# TOWARD A LEAPFROGGING STRATEGY FOR NATIONAL SELF-RELIANCE IN SCIENCE AND TECHNOLOGY[1]

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## I. SCIENCE AND TECHNOLOGY PROBLEMATIQUE IN THE THIRD WORLD

Science and technology (S&T) for development has become a fashionable battle cry of the development community for many years now. In spite of the many studies undertaken in this connection, many of the Third World countries are still in a state of abject poverty. The S&T capacity has remained woefully inadequate and irrelevant to production activities. National efforts directed at science policy studies, the survey of S&T potentials, and the determination of S&T indicators have not resulted in any palpable technological progress for the developing countries. Third World countries have remained technologically dependent on developed countries.

The S&T problematique typical in many Third World countries also beset the Philippines.

## II. THE PHILIPPINE SITUATION

After almost four decades of S&T policy formulation and planning in the Philippines there has been no qualitative improvement in the status of S&T. Surely, there were quantitative changes. There are now more S&T and R&D (Research and Development) institutions, more scientists and technologists with advanced degrees, more researches going on, and more laboratory equipment and tools. In the production systems there are new indigenously developed technologies being used, specially in agriculture. Although there are new industrial facilities, these are mainly established through turnkey agreements.

The more crucial process of what Sagasti (Sagasti, 1979) called the "endogenization" of technology has not been achieved except in some trivial industries like soy sauce and soap manufacture. Endogenization would require a strong feedback linkage between scientific and technological R&D and the country's production systems.

In general, technological skills have not gone much beyond the simple capability to operate imported technology.

In the present world economic and technological order, the Philippines is at a serious disadvantage. Because of its scientific and technological backwardness, the Philippines cannot produce the equipment and machineries needed to transform raw materials into manufacture goods. As a consequence of this scientific and technological incapacity to produce its own means of production, the national economy has to depend on the importation of foreign technologies in the form of manufacturing processes, producer goods, and even complete production facilities in order to meet the consumer needs of the domestic market.

To finance the country's technological dependence on imported technologies, the national economy relies on the export of low value-added products and raw materials such as sugar, coconut oil, logs, handicrafts, copper concentrates, and other minerals. The so-called semi-conductor industries of the Philippines are just labor-intensive assembly operations of multinational companies. As a result, the Philippines finds itself locked into the international division of labor, playing the role of the exporter of primary commodities and importer of production technologies.

Part of today's geopolitical reality is the growing militant awareness of Third World countries on the sovereignty over their natural resources and economy. On the other hand, the industrialized countries are strongly asserting their proprietary rights over some vital technologies. Certainly some hard bargaining could be expected regarding the access to technologies and natural resources. Careful planning and strategy formulation will be required by Third World countries in order to obtain an equitable deal. This would require a good measure of self-reliance in S&T.

Modern S&T is very different in character from the S&T of the early years of the Industrial Revolution. Before, most of the industrial skills were accumulated knowledge learned through long practice. Today we have a *science-driven technology* which means that innovation in technology arises out of fundamental scientific R&D. There are "technology factories" under big transnational corporations where systematic mission-oriented R&D are undertaken. Some well-known examples are microelectronics, computers, and telecommunications. Commercial technologies are therefore considered as products of long-term investment of venture capital in the commercialization of R&D. These commercial technologies are carefully-guarded properties of transnational corporations. Their transfer to other parties is done with deliberate care and entails huge payments. If Third World countries are to achieve a state of S&T excellence, that is, competitive with the industrialized countries they must be able to match the modern R&D infrastructures in some particular problem areas.

## III. THE VICIOUS CYCLE PARADIGM

For purposes of organized analysis and strategy formulation, it is useful to construct a conceptual model to represent the salient features of the forces shaping the character of S&T in the Philippines. This model also summarizes in a concise way the rather complex feedback relationships among the numerous factors that affect the state of S&T in the Philippines. This conceptual model is represented by Figure 1 which depicts the vicious cycle paradigm of S&T in the Philippines.

