Information Technology and Industrialization Policy in the Third World: A Case Study of Singapore, Malaysia, and Indonesia

Morris H. Crawford

Program on Information Resources Policy

Harvard University

Center for Information Policy Research

Cambridge, Massachusetts

A publication of the Program on Information Resources Policy.

Information Technology and Industrialization Policy in the Third World: A Case Study of Singapore, Malaysia, and Indonesia

Morris H. Crawford
August 1984, P-84-4

Morris Crawford is President of International Informatics Consultants.

Printing 5 4 3 2

December 1988

PROGRAM ON INFORMATION RESOURCES POLICY

Harvard University **Center for Information Resources Policy**

Affiliates

Action for Children's Television
American Telephone & Telegraph Co.
Ameritech Publishing
Anderson, Benjamin, Read & Haney, Inc.
Apple Computer, Inc.
Arthur D. Little, Inc.
Auerbach Publishers Inc.
Automated Marketing Systems
Bell Atlantic
BellSouth Corporation
Booz-Allen & Hamilton, Inc.
Bull, S.A. (France)
Centel Corporation
CMC Limited (India)
Commission of the European Communities
Communications Workers of America
Computer & Communications Industry Assoc.
Computer Intelligence
Continental Graphics Corp.
Copley Newspapers
Data Communications Corp. of Korea
Department of Communication (Australia)
Dialog Information Services, Inc.
Direction Generale des Telecommunications (France)
Dow Jones & Co., Inc.
Dun & Bradstreet
Gannett Co., Inc.
Gartner Group, Inc.
GTE Corporation
Hitachi Research Institute (Japan)
Honeywell, Inc.
IBM Corp.
Information Gatekeepers, Inc.
Information Industry Association
Interconsult
International Data Corp.
International Resource Development, Inc.
Invoco AB Gunnar Bergvall (Sweden)
Knowledge Industry Publications, Inc.
Korean Information Society Development Institute
Lee Enterprises, Inc.
John and Mary R. Markle Foundation
MCI Telecommunications, Inc.
McKinsey & Co., Inc.
Mead Data Central
MITRE Corp.
National Telephone Cooperative Assoc.
The New York Times Co.
NEC Corp. (Japan)
Nippon Telegraph & Telephone Corp. (Japan)
Northern Telecom Ltd. (Canada)
Nova Systems Inc.
NYNEX
The Overseas Telecommunications Commission (Australia)
Pacific Telesis Group
Pitney Bowes, Inc.
Public Agenda Foundation
Research Institute of Telecommunications and Economics (Japan)
RESEAU (Italy)
Rizzoli Corriere della Sera (Italy)
Saint Phalle International Group
Salomon Brothers
Scaife Family Charitable Trusts
SEAT S.P.A. (Italy)
Southam, Inc. (Canada)
Southern New England Telecommunications Corp.
State of California Public Utilities Commission
State of Minnesota Funding
TEKNIBANK S.p.A. (Italy)
Telecommunications Research Action Center (TRAC)
Tele/Scope Networks, Inc.
Third Class Mail Association
Times Mirror Co.
United States Government:
- Department of Commerce
  - National Telecommunications and Information Administration
- Department of Defense
  - National Defense University
- Department of Health and Human Services
  - National Library of Medicine
- Department of State
  - Office of Communications
- Federal Communications Commission
- General Services Administration
- National Aeronautics and Space Administration
- National Security Agency
- U.S. General Accounting Office
- United States Postal Rate Commission

United Telecommunications, Inc.
US West

Table of Contents

List of Illustrations

Executive Summary

Singapore, Malaysia, and Indonesia rank at the top of the Third World in post-colonial development. After two decades of growth rates double those of the United States, they are moving towards a high tech mode and are incorporating computer-communication usage as a leading element in development policy.

-- Like other Third World nations that are promoting high tech, Singapore, Malaysia, and Indonesia regard government intervention as essential for success. The crux of the "information technology strategy" is reliance on "industrialization coordination" of the flow and use of technology. Some Third World strategies are autarkic in intent as well as in effect; the Southeast Asian versions are internationally oriented in principle -- though they sometimes stray in practice:

(1) primary emphasis is on applications of computer-communications;

(2) the principal objectives are to strengthen international competitiveness or accentuate perceived comparative advantages;

(3) commercially proven technologies that are readily exploitable are preferred for industrial and commercial applications;

(4) implementation is primarily private sector and foreign investment;

(5) subsidies are usually limited to training and education, research and development, and telecommunication infrastructure.

-- Singapore is the most advanced technologically and has the most tightly structured planning system. High tech strategy is formulated and followed up centrally, with an acute sensitivity to what is workable.

-- Basic decisions a decade ago have led to a world class telecommunication system that reinforces other economic strengths, especially in finance and trade. Singapore's financial center is a product of the strategy, the consequence of a managed fusion of financial and telecommunication technologies and of the managed advance to progressively more sophisticated levels. Similar technological convergences have been successfully promoted in engineering and tool design, shipbuilding, printing and publishing, wood and paper products, microelectronics, and medical equipment. Singapore is currently aiming to establish itself as the software center of the region and is erecting the research and training structure for that purpose, intending to repeat their success in financial services.

-- Regulatory problems are arising, however, in dealing with successful technological convergences. Revisions in financial regulations over the past two years have created a turbulent atmosphere in Singapore's international finance community. This may be troublesome for future technology transfers.

-- Malaysia is larger than Singapore, more diffused demographically, and more diverse politically. This necessitates different organizing principles and different priorities in economic planning. Thus, development administration is less intensive and more loosely structured, and a large part of the telecommunication budget is spent on rural areas and small towns, less on business needs.

-- Progress in computerizing industry and commerce and in computer-communication applications is proceeding steadily. Major usage is found in banking, insurance, estate management, oil drilling, electronics, wood and paper products, transportation, electric power,

and government agencies. The microcomputer has led to greater business usage and internal networking. Upgrading of telecommunications and packet switching in the next 2-3 years is expected to stimulate corporate and intercity networking.

-- Political indecision on critical economic issues may have held back a more active strategy. Malaysia is considering major shifts, promoting heavy industry production, deregulation of some sectors, and sale of public enterprises. The pace and direction of high tech will be influenced by this debate.

-- Indonesia is the largest and most populous of the three countries, with ambitions to match its size. But, its policies necessarily pursue distant goals, for computer-communication usage is still on a limited scale.

-- The foundation for nationwide telecommunications has been broadened by the PALAPA satellite system. New terrestrial support planned in the next five years should ease computer-communication applications and pave the way for a unified marketing system needed for industrialization. A major national program for research and technology answers a second policy imperative. It provides for training and technology appraisals for short term industrial needs, and for the long term scientific and professional requirements of a high tech economy.

