelopment, New York, 1972.
As for the process of technology transfer by multinational corporations, see M.V. Posner, op.cit.; G.C. Hufbauer, op.cit. and ibid, "The impact of national characteristics and technology on the composition of trade in manufactured goods", in Raymond Vernon (ed.), The Technology Transfer in International Trade, National Bureau of Economic Research, New Yor, 1970.
Southeast Asian sentiment towards multinationals are fairly expressed in Soedjatmoko from Indonesia, "Technology, Development and Culture", Conference at the Institute for Religion and Social Change, April 1972.
It should be pointed out that the authors do not hold the optimistic view about the two outlets-socialism and pseudo-imperialism from the labyrinth of dependence on foreign capital and multinationals.

joint ventures or the subcontracting arrangements with them, their chance of learning modern technology increases.

Finally, to attain an appropriate technology-mix in an industry, a proper balance between the public sector and the private sector is necessary. Most of the enterprises owned by colonial powers have been succeeded by the government and become state enterprises. Their size is often very large, and they usually enjoy a monopolistic position. The technology adopted by them is often inappropriate from the viewpoint of the national economy. At the same time, with their monopoly power, the management is often inefficient or sometimes corrupted. Pertamina (National Oil corporation in Indonesia) almost bankrupted and gave a serious menace to the national economy. These public enterprises, with special favors given by the government, often deprive the private business groups of opportunities to generate more appropriate technologies. This point deserves a serious study. What should be contrasted with these cases is the success of private enterprises in those countries called "Gang of Four" or "New Japan's", Hong Kong, Singapore, Taiwan and South Korea.

Related to this is the problem concerning the decisions on the location and scale of plants, which are very often at the mercy of political considerations. For instance, the growth of prosperous private enterprises in some area changes the balance of economic power among various regions in the country. This, in turn, has political implications to new fragile nations. The location of plants changes the regional distribution of economic opportunities, so that appropriate technologies in the sense of employment creation and improved income distribution may mean appropriate location of plants and enterprises. These considerations are particularly important in the Philippines and Indonesia. Politically also the outer islands' provinces in Indonesia often complain of excessive power concentration in Java, and it is said, the powerful business groups in the Philippines since the time of Spanish-American days are challenged by the new business groups with the aid of the government. The regional development problems are usually more vital in LDC's than developed countries.

The independence of Singapore from Malaysia is an historic instance.

It is usually argued that the technology using more of surplus labor or abundant resources may be more appropriate. But the question is not so simple. For example, the shortage of skilled labor and inadequacy of infrastructure sometimes necessitates the use of very advanced capital-intensive technology. Export requires a high standard of quality which can only be achieved by modern machinery. These considerations often work as the factors against the wishes of many experts who advocate the need for "intermediate technology" in developing countries. Needless to say, appropriateness in factor proportions depends on relative prices. In this connection the rate of foreign exchange plays a very important role. In most developing countries industrialisation takes place from import substitution with government protection. As a result the foreign exchange rate tends to be overvalued, so that exports stagger. It must be clearly kept in mind that the appropriate technologies defined in terms of factor proportions depend on the relative prices of productive factors. A fortunate case was a number of modern textile plants in Indonesia. Partly, due to the shortage of skilled technicians and partly due to the national pride of political leaders, the most modern machines were installed in many textile joint-ventures in Indonesia. When devaluation of Rupiah took place in November 1978, Indonesian textile exports unexpectedly increased to the happy surprise to policy-makers as well as businessmen themselves. This proves that technological choice and relative prices are interdependent.

Technology is, however, part of modern culture, so that adoption of modern technology is not just a change in production function. It is a process of accepting modern civilization, which requires a change in the way of thinking and in the social order. For example, the social position engineers and managers in the society may become much higher than that of the religious leaders, and this may not be acceptable in the traditional society. Consequently, new social conflicts may occur. The substitution of modern technology for traditional techniques has always been very controversial due to its spiritual implications and the time allowance

needed for the human mind to absorb a new cultural factor like modern machinery.[1] This is a slow process of adjustment and compromise. Nature cannot jump.

If technological choice is to be appropriate for factor endowment in LDCs, there is undoubtedly a vast area of industries and service activities where labour-intensive technologies and know-how must be applied. This implies that there remains the traditional sectors which employ workers with poor capital equipment, even though capital-intensive technology is introduced to the modern sectors. Hence, it is unavoidable to have the dual economy in any developing country. In this connection, the experience of Japan is suggestive.