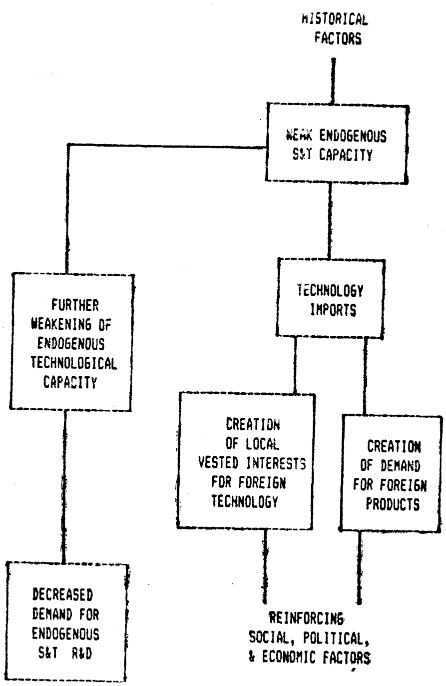


Figure 1. The Vicious Cycle of Technological Dependence and Backwardness

One of the principal driving forces of the vicious circle is our colonial legacy, which is one of the major causes of the present weakness of the endogenous S&T capacity. Of course, it can be argued that there was no significant indigenous S&T before the first contacts with the West. However, the point being made here is that the colonial policies actually inhibited the emergence of a relevant and nationalistic community of scientists and technologists. During the Spanish colonial era, S&T was discouraged in favor of the more classical learning. In the American era, the directions of Philippine S&T were towards those in the service of the colonial objectives. Scientific and technological R&D was not linked to the local production system. As they are today, S&T was not relevant to the country's economy.

The momentum of these historical forces and the hostile social ecology of S&T that they create are responsible for the present weakness of the endogenous S&T capacity. Since the local S&T is inadequate to serve local economic needs, the required technologies are imported. The widespread use of foreign technology brings about many undesirable consequences: foreign investments, loss of control over decision-making, and the emergence of a pattern of consumption and production based on developed-country tastes. Local vested interests for foreign technology are also created in the process. When foreign experts and executives actually enter a country, they could establish, rather easily, strong ties with the local political and business elites. The developed country's interests are internalized in these ways, effectively inhibiting attempts to break the dependent relationships. This could strongly affect future options that are more advantageous for the host country as a whole. Under this situation, local S&T becomes irrelevant to local production and further weakened because of the lack of effective demand for local S&T products and services. The result is a self-reinforcing, negative feedback loop that marginalizes the indigenous S&T activities.

The other set of driving forces of the vicious circle is the set of contextual factors originating from the social, political, and economic environments. One of the most significant factors in Philippine social reality is the lack of self-reliant attitudes on the part of local scientists and engineers. The peer group of local scientists is the larger world scientific community. The local science community is not large enough to constitute a viable self-sustaining community with its own set of professional values. The engineering community, on the other hand, lacks a useful R&D attitudes. Moreover, the science group is isolated from the engineering group. There is practically no linkage between the two and both look up to the West as model for emulation. Local scientists and engineers usually serve as consultants to foreign firms and contribute indirectly to the perpetration of the vested interests in foreign technology and the demand for foreign products. The local S&T community is not a strong techno-class in the sense of being an identifiable and recognized actor whose views are sought and expected to influence social choices.

The nature and character of the country's development philosophy also implicitly abets the vicious circle. Since the 1946 independence, the Philippines has deliberately courted foreign investments and technology transfers. It is obvious that the direct social costs of foreign investments are, as shown in Figure 1, the stimulation of demand for foreign products and the creation of local vested interests in its perpetration. Technology transfers are largely unregulated in terms of the desirable technology learning process.

The fact that the country is underdeveloped is in itself a contributory factor to the vicious circle. There are two aspects to this. One is the highly distorted distribution of wealth in which 85% of the national assets is owned by only 15% of the population. The result is that the wealthy have a natural preference for imported goods and the poor do not have sufficient purchasing power to encourage production for the local market. In a sense this is another vicious circle within the vicious circle of S&T backwardness. The other aspect is the timidity of the wealthy class to risk investments in technology-intensive ventures. The business outlook of the rich has always been focused on traditional sectors like banking, agribusiness, insurance, real estate, and merchandising.