-- These programs lay a technological base for Indonesian policy. Two key political hurdles remain; reforming an array of economic controls that thwart efficient management; and providing jobs for a growing urban work force. These are formidable issues that have neither quick nor easy solutions. The persistent efforts of recent years, however, have shown that progress is possible, suggesting that

Indonesia's step-by-step policy for a knowledge based economy is feasible.

-- The international implications of Third World movement into high tech are of great importance because of the shift in economic power that might ensue. While speculation on this prospect is premature for a Third World economic strategy still in its formative years, it is essential to consider how trade and investment are affected by what is happening now in these Southeast Asian nations, particularly (1) the large expansion factor in their trade and foreign investment, and (2) the rising technological component of their imports and capital growth.

-- Japan, with a 20% share of a $59 billion market compared to U.S. 12%, is the leading external force in the area. U.S. companies are advantageously placed for an increasingly high tech market. The competition hinges on many factors, the most important of which is recognition by corporations and government of the new economic forces operating in these countries. Of particular relevance are:

(1) satisfying requirements for technologically converged equipment, services, integrated industrial systems, and appropriate managerial guidance;

(2) adapting to changing regulatory cultures brought about by technological convergence, rapid growth, and advancing technologies;

(3) searching for acceptable international standards for computer-communication goods and services, and answers to other international regulatory issues;

(4) maintaining open markets for manufactured exports of these countries.

-- A new perspective of international interdependence may be called for. The advanced nations whose government and businessmen grasp the new perspective and adapt it to trade and technology relations will be best positioned to prosper from the economic strengths that are developing in Southeast Asia.

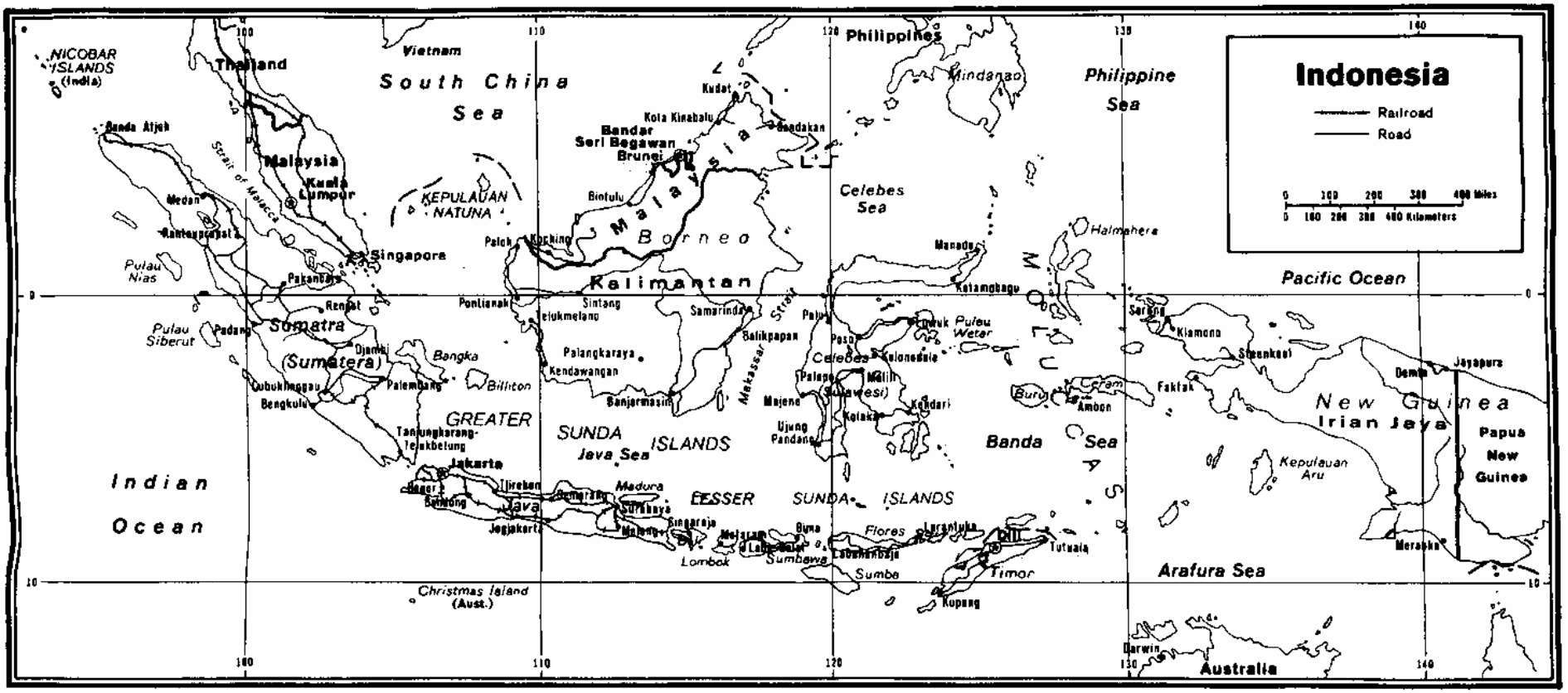
Preface

This study examines the development and commercial use of information technology in three countries in the Third World. Several developing countries are making significant advances in computer-communications by linking their production and use to industrialization. What are they doing to accelerate information technology advancement? What impact will it have on their overall development? How will this affect international trade and investment? These are the questions for this study of Singapore, Malaysia and Indonesia.

In the research for this project a large number of officials, businessmen, and educators in Singapore, Malaysia, and Indonesia were interviewed and many others were contacted for information, documentation, ideas, and opinions. Deep appreciation is expressed for the invaluable help and guidance received from the men and women whose names and affiliations are listed in Appendix A.* These persons, however, are not responsible for nor necessarily in agreement with the views expressed herein, nor should they be held accountable for any errors of fact or interpretation.

---

* A summary of some of the interviews may be found in an earlier Program publication. See Morris H. Crawford, Data Communications and Industrial Policy in Southeast Asia, A Summary of Interviews with Nine Government and Industry Leaders in Malaysia, Singapore, and Indonesia, Program on Information Resources Policy, Cambridge, Massachusetts, August, 1983.



Vital Statistics

	Malaysia	Singapore	Indonesia
Area	24,600 square miles	382 square miles	1,189,780 square miles
Population	14.2 million	2.5 million	149 million
Per capital income	$1,940 (1981)	$4,071 (1981)	$530 (1981)
Gross domestic product	$24,770 million	$12,910 million	$ 84,960 million

Map Source: U.S. Dept. of Commerce
Statistics: World Bank

Introduction

Information Technology and Industrialization Policy in the Third World

Several Third World nations are making impressive progress in the production and employment of computers and communication goods and services. Their achievements are not the result of good fortune or accident. What they are doing is the consequence of industrialization policies in which information technologies have a key activating role. Three distinctive policy patterns have been followed.