In order to achieve industrialisation along with the dual economy, the Japanese Government adopted the so-called "Industrial Policy; and played a positive role in fostering new industries and implementing the various policies for domestic industries.[2] It is particularly interesting that the Japanese Ministry of International Trade and Industry has performed the dual functions. On one hand it has tried to foster new industries which would become export industries by various means of assistance including its own effort of developing appropriate technology at the Agency of Industrial Technology.[3] On the other hand, however, it tried to help small- and medium-sized enterprises establish themselves by all kinds of protective measures, which helped solve the employment problems in the early stage of development and post-war recovery. Such dual functions of the Japanese industrial

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1) Many LDC leaders like Onyemelukwe in Nigeria and others realised that it implied many political and spiritual problems (C.C. Onyemelukwe: Economic development, London, 1974).

2) The Japanese Government policies are well documented in the publications of the Ministry of International Trade and Industry, Japan. The following is a survey article of these documents and studies in Japan. Shinichi Ichimura: "Japanese industrial policy, 1945-1969" presented at the conference at Bellagio, September 1979: Discussion Paper No. 106, Centre for Southeast Asian Studies, Kyoto University, 1979.

3) It is an agency which belongs to MITI and is specialised in the development of adaptation and generation of technology. It has about 4.000 staff, when the total number of staff of MITI itself is about 5.000. The importance attached to the problem of technology was so great.

policy made it possible for the Japanese economy to combine highly advanced technology with relatively labor-intensive "intermediate" technology of small and medium enterprises. This combination may have been the most appropriate technology in Japan where sub-contracting is widely practised.

The developing countries governments sometimes request small and medium enterprises to invest directly. They may, however, have the difficulties in responding to such requests due to (a) insufficient capacity in capital and resk-bearing, (b) imperfect information on overseas market, (c) shortage of internationally oriented personnel, and (d) potential competition with native businesses in the future. Once, however, they succeed in transferring the technologies, the diffusion may be fast due to small capital and managerial skill requirement, but the product cycle will be short.

There are, however, many successful cases of developing appropriate technology also in other Asian countries. Some examples are related to MADA (Mudah Agricultural Development Authority) in Malaysia. It developed the Province of Mudah by introducing new "high-yielding variety of rice" (HYVR) and simultaneously devising the new cultivating machines which are different from the ones offered by IRRI (International Rice Research Institute). This seems to have been possible under the outstanding entrepreneurial leadership of Tamin Yeop, the then director of MADA. He clearly saw the need of new types of smaller tillers and other farming machines. Asking the cooperation of some Japanese firms and government, he succeeded in initiating the design of new cultivating machines. The important factors then were the existence of an entrepreneurial leader and the organisational support to implement the ideas by the leader.[1)]

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1) M. Yamashita, S. Jegatheesan, and Wong Chee Yoong: Agro-economic studies in the Mudah project area (Alor Setar, MADA, May 1976.

Technology is not only embodied in machinery but also maintained or improved by personnel in enterprises. Its generation and dissemination in developing countries requires therefore a certain minimum number of engineers who are familiar with machines, tools, equipment and their production,[1] and in order to secure the supply of such basic manpower it seems necessary to develop domestic capital goods industries in the early stage and also to learn from similar experiences in other LDCs. The latter is particularly important in adaptation of foreign technology to local conditions and modification of traditional techniques to slightly more advanced technologies.[2] To what extent this has been limiting the generation and application of more appropriate technologies in Southeast Asia is an interesting subject of study.

5. Concluding remarks

This paper tries to explore a difficult area between technological innovations and institutional factors in developing countries. The documents are not of short on each subject, but very little have been known about the inter-relations between the two. Within the limited knowledge of the present author, some important information has been collected, summarized and presented as a frame of reference in the following empirical study. The central scheme of obtaining information is the logical process of learning new knowledge to generating own technologies described in §2. In each stage of collection of information, social attitude, decision and adjustment implementation, institutional factors become relevant and play the roles. The main points of issues to be raised in questionnaire survey have been pointed out, and some preceding examples of similar surveys were presented. Since very few surveys of this type were conducted in the field of manufacturing industries' technological innovations, the information to be collected will cer-

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1) See, Henry J. Bruton: "On the production of appropriate technology", World Employment Programme Research Working Paper, WEP 2-22/WP 49 (ILO, June 1979).

2) Frances Stewart: Technology and under-development, London, Macmillan, 1977.

tainly ascertain or modify the observations here and give the additional knowledge to the subject.

The government policies of development strategies have been suffering from the shortage of information of this type. Even the knowledge summarized here has not been available to most policy-makers, although all of them have been very well aware of the issues and often have their own views on the questions. These views of decision-makers must be collected and analyzed. The government policies of developing countries, particularly those of most seriously underdeveloped countries will greatly benefit from such studies, because it is in those countries that institutional and cultural factors make the barriers to implementing appropriate technologies and even satisfying the basic human needs.