## IV. BREAKING THE VICIOUS CIRCLE

The basic flaws in all previous government S&T development plans, strategies, and policies can be traced to the lack of a full recognition of this vicious circle and the lack of a sustained national political will to break it.

Since the establishment of the National Science Development Board as the highest S&T policy-making agency of the government in 1958 up to its most recent reorganization on January 20, 1987 into a full-pledged Department of Science and Technology (DOST), S&T development was viewed as simply a matter of new science policy statements (such as "mission-oriented strategy" in 1976-1981 and "demand-pull strategy" in 1981-1986) coupled with a reorganization of the government S&T agencies.

In contrast to this superficial formalistic approach, countries like Japan, Korea and China consider S&T to be the leading factor in their development efforts. A review of Philippine development plans will show that S&T has merited only cursory attention. The so-called S&T plans were not fully integrated with national economic development plans. The former merely served the parochial interests of the ineffective and feeble S&T establishment.

With the appointment in June 1986 of a new Science Minister under a new administration and the reorganization of government science agencies under the new DOST, new science and technology policies have been formulated and new government S&T agencies have been established. Yet, it is becoming clear that an all-out drive to break the vicious circle cannot be carried out by the new DOST for, as our previous analysis has shown, it takes more than S&T policy statements and reorganizations to break the vicious circle. An entirely new national development strategy is needed to overcome technological and economic dependence.

Our initial assessment of the Aquino administration does not evoke an optimistic prospect for national self-reliance in science and technology because the present government's economic development strategies and policies do not differ qualitatively from the previous regime's policies of economic dependence that have been largely responsible for maintaining the vicious circle of technological backwardness and dependence.

In order to liberate the country from its morass of economic and technological dependence, we have to pursue new and bold economic and technological policy directions that must attempt, first of all, to break our vicious circle of technological backwardness and dependence.

Since this vicious circle stems from the interrelated problems of (1) the weakness of the country's scientific and technological potential, (2) the lack of effective demand for endogenous R&D and technological innovation, and (3) the almost total dependence of the country on importation of technology for its required means of production, it is obvious that these three problems have to be tackled and overcome simultaneously if the vicious circle is to be broken.

A national strategy for breaking the vicious circle is shown by the conceptual model of Figure 2. This includes the following essential components:

1. Accelerated, massive development of the country's scientific and technological potential through the expenditure of at least 1% of GNP on the development of advanced S&T manpower, infrastructure, and information resources and the implementation of selected R&D projects;
2. Increase in the effective demand for endogenous R&D and technological innovation through fiscal policies and legislative acts which would make local firms, whether private or government-controlled, invest a certain percentage (at least 1%) of their net income before taxes on endogenous R&D; and
3. Strategic management of technology transfer which would link the importation of selected foreign technologies with endogenous R&D and technological innovation projects for the purpose of facilitating national technological mastery of these selected technologies.

The central goal of this proposed national strategy would be the technological mastery of those selected technologies which are strategically important to the Philippine economy in its relationships with the rest of the world.