Brazil and India are producing a limited range of products and services for domestic markets that are protected by infant industry regulations. Korea, Taiwan, and Hong Kong are focussing on internationally competitive production and export of microelectronic goods and services. In Singapore, Malaysia and Indonesia, policy is oriented toward applications of products and services that improve international competitiveness in both domestic and foreign markets.

The achievements of these nations represent a breakthrough for the Third World. By using information technologies as a means to industrialization ends, these countries are advancing national development at the same time that they are energizing technological capacity. They have initiated a Third World industrialization strategy that is of great importance for themselves and for others. The consequence of the information technology strategy could be momentous: for the nations adopting it, if they can sustain it; for other developing countries, if they can apply it in their circumstances; and for the advanced nations, if they can cope with the new competition.

This case study of Singapore, Malaysia, and Indonesia addresses these questions. It is an analysis of industrialization policy in national environments where the use and production of computers and communications are key elements in an stylized strategy. Part I is an analysis of the historical evolution of industrial advance in each of the three countries. It looks at the economic foundations on which each nation is employing information technology and shows how this is related to industrialization planning. Part II is an examination of the policy framework for an information technology strategy, and a description of the theoretical structure of the strategy as it is employed in Southeast Asia. Part III is an assessment of the impact of the information technology strategy for the U.S. and other countries, especially as it relates to the competition between the U.S. and Japanese firms for markets and investment outlets.

PART I

Information Technology and Industrial Development in Southeast Asia

A dynamic economic life is a latter day experience for Southeast Asia. Forty years ago Indonesia was a Dutch colony, and Malaysia and Singapore were territorial outposts of the British Empire. Today, income and production levels are 300 to 600 percent higher, and all three nations are active parts of an East Asia complex that is widely regarded as the world's most promising center of growth.

Each nation attained independence with a politically divided populace. This was unsettling for Malaysia and Singapore, but devastating for Indonesia. The first years of independence for Indonesia have been accurately called "twenty years of failure."[1] This was not corrected until 1965 when a bloody uprising led by the Communist Party of Indonesia was suppressed and a "New Order" took form under General Suharto and slowly built up the political environment needed for economic progress. Communist insurgency and racial tensions in the Federation of Malaya menaced stability for a decade or longer, impeding but not halting economic development. By 1965 the insurgency had been overcome and racial tensions had been considerably eased by splitting the Federation into two separate nations of Malaysia and Singapore.[2]

1. The New Growth Centers

The mid-1960s were a threshold for these Southeast Asian countries, the beginning of an era of domestic stability and steady economic advancement. Popular governments were clearly in command in Malaysia and Singapore, and Indonesia's Presidential Election in 1968 legtimized Acting President Suharto's three year regime. In 1967 the three

governments entered a joint declaration with Thailand and the Philippines, establishing the Association of Southeast Asian Nations (ASEAN).[3] ASEAN reopened vital links for regional communications, transport, trade, and financial transactions. The pact also provided political sanction for practical cooperation and coordination of many common economic interests and a forum for discussing economic differences. It ended Indonesia's economic isolation from its closest neighbors, to the great benefit of all three nations. The ensuing years have offered a composed environment in which the resources of Singapore, Malaysia and Indonesia could be concentrated on the pressing problems of economic development.

All three nations benefitted from the rise in oil prices in the 1970's, Indonesia and Malaysia as producers and exporters, and Singapore even more as a middleman and supplier of drilling and refining services. The results can be seen in the high growth rates of the 1960's and 1970's.[4] Indonesian improvement was the most spectacular, with growth averaging 7.6 percent a year in the 1970's compared to 3.9 percent in the previous decade. Both Malaysia and Singapore had been experiencing rising growth throughout the 1960's. Higher rates of 7.8 percent per annum for Malaysia and 8.5 percent for Singapore in the 1970's extended already impressive rates of advance.

All three countries have had economic growth substantially above other parts of the world. While the U.S. and other members of OECD have been slowing down, Indonesia, Malaysia, and Singapore have been moving ahead at a brisk pace, recently at rates comparable to the more publicized East Asians in Korea, Taiwan, and Hong Kong.

Figure 1

Growth of Real Gross Domestic Product
of
Singapore, Malaysia, and Indonesia

	Average Annual Rate of Growth	
	1960-70	1970-80
Indonesia	3.9	7.6
Malaysia	6.5	7.8
Singapore	8.8	8.5
Other Countries		
U.S.	4.3	3.0
Other OECD	5.2	3.2
Other East Asia:		
Korea	8.6	9.5
Taiwan	6.7	7.2
Hong Kong	10.7	9.3
Japan	10.9	5.0

Source: The World Bank, World Development Report, 1982. Washington D.C., 1983. Data on Taiwan are from Edward K.Y. Chen, Hypergrowth in Asian Economies, Holmes and Taylor, New York, 1979, and Taiwan Statistical Data Book, Executive Yuan Council for Economic Planning and Development, Taipei, 1980.

External loans and grants and foreign investment have been very important in the growth performance of these countries. Such external assistance has been especially valuable in infrastructural and agricultural development in Malaysia and Indonesia, perhaps vitally so for the latter. Foreign investment has been increasingly important in bringing new industries into all three. In Singapore, the volume of foreign investment has been extremely high for several years.

The decisive factors in high growth performance, however, have come from the inside. High domestic savings, large domestic capital investment, and strong export performance have been the critical ingredients. The high growth rates would not have been possible without these internal accomplishments.

Figure 2

Sources of Economic Growth

	Domestic Savings (% of 1980 GDP)	External Capital (% 1980 GDP)	Export Growth (1968-1980)	Manufactured Goods Export Growth (Annual Rate of Increase 1970-1980)
Indonesia	30%	4%	1251%	24%
Malaysia	30	5	1311	21
Singapore	32	16	1524	27

Sources: a. Statistical Yearbook for Asia and the Pacific, 1978, United Nations Economic Commission for Asia and the Pacific, Bangkok, 1978. World Development Report, 1982. World Bank, Washington D.C., 1983.
b. World Development Report, 1982, op. cit.
c. Parvez Hassan, Growth and Structural Development in East Asia, World Bank, op. cit.

The data in Figure 2 show the very high levels of savings that have been characteristic of Southeast Asia for the past two decades. Rates of domestic savings of 30-32 percent a year may be compared with U.S. savings of 17 percent of GDP in 1980, and the average rate for all industrialized countries of 22 percent. High domestic savings levels have been achieved through high public savings. They have been of crucial importance for capital formation in all three countries, enabling capital stocks to grow much more rapidly than domestic production. Indonesia's new investments have expanded twice as fast as production, permitting the country to raise annual investments ten fold in a single decade.