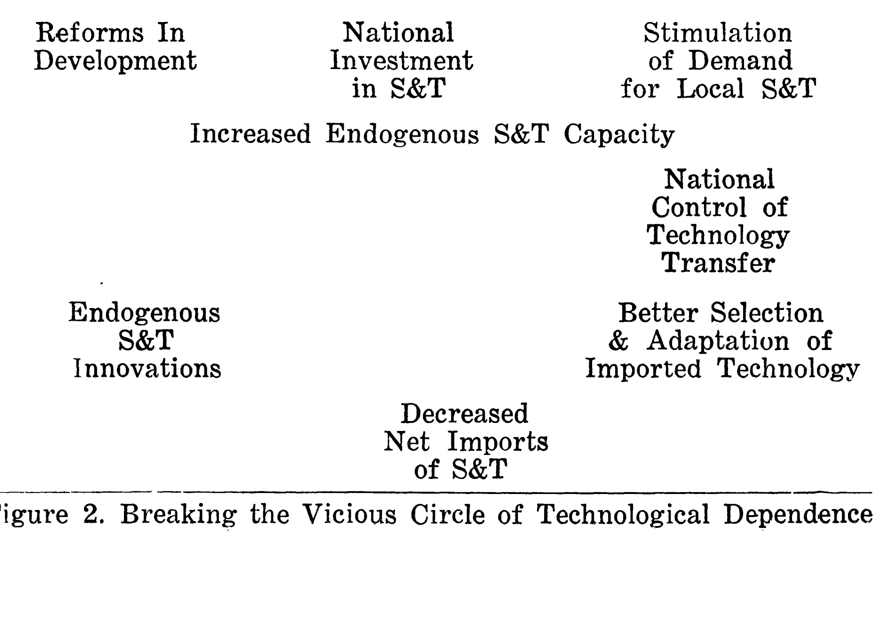


Figure 2. Breaking the Vicious Circle of Technological Dependence

## V. S&T TAXONOMIC MATRIX AND EVOLUTIONARY STAGES

The discussion of strategies and technological choices is meaningful only in the context of the evolution of technological civilization and a theory of the dynamics of technological learning. A taxonomic classification according to technology types is useful.

We may classify technologies into the following basic types:

1. Materials Technologies, which deal with the extraction, processing, fabrication, and combination and synthesis of materials;
2. Equipment Technologies, which deal with the design and fabrication of tools, instruments, devices, machines and transportation equipment;
3. Energy Technologies, which deal with the generation, conversion, and distribution of various forms of energy;
4. Information Technologies, which deal with the preservation, storage, processing, retrieval, and transmission of information;
5. Life Technologies, which deal with the preservation, repair, maintenance, reproduction, and improvement of living systems; and
6. Management Technologies, which deal with the planning, organization, mobilization, coordination, and control of social activities.

All these basic types of technologies provide the essential inputs to production systems. For a country to call itself modern, important elements of all types of technology must be in its possession and under its control.

Major advances in S&T have resulted in the improvement of the various types of technologies in terms of efficiency, raw-material intensiveness and general sophistication.

Alvin Toffler's (Toffler, 1980) paradigm on the three waves of civilizations following and often overlapping one another provides an adequate conceptual anchor for discussing the "break away" strategies. This classification is also important in the sense that they represent the major stages in S&T development. They also depict the increasing human knowledge about nature. Indeed, Toffler's "waves" correspond to an ascending level of scientific and technological sophistication. These civilizations are characterized by the following classes of technologies:

1. First Wave Technologies, comprising the pre-industrial technologies which are labor-intensive, small-scale, decen-

tralized, and based on empirical rather than scientific knowledge. The intermediate, appropriate, or alternative technologies based on the Schumacherian philosophy of "small is beautiful" also fall under this category.

2. Second Wave Technologies, comprising the industrial technologies which were developed since the time of the industrial revolution up to the end of World War II. These are essentially based on the principles of classical physics, classical chemistry, and classical biology.

3. Third-Wave Technologies, comprising the post-industrial or high technologies which are science-based because they are based on our modern scientific knowledge of the structures, properties, and interactions of molecules, atoms, and nuclei. Among the important high technologies are microelectronics, robotics, computers, laser technology and fiber optics, genetic engineering, photovoltaics, and other materials science.

Some of the representative types of technologies under the First Wave, Second Wave and Third Wave classes are tabulated in the S&T taxonomical matrix (Figure 3).

For any given technology, it is possible to define five discernible stages in the development of a national technological capability. These are:

Stage 1. *Operative Capability,* which is the ability to put an imported technology into actual operation and carry out routine maintenance and minor repairs on components of the technology;

Stage 2. *Adaptive Capability,* which is the ability to adapt a foreign technology system by modifying its scale or replacing some of its minor components to suit local conditions and available materials;

Stage 3. *Replicative Capability,* which is the ability to reproduce most, if not all of the major components of a technology through endogenous technological innovations;

| Type of Technology | First Wave Technologies | Second Wave Technologies | Third Wave Technologies |
|---|---|---|---|
| Materials Technologies | copper, bronze, iron, glass, ceramic, paper | steel, aluminum, dyes, plastics, petrochemicals | polymers, semi-conductors, liquid crystals, superconductors |
| Equipment Technologies | plow, lathe, mills and pumps, spinning wheel | engines, motors, turbines, machine tools | laser tools, microprocessors, robots |
| Energy Technologies | wood, charcoal, wind power, water power | hydroelectric power, coal, oil, geothermal power | solar cells, synthetic fuels, fusion power |
| Information Technologies | printing, books and letters, messengers | typewriter, telephone, TV, radio, telegraph | computers, fiber-optics, artificial intelligence |
| Life Technologies | traditional agriculture, animal breeding, herbal | mechanized agriculture, surgery, food, antibiotics | hydrophonics, artificial organs, genetic engineering |

Figure 3. S&T Taxonomic Matrix

Stage 4. *Innovative Capability,* which is the ability to make significant modifications and improvements on the basic design of an existing technology; and

Stage 5. *Creative Capability,* which is the ability to design and produce an entirely new and revolutionary technology.

The attainment of Stage 5 (creative capability) may be called technological mastery. This is similar to the definition offered by Dahlman and Westphal (1982) which says:

> ". . . technological mastery is the effective use of technological knowledge, through continuing technological effort to assimilate and/or create technology."

Our definition, however, is more specific because technological mastery refers to a particular technosystem. Technological mastery in all Third Wave technology classes would be the ultimate goal of all national efforts at S&T development.

The estimated levels of Filipino technological capabilities relative to these three classes of technologies appear in Figure 4. The

Philippines has reached the replicative and even innovative stages of technological capabilities in most First Wave Technologies but it is still largely at the operative and adaptive stages in most Second Wave Technologies and at the preoperative and operative stages in most Third Wave Technologies.

| Type of Technology | First Wave Technologies | Second Wave Technologies | Third Wave Technologies |
|---|---|---|---|
| Materials Technologies | Stage 3 in most<br>Stage 2 in some | Stage 1 in some<br>Stage 2 in others | Stage 0 in most<br>Stage 1 in some |
| Equipment Technologies | Stage 3 in most<br>Stage 4 in some | Stage 3 in most<br>Stage 2 in some | Stage 0 in most<br>Stage 2 in few |
| Energy Technologies | Stage 3 in most<br>Stage 4 in some | Stage 3 in most<br>Stage 3 in some | Stage 0 in most<br>Stage 1 in some |
| Information Technologies | Stage 3 in most<br>Stage 4 in some | Stage 1 in some<br>Stage 2 in others | Stage 0 in most<br>Stage 2 in some |
| Life Technologies | Stage 3 in most<br>Stage 4 in some | Stage 2 in some<br>Stage 3 in others | Stage 0 in most<br>Stage 2 in few |

Figure: 4. Filipino Technological Capabilities

Legend: Stage 0: pre-operative
Stage 1: operative
Stage 2: adaptive
Stage 3: replicative
Stage 4: innovative
Stage 5: creative

## VI. TECHNOLOGICAL CHOICES FOR THE PHILIPPINES

For the past two decades, the Philippine national debates on technological choices have been dominated by two schools of development thought: the "Countryside Development" School and the "Nationalist Industrialization" School. The former, arguing that agricultural development must precede industrialization, advocates the adoption of labor-intensive, employment-generating First-Wave Technologies. The latter, on the other hand, insists on following classical industrialization programs and promoting Second Wave Technologies.

Under the present government, the "Countryside Development" School has gained ascendancy over the "Nationalist Industrialization" School, and the development of the agricultural sector has been given priority over that of the industrial sector in national development plans. In fact, the "Countryside Development" philosophy was even incorporated into the new Philippine Constitution of 1987. Hence, industrialization will now be given a low priority, while agriculture-based, labor-intensive, export-oriented economic development will be pursued.

In justifying the "Countryside Development" strategy, government economic policy-makers invoke the "law of comparative advantage," arguing that the country's comparative advantages lie in its abundant cheap labor, natural resource endowments, and agricultural products. Thus, they have been promoting the export of cash crops, garments, handicrafts, dolls, furniture, copra, prawns, etc.