The second domestic source of economic growth--expansion of exports--is also shown in Table 2. In all three countries exports have grown faster than domestic production. Substantial amounts of the foreign exchange that is vital for development have been provided from the resources of these nations themselves.

The rapid pace of activity has led inevitably to significant structural changes. In twenty years, production in Indonesia tripled, in Malaysia it quadrupled, and in Singapore it quintupled. The results may be seen in Figure 3, which shows the shift between 1960 and 1980 away from agriculture, services, and primary production toward industrial production.

Figure 3

Structural Composition of Gross Domestic Product

1960-1980

	Percent of Gross Domestic Product					
	Singapore		Indonesia		Malaysia	
	1960	1980	1960	1980	1960	1980
Agriculture	4%	1%	54%	26%	37%	24%
Industry*	18	37	14	42	18	37
(Manufacturing)	12	28	8	9	9	23
Services	78	62	32	32	45	39

*Includes extractive industries.

Source: World Development Report, 1982, op. cit., p. 114.

These data indicate a relative increase in Singapore's modern manufacturing sector from 12 percent of GNP in 1960 to 28 percent in 1980. In Malaysia the shift was similar, from 9 percent in 1960 to 23

percent in 1980, with dependence on agriculture correspondingly declining. The structural shift in Indonesia has been more modest, with manufactures rising from 8 percent in 1960 to 9 percent in 1980, according to World Bank figures. Indonesia has significantly diminished its dependence on agriculture as a source of income despite a steadily rising agricultural output of nearly 4 percent a year.

An inevitable consequence of the structural changes in the three countries has been growing international interdependence. Each country has become highly reliant on international trade. For Indonesia, exports are 26 percent of GDP, for Malaysia they are 52 percent, and for Singapore, exports (including reexports and entrepot trade) are 162 percent of GDP. Japan is the principal trading partner of all three, and the country from whom each buys between 20-30 percent of all imported goods.

Interdependence has been a source of strength, as prosperity at home has been inseparable from success in trade and finance abroad. Global and regional interdependence have become tacit assumptions underlying both past accomplishments and future expectations. But interdependence has its price. International recession spreads through declining markets and foreign investments, and the Southeast Asians have shared in the consequences of the worldwide recession and financial crisis of 1981-83. All three countries have seen economic activity recede. In 1982 growth rates were only one half of earlier levels--even less for Indonesia. By late 1983, however, signs of recovery were beginning to appear.

The impact of the financial crisis has not been as severe in Southeast Asia as in other parts of the world. But because of adverse

current accounts caused by declining exports, retrenchments have been necessary in all three countries, and further cuts in public spending may be in order. External indebtedness, however, is modest and accounts are probably manageable unless the global economy turns sour. The world crisis has also stimulated all three countries to reassess industrial policy and in the course of that rethinking to reexamine the role of technology in industrialization.

2. Singapore's Intensive Economic Style

Singapore's spectacular record is due in great measure to the driving leadership of Lee Kuan Yew, who has headed the nation for more than two decades. Lee is a "hands on" chief executive, with a total commitment to economic advancement through a meritocracy. His work ethic aligns traditional belief with dedication to modern technology. To move into the "technetronic era the Americans have created," Lee thinks, it is necessary to graft onto old value systems and behavior patterns, new mores that "encourage punctuality, work discipline, the desire to increase production norms, the acquisition of scientific knowledge, and engineering techniques." Success, Lee concludes, is "only possible if the people are intense in the pursuit of these goals."[1]

Lee's economic philosophy is embodied in the Economic Development Board. The EDB is often called the MITI of Singapore, and its resemblance to the Japanese institution is not entirely coincidental. But EDB's inspiration is Lee Kuan Yew, and it performs with a unique Singapore flair and dedication.

EDB has responsibility for drawing up a national development strategy and negotiating the public-private consensus for implementing it. It is also responsible for mid-course corrections when a mistake has been made or circumstances change. Finding and removing bureaucratic obstacles is as much a duty as initiating projects. EDB is not an economic czardom. It is a consensus maker among agencies and corporations that command much larger financing. Its modest operating budget is less than $5 million.[2]

Functionally, EDB coordinates action in industries that have been identified for their prospects for high value-added production, or for being technology intensive, or for both. These objectives are sought through orchestrated inducements for foreign and domestic investment, skill raising, and for promoting research and development.[3]

EDB's impressive record is not spotless. Frequently, it is necessary to compromise between reasoned goals and entrenched interests. Identification of prospective winners is inexact and even slight errors can be costly. EDB has been faulted recently for causing an overbuilt hotel sector and for failing to spot the recession in time to take cover. But EDB's performance is often shored up by its facility for shifting direction when an operation is headed for trouble.

EDB's planning and implementation are supported by a worldwide network of offices (four in the U.S.) that are charged with maintaining up-to-date information on fields of current interest to Singapore. A major function of this network is to stay abreast of markets in order to forecast in detail what the demand is for Singapore's products. This information is utilized in particular in determining long-run strategy. The network is also expected to seek out prospective

firms and investors who possess the sought-for technology, financing, and managerial competence. Such firms are attracted to Singapore through tax incentives and capital allowances that are geared for restructuring the manufacturing sector toward higher value-added and technology-intensive products and services. Similar inducements are also offered to existing local and foreign firms to encourage their upgrading of plant and labor skill requirements.

Singapore is now looking to information technology employment as the principal instrument for implementation of the next phase of its industrial revolution. "Creating new markets through product development and innovations" is the watchword of the strategy.[4] Without the cost and productive efficiencies from a high technology economy, the Director of EDB says, Singapore will fall behind, lose competitive position, and fail in the struggle for export markets.[5] And it is the export market on which prospects depend, not the domestic market. For every dollar of gross national product it is necessary to generate $1.75 in exports of goods and services.

Telecommunications

A key performer in Singapore's strategy is Telecoms, the Telecommunication Authority of Singapore. Telecoms and telecommunications have had an important auxiliary role in the advance of every industry in Singapore. And not by chance. The telecommunications role in particular was critical in making Singapore's financial community into a regional and a world center. Every important bank in the world, says the Economist, now has a representative in Singapore or Hong Kong, or both.[6] Why? Because, the Chairman of

Telecoms says, Singapore "has consolidated its position as a communications center."[7]

Foreign banks and financiers have been attracted to Singapore for many reasons: the nation's high savings; its local and regional investment facility; the region's demand for banking services; and the hospitable banking and financing regulations found there. All of these attractions for profitable financial operations hinge on the fact that international banking and finance are communications-intensive industries. Singapore's objectives could not have been achieved without a strong and responsive communications system. Their success was the result of skillful blending of several factors, each of which reinforced the others in Singapore's claim as a financial center.