What these policy-makers do not seem to realize is that comparative advantage is not absolute and permanent but rather subject to technology. What they have failed to see, or chosen to ignore, is that today, comparative advantages are increasingly determined by scientific and technological knowledge. For example, the development of synthetic and genetically engineered products in advanced countries has undermined the comparative advantages that used to be enjoyed by certain resource-rich Third World countries, while the increasing automation and robotization of production are now beginning to erode the comparative advantage of labor-intensive manufacturing in Third World countries.

In fact, three of the industries which we investigated in a study sponsored by the United Nations University have become "sunset industries" for the Philippines because of high-technology developments. The international market for copper has been dwindling because copper wires are now being replaced by optical fibers in communication systems. New substitutes for coconut oil have been developed, resulting in the shrinkage of its export market. The use of fully automated systems for the fabrication of highly integrated, high-speed, sophisticated chips has started reversing the trend of setting up labor-intensive semiconductor assembly facilities in Third World countries.

What is very clear is that whatever comparative advantages the Philippines used to enjoy in the recent past due to its natural resources or cheap labor are fast being eroded by Third Wave Technologies. It is also obvious that in the 21st century, economic viability of nations will be determined largely by mastery of Third Wave Technologies.

The current national debate between the proponents of First Wave Technologies and those of Second Wave Technologies is, therefore, ludicrous and pathetic at a time when almost all the rest of the countries in East Asia and Southeast Asia are trying to master Third Wave Technologies in preparation for the 21st century. To pursue either a First-Wave or a Second-Wave Development Strategy is to develop the country to economic obsolescence and increased dependence.

In the face of high-technology developments that are already threatening the national economy, the Philippines can no longer afford to ignore the Third Wave Technologies which are radically reshaping human civilization. The only choice left for the country before the 21st century is whether to start mastering these Third Wave Technologies for its economic advantage or to let high-tech developments undermine its economic survival in the next century.

While the Third Wave Technologies pose threats to the Philippine economy, these also offer opportunities for the country's economic development because of their knowledge-intensive and capital-saving characteristics. For example, the abundance of highly educated manpower in the Philippines could be turned into a comparative advantage in areas like software development which for some time will remain a labor-intensive and skill-intensive activity. Biotechnology could also be used to lessen dependence on imported agricultural inputs and to produce high-value crops, while microelectronic instrumentation and CAD/CAM systems could be utilized to improve certain existing manufacturing processes. Certainly, the Philippines can find niches among the Third Wave Technologies that it can master and turn into economic advantages.

To cope with the threats and promises of the Third Wave Technologies, the Philippines has no choice but to leapfrog the First Wave and Second Wave Technologies and master selected, strategic areas of Third Wave Technologies.

## VII. TECHNOLOGICAL LEAPFROGGING TOWARDS TECHNOLOGICAL MASTERY

The strategy of breaking the vicious cycle of S&T backwardness and economic dependence and gaining national technological mastery of selected Third Wave Technologies is what we propose for the Philippines. An appropriate term for this strategy is *technological leapfrogging* because it seeks to master selected Third Wave Technologies in order to (1) modernize Philippine production technologies, (2) provide a competitive edge to the national economy, and (3) bridge the technological gap between the Philippines and the advanced countries.

The essential feature of the strategy of technological leapfrogging is the linkage of selected transfers of Third Wave Technologies with endogenous R&D and technological innovations for the purpose of successively building up adaptive, replicative, innovative, and ultimately creative capabilities in these technologies.

A specific example of a technological leapfrogging approach would be the bypassing of the technology of the Second Wave, steel-based machine tools in favor of mastering the technology of Third-Wave industrial lasers for use in cutting, drilling, welding, annealing, and marking materials. The basic idea is to master, whenever feasible, the state-of-the-art technology rather than to invest money and efforts in acquiring competence in the corresponding obsolete technology.

Technological mastery refers to the innovative and creative levels of technological competence. In the example of industrial lasers, technological mastery would be indicated by the ability to improve the design and performance of existing industrial lasers or to invent and fabricate entirely new and better laser systems.

In our view, the term "technological mastery" is preferable to the term "technological self-reliance" because the latter is open to misinterpretation of being either equivalent to technological autarky (i.e. developing the technology from exclusively indigenous resources) or limited only to replicative levels of technological capability.

Besides, technological mastery connotes not only innovative and creative technological competence as well as state-of-the-art S&T knowledge and skills but also the idea of "socio-economic command of technological development," that is, the ability of the entire society to control the direction of technological innovations in such a way as to maximize their social benefits and minimize their negative effects. In this sense, national technological mastery of Third Wave Technologies would imply democratic, social consensus in the selection, assimilation, development, application, and diffusion of high technologies so as to insure a better future for everybody in the society.

## VIII. PROSPECTS FOR NATIONAL TECHNOLOGICAL MASTERY

The successful implementation of the strategy of technological leapfrogging from the vicious circle of S&T backwardness and dependence to a national technological mastery of Third Wave Technologies is an extremely difficult national project that requires the following:

(1) A strong political leadership that is fully committed on a long-term basis to this national project;
(2) An effective, internationally linked national system for S&T and economic scanning, forecasting, prospective assessment, and intelligence;
(3) A strong S&T system which is highly competent in adapting, replicating, and improving foreign technologies and creating new science and technology;
(4) A national economic planning and management system that can formulate and implement integrated national technological and economic plans and policies in anticipation of opportunities and threats from new technological developments;
(5) An economic system that is self-reliant, technologically oriented, innovative, internationally competitive, and possessed of a high degree of social equity and mobility;
(6) An educational system that can anticipate and assess various probable futures and provide students with self-learning capacities for adapting to a rapidly changing society; and
(7) A national culture that places high values on learning, creativity, originality, innovativeness, productivity, quality, and excellence. Furthermore, all these elements must be coordinated and integrated with one another.

In short, a radical overhaul of Philippine society would be required if the strategy of technological leapfrogging were to be pursued successfully. Unfortunately, however, the prospects for this necessary social transformation are dim at the present time for notwithstanding the 1986 February Revolution that overthrew the Marcos dictatorship, the new Aquino government seems to lack any long-term national vision for the country beyond national economic recovery.

Nevertheless, inspired by the successful experiences of Japan, the Soviet Union, China, and Korea in technological leapfrogging, we believe that a national program to master Third Wave Technologies could still be carried out in the Philippines if future national leaders could be convinced that it is imperative for national independence, self-reliance, and progress.

## IX. TECHNOLOGICAL MASTERY FOR AN INDEPENDENT FOREIGN POLICY

In the present world situation, a nation's relationships with other nations are largely shaped by its economic relationships which, in turn, are principally conditioned by its scientific and technological capabilities. This explains why the Philippines is not yet in a strong position to pursue an independent foreign policy. Its relationships of economic and technological dependence on the advanced countries, principally the United States and Japan, prevent the Philippines from realistically charting an independent foreign policy notwithstanding the occasional nationalist rhetoric from national political leaders.

As we pointed out in the preceding sections, the new scientific and technological revolution is starting to place Third World countries at a serious disadvantage in the international division of labor as it threatens to upset current comparative advantages and to offset the Third World's natural resource endowments. In the next century, a nation's power will no longer be a function of its military or financial might; it will be largely dependent on its technological superiority. Technologically inferior and dependent nations like the Philippines are liable to become technological colonies by the 21st century as technological imperialism replaces the military-financial imperialism of the present and past centuries. The looming shadows of this coming technological imperialism can already be discerned from the emerging globalization of information databases and communication networks under the control of a few advanced countries.

The only way to counter this emerging technological imperialism is through the national mastery of these new technologies and the pursuit of collective regional technological self-reliance with our Southeast Asian neighbors. Realizing the strategic importance of mastering new technologies, most of our ASEAN neighbors have begun building up their scientific and technological infrastructure and resources in preparation for the next century. In the process, they have left the Philippines behind in terms of scientific and technological development. So unless our national leaders wake up and start doing something about our deteriorating technological situation, our country will most certainly find itself an economic basket case and a technological colony in the 21st century. In such a situation, no amount of nationalistic rhetoric will enable us to pursue an independent foreign policy.

In conclusion, we are convinced that an independent foreign policy can be realistically pursued only on the basis of a self-reliant, self-sustaining economy, which in the face of the new scientific and technological revolution, can only be realized through the national mastery of the new technologies that are revolutionizing all aspects of human cilization.

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