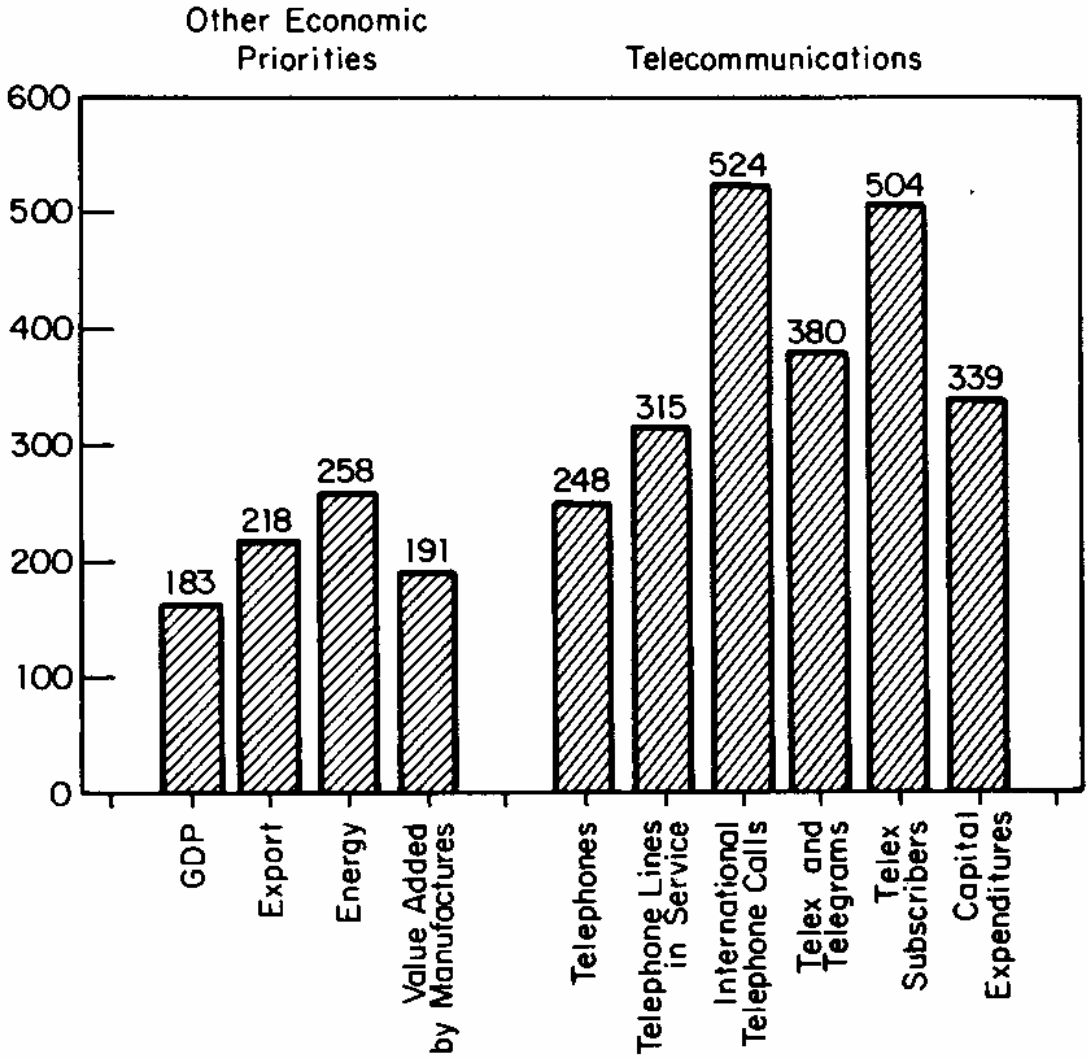
Telecoms' role as a leading edge can be seen in its past performance. Compared to other high priority elements of economic activity, such as energy consumption and production of manufactured goods, telecommunications services have expanded at a much faster pace. The accompanying table shows several measures of telecommunications services in relation to other factors. Between 1974 and 1980, for example, energy consumption grew at 17 percent per year while international telex grew at a 24 percent pace. Value added in manufacturing expanded 91 percent in 1974-80, while capital outlays for national and international telecommunications rose 239 percent.

Statistical comparisons are less important than their explanations. The strong growth in telecommunications services reflects a more than proportionate increase in demand for commercial communications as the

Figure 4

Telecommunications in Singapore's National Economy

Comparative Performance - 1974-80
(1974=100)



Comparative Performance 1974-80
(1974= 100)

Sources: World Development Report, 1982, op. cit. Statistical Yearbook for Asia and the Pacific, 1978, op. cit. Telecoms Annual Report, 1981/82, op. cit.

economy prospered. The Telecoms strategy consisted of anticipating that increase in demand, in particular the growing importance of information systems and data communications for corporate management.[8] Anticipating the impact of information technology advances on corporate accounting and finance, Telecoms arranged its facility planning so as to provide large corporations with what they needed in order to manage their activities efficiently.

Among the special services recently introduced are a public data exchange, multi-access telex, teleconferencing services, and electronic teletype terminals with memory. High quality lines have been available for lease on a dedicated basis for many years, and can usually be committed on request. Domestic lines have been progressively upgraded to accommodate the high speed equipment of some users. Digitization of the domestic system is anticipated, though a program for complete digitization has not been finalized. Both satellite and submarine cable facilities have been enlarged, particularly important for both transoceanic and regional links with other ASEAN members.

A major factor in Telecoms' ability to respond to user demand is its financial autonomy. In an era of technological advance, the World Bank's study on telecommunication development points out, financial and managerial autonomy are essential for professional discipline and flexibility to meet evolving needs and opportunities.[9] The 1974 legislation for present day Telecoms operations provides the mechanisms for self-financing. Telecoms prices its services so as to pay for future facilities expansion from earnings. Domestic service and commercial rates are comparable to rates in other parts of the world for similar high grade services. Residential rates have been unchanged for

the past decade; commercial rates have been lowered substantially over the years, reflecting technological improvements and productivity growth. The overall result is that the margins between costs and earnings produce substantial profits that are currently running about one-third of operating revenues. These are apportioned each year by Telecoms. An annual dividend that is paid to the Ministry of Finance is negotiated each year with the Ministry. In 1982, for example, 8.5 percent of net revenues were turned over to the Treasury and the remainder stayed in Telecoms. This procedure has enabled Telecoms to finance new facilities and add new services without having to seek funds from the government or from the financial markets.

One result is Telecoms' solid financial position: its outstanding indebtedness to the World Bank and the Singapore Government amounted to S$72 million,* compared to a development reserve of S$1,284 million at the end of 1982.[10] This method of financing has made possible an aggressive policy in investing in new facilities and has provided the necessary funding for international systems, such as INTELSAT, Inmarsat, and the ASEAN submarine cable network. Telecoms' capital expenditure program over the next five years (1983-88) is no less aggressive than in the past. Expansion costing S$2,905 million is planned, which will more than double present fixed assets and will go primarily for technological improvements. According to Chairman Frank Y.C. Yung, this expansion program will be financed internally, without resort to large-scale external borrowing.[11]

Not surprisingly, Singapore's telecommunication system is well-regarded by those who rely on it. Many users comment on the quality of

---

* The current rate of the Singapore dollar is $S52.09 = $US 1.00.

service and the responsiveness and foresight of Telecoms in handling problem situations and its promptness in answering requests to install new equipment or begin new services. They also refer to instances where approvals have been withheld. Although Telecoms approval is normally given unless technical compatibility or non-interference cannot be assured, other agencies may withhold approval, regulate usage, or limit operations for other reasons. These are the grounds for some complaints.

An example of dissatisfaction is related to the use of automatic teller machines. The ATMs have been technically approved for sale and use in intrabank networks connected through the telecommunication system to bank headquarters in Singapore. The banking authorities, however, have interpreted the use of ATMs as a part of a branch bank operation. This causes little difficulty for local banks or established banks that have numerous small branches throughout the city; but it severely restricts employment of ATMs by foreign banks and newly arrived banks that have limited branch bank operations and are unable to get approval for them.[12]

Another similar controversy arose in 1982 over the handling of certain international financial transactions. A complicated chain of financial movements was stimulated by the abolition of foreign exchange controls in 1978. One consequence of the action was to allow all banks in Singapore to accept local currency deposits for overseas accounts. These deposits were automatically credited in an account of the depositor in a branch or associate bank abroad, usually Hong Kong. Such deposits were not subject to the 26 percent reserve requirement that the Monetary Authority of Singapore imposes on all on-shore deposits. But

the deposits often returned to Singapore in the form of "inter-bank" deposits that were also exempt from the reserve requirements. The Monetary Authority concluded that several banks were engaging in "round tripping," handling what were in reality local deposits in a manner that evaded the reserve requirement and gave them access to cheaper money. "Round tripping" is now prohibited and several banks, including Citibank, have been levied stiff fines.[13]

Computer Production and Applications

A second arm of Singapore's strategy is centered on computer production and use. Singapore's economy has been turning towards computer and related electronic industries for many years. Electronics has become Singapore's largest industry, measured either in numbers of jobs or value added by manufacturing. The 65-70,000 jobs in electronics in 1981 were about 7 percent of the labor force, and gross production of electronics of about S$5.9 billion was about 15 percent of total manufacturing output.

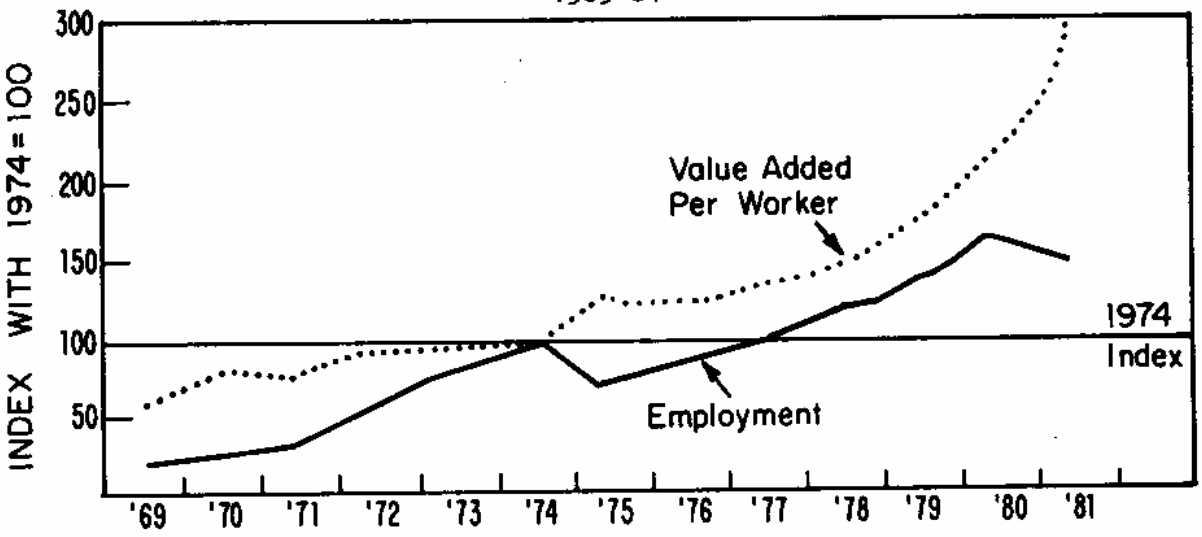
A significant transition in the electronics industry began in 1974. Since then the industry has progressively moved away from labor-intensive and toward higher technological content- and worker-skilled products. The transition was a calculated one. Incentives policies have discouraged investment in labor-intensive production; potential investors have been encouraged to look elsewhere for low wage and unskilled worker requirements. Minimum wage scales have been pegged at relatively high levels to discourage investment in electronics production that is highly labor intensive.[14]

These policies have produced the desired results. In the 1969-74 period, electronics jobs increased at a much higher pace than value

added per worker, an average of 40 percent a year in jobs, compared to a 9.5 percent average improvement in value added. Since 1974 the comparison has been reversed. Value added has continued upward at a higher 16 percent rate, while the increase in overall employment in electronics has dropped to a 7 percent pace.

Figure 5

Transition to a High Value-Added
Electronics Industry
1969-81



Source: "The Electronics Industry in Singapore," Economic Development Board, Singapore, 1982.

The significance of this transformation should not be missed. But it shows only one side of Singapore's strategy. The objective is to turn Singapore into an island of high value added production. The computer and electronics industries are given high priority when they produce high value added results. Their high priority is equally a consequence of the vital role that computerization and computer-communications have in elevating manpower productivity in other technology intensive industries. Electronics is 15-20 percent of

Singapore's manufacturing output; it is the remaining 80-85 percent that is the main target of the strategy.

Priorities within the computer and electronic industries, accordingly, have been progressively turning toward software applications and specific usage. Advances in hardware production are emphasized only when justified on pragmatic grounds.[15]

The centerpiece of Singapore's effort in computer applications is the newly created National Computer Board (NCB). The NCB was established in 1981 on the recommendation of the Committee on National Computerization. The objectives of the NCB are to reduce and eliminate the shortage of trained computer professionals and to assure professional standards that are of international caliber at all levels of requirement. Its mission is to establish Singapore as an international center for computer services.[16]

Most of NCB's activities are aimed at training within Singapore itself. International scholarships are also granted each year for graduate and undergraduate study in the U.S., Japan, and Europe. In Singapore much of NCB's initiative has involved the National University of Singapore. The program of the Computer Science Department is being enlarged to turn out about 200 graduates a year by 1985. A new post-graduate institute, the Institute of Systems Science (ISS) has been set up jointly by the National University of Singapore and IBM. ISS will train 100 systems analysts a year as well as provide upgrading and other refresher courses and seminars for working professionals.[17]

Other newly formed schools give training in special fields and specific aspects of computerization. The Japan-Singapore Institute of Software Technology gives diploma courses and provides training for

programmers and systems analysts. The JSIST is a part of the new science center in the Jurong industrial estate. It also runs familiarization courses for senior executives and retrains software specialists on new programming languages. The Center for Computer Studies is a joint endeavor of the Ngee Ann Polytechnic and International Computers Limited of the United Kingdom. It provides training and offers diploma courses for programmers at the sub-professional level. The CAD-CAM Training Unit that opened in 1982 and the Robotics Institute that will open in 1985 are other specialized institutes.

An important part of NCB's functions is to establish high grade, international standards for the buildup in computer professionals. A Professional Standards Secretariat has been set up to regularize standards of computer training through publicly held examinations. An agreement has been made for jointly held professional examinations with the British Computer Society. Arrangements are being made with the Ministry of Trade and Industry in Japan and with the Institute for Certification of Computer Professionals in the U.S. to assure reciprocal recognition, accreditation, and syndication of publicly held examinations.[18]

Industry and Commerce

Tying it all together is the third part of Singapore's strategy, which is most often performed by EDB itself. Other advanced technologies must also be introduced and improved upon in order to accomplish economic goals. The thrust of policy is to produce goods and services in which Singapore has comparative advantage, a concept that is dynamic, not reliant on a static notion of resource base or resource

allocation. In formal terms, EDB's strategy for the 1980's is to exploit information technology uses that will promote maximum efficiency and productivity in industries that have potential for fast growth and in which Singapore can be internationally competitive.[19] In practice, EDB prepares a smorgasbord of industrial opportunities that looks promising and zeros in on those portions where the response from the business community looks like it will pay off. Both the dynamism of Singapore's pursuit of comparative advantage and the pragmatism and opportunism of its implementation are evident in the diversity of applications. Current priorities illustrate the strategy in a wide variety of specific circumstances.[20]

- EDB has worked closely with the printing and publishing industry, and has been instrumental in the industry's expansion of computerizing, typesetting, color separation, and book binding. Value added per worker rose by 17 percent in 1981 in a market where sales were rising.

- Both the timber products and textile industries have been declining and international competition has been sharpening. EDB has encouraged automation, upgrading of product lines, and greater catering to prestige design and high fashion markets. A new training center was opened in 1982 to improve manpower skills in textile production.

- The machine tool industry has been of special interest to EDB. Overall output and exports have been increasing in an industry that has been in the forefront of technological innovation. The diffusion of computer numerically controlled production, industrial robots, and flexible manufacturing systems are the principal innovations EDB is promoting. EDB has encouraged manufacturers to establish technical and engineering support centers for disseminating computer controlled

production of machine tools, precision engineered products, and tool and die fixtures. Official centers have been used for training in computer machining methods as well as in employing CAD-CAM in the machine tool industry.

- EDB's support for the electronics industry has been directed increasingly toward software support and applications requirements. Significant projects include production of dedicated software for microprocessor controlled products, portable microcomputers, computer printers, and computer keyboards. Automation and other computerized production has been supported in the semiconductor industry. Many software and hardware companies have been helped in establishing in-house software training centers. A major effort is underway to enhance electro-medical capabilities and to strengthen Singapore's position as a regional medical equipment and repair base.

One of Singapore's most successful high tech industries has been financial services, a product of technological fusion between the telecommunication, computer service, and financial service technologies. This sector now accounts for about 15 percent of the nation's annual production. Financial services have been steadily upgraded. Singapore has now reached an international stature as a financial center that has made its money accepted as an international currency. The financial sector is a textbook case of development levering. It is beginning in 1984 to move into several advanced areas of finance, loan syndication, fund management, and financial futures.

The style and method that have been hammered out in past experience are likely to be followed in the future. This means Singapore will consciously seek out industries and services in which dynamic

comparative advantages are strong, and will employ information technology to reinforce perceived natural advantages. It also means that the Government will not interfere where economic forces point to inefficiency and low profits, or to areas which are potential subsidy creators. Singapore's industrial profile will change in the 1980's as opportunities decline for high value added in traditional production lines, such as timber, non-specialty steel, furniture, textiles, and paper products. Research and development in electronics, telecommunications, instrument development and instrumentation, controlled robotics, CAD-CAM systems, laser systems, and electro-optical applications are sure to be given greater emphasis. Financial services and related trade and commercial services will continue to be major features in Singapore's increasingly high tech economy.

A Bright Future?

These are ambitious aspirations. Are they likely to be achieved? Success in the past two decades has been the result of a hard-driving, intensive style that has been tailor-made for this period in history. It may be logical to anticipate similar advancement in the next two decades. But several observers have questioned how well the past strategy will work in the future.

Skepticism is often perceived on philosophical and social psychological grounds. T.D. Allman, for example, recently expressed a widely-held belief that "well-governed, clean, and comfortable, affluent Singapore seems - to its critics - to have nourished the body but starved the soul."[21] Allman and similar doubters view Lee Kuan Yew's Singapore as an authoritarian state whose well-ordered and hard working people have passively fallen into line in a superficially successful

transition from simple commerce to a more complex industrial nation. These critics ask whether the work ethic of Lee Kuan Yew will prove too shallow for the requirements of a knowledge society. Will brain drain evacuate pools of the talented and educated? How will the Singapore elite measure up when spontaneity, intellectual curiosity, and independent thinking are the desired virtues rather than the "punctuality, work discipline, the desire to increase production norms" that Prime Minister Lee has espoused?

Such criticism seems to discount evidence of genuine intellectual vitality in Singapore. In truth, only time will show one way or the other whether the present intensive system can answer the intellectual challenges of the information age. Meanwhile, a large number of observers have been speculating about a post Lee Kuan Yew Singapore. This is not an idle concern for a country whose life style has been dominated by a charismatic leader for two decades. Other talented men have emerged. Some of them have been associated with the regime for many years, while others are of more recent vintage. There is no obvious heir apparent in the Prime Minister's political family, and formal opposition consists of one member against a Parliamentary majority of 74-1. Lee has expressed concern many times about his nation's future, but has done little to prepare for that day. He turned 60 years of age only recently, however, and shows no sign of either diminished energies or intention to give up or share his powerful position. A Post-Lee Kuan Yew era appears to be several years away.

A third concern is the possibility of a general world trend towards insular policies and a reversal of the past 40 years of growing world interdependence. All of Southeast Asia would suffer, Singapore probably

more than proportionately, from any pronounced turn towards a closed international economic order. On the other hand, its performance should continue to benefit if the U.S. and other powers continue to practice open economic policies.

3. Malaysia Considers A 1980's Dilemma.

Economic policies in Malaysia are shaped by different conditions than in Singapore. The country is much larger and its economic health is closely tied to primary products and related processing industries. Industrialization has been directed mainly at building on perceived comparative advantages in primary products. Socio-political objectives have a prominent place in policy making.[1] Just as in Singapore, Malaysia's leaders regard information technology as an indispensable tool of development which must be integrated in specific adaptations to development goals. But different conditions produce different results. Moreover, while Singapore's industrial policy lines seem firmly set, Malaysian leaders are debating the suitability of present industrial goals.[2]

Malaysia's Prime Minister Mahathir has been in office for three years. He is the first of the post-independence generation to reach top power in the country. He is a charismatic figure, an activist whose fiery speeches led to a temporary black-balling from Malay politics a decade ago. As Prime Minister, his crisp behavior in several international situations has fed conjecture that he would lead Malaysia into aggressive nationalistic policies. He has a confrontational style and has spoken with great vigor about shifting direction in Malaysia's

economy in order to correct industrial frailties that he believes will become increasingly onerous. In practice, Mahathir's government has been slow in moving the economy from the course of his predecessors. These able leaders had achieved significant progress for the Malaysian economy, creating a strong constituency for the status quo. Mahathir's politics, like his predecessors', are conditioned by dependence on a consensus of a loosely knit coalition of the three racial parties that has governed the country for three decades. In the face of a fragile racial-political balance, his policies have been advancing slowly, with relatively little departure from principles that have guided economic development in the past.

Malaysia's economic planning system has received high marks in international circles. The country has earned its reputation for sound monetary and fiscal management.[3] The system and its enviable growth records are the product of a professional group of planners who have traditionally functioned as a collegial body around the Prime Minister's office. The system's successes are dependent more on consensus at the top and good management down the line than on precisely defined planning objectives and exacting implementation. Administration of the system is decentralized, strategies are broadly conceived and implementation is loosely coordinated. The Economic Planning Unit (EPU) occupies a bureaucratic niche similar to that of Singapore's EDB. But Malaysia is larger in population and area, and has a more diverse economy. A more complex planning system is called for and a more formal management structure. This has important practical consequences. EPU is not responsible, as is EDB, for followup on priority areas identified in the planning process. The Malaysia Industrial Development Authority (MIDA)

runs the international field offices for the industrial program, as well as the extensive set of investment incentives that is designed to attract foreign investors. Other independent agencies, government ministries, departments, and semi-public corporations in Malaysia exercise more autonomy than their counterparts in Singapore. State governments, which do not exist in Singapore, have considerable authority over economic activity in their jurisdictions, especially in providing infrastructure for industrial estates and in setting policy for resource exploitation.[4]

Telecommunications

The Malaysian style of economic planning can be seen in the communication system that is run by the Department of Telecommunications. Telecoms provides efficient and modern telephone service that is available in all parts of the country. The World Bank gives its highest "A" rating to Malaysian Telecoms. All principal cities and towns, including those across the South China Sea in Sabah and Sarawak, are linked by telephone. Most parts of the country can be reached by direct dial. International service is available through land lines to Singapore, as well as through satellite communications and submarine cable systems. Many parts of the world are accessible by direct dial. Transmission quality, even in the more remote places, is comparable to most developed countries. The service is expanding continuously. The number of telephones is growing more than 10 percent a year, and Telecoms sees to it that a respectable proportion of new subscribers are in small towns and rural areas.

Telecoms traces its origins to colonial days. It took over a system of limited line coverage. But the system was in operating order,

with competent technical personnel, training facilities, and an effective organization. Telecoms inherited a sense of mission that is common to the European Post, Telephone and Telegraph Administrations (PTTs) concept of a monopolistic authority created to perform a public service. The tradition remains an important influence today. All classes of users are treated equally. Financial needs are filled through budget appropriations. Services are provided on the basis of recognized public need rather than anticipated profitability.

The telecommunications system has grown steadily since independence. Telecoms has about 30,000 employees, capital expenditures of about $350 million annually, and a budget that is, relative to national income, larger than Singapore's. It has a highly centralized structure, with users having to go directly to Telecoms in order to obtain access to the system, for procuring all services and maintenance, and for guidance and approval on installing internal equipment. Telecoms has a favorable record of upgrading both the quality as well as the volume of service. Technological improvements are regularly brought into the system, once the market is known and the technology has been proven in other systems. Manually operated switchboards were replaced many years ago. Computerized switching is used throughout for telex operations. Telecoms is midway through a countrywide program to replace electro-mechanical and crossbar equipment with digital switching.

As a member of INTELSAT, Malaysia has two earth stations for satellite communications, located in Malacca for satellites in Indian Ocean orbit, and in Kuantan for Pacific Ocean satellites. They were installed in 1970 and a second, larger, antenna was added at Malacca in 1982. With other ASEAN members, Malaysia utilizes the Indonesian PALAPA

satellite under a transponder lease that began in 1980. These links make it possible for Telecoms to provide international communications for high speed data systems, for television, for better quality voice circuits, and for other high tech services. Ground linkage between the earth stations and population centers has been upgraded also, generally through microwave installations.

Data communications will get a strong upward boost with the installation of a public data network that is now underway. Telecoms has called for bids on some portions of the network, which will be progressively enlarged until it encompasses all parts of the country. The network will employ a combination of cable, fiber optic channels, and microwave units. It will offer packet switching services to those who want them.

Currently, data communications is restricted to large scale users who can employ leased lines. This limits data communications to large, well-heeled companies. The public network should give smaller companies a better opportunity for employing information systems. It will give all users easier access to foreign data systems, especially the SWIFT system for international banking transactions.

Telecoms insists that market projections for usage of the public data communications network have moved dramatically upward in recent years. Some critics fault Telecoms for not beginning the network several years ago when it was included, but not implemented, in the 5-year plan. The delay has been costly, setting back employment of managerial and distribution improvements unnecessarily. Financial and banking interests have also been handicapped because of the slow start on a data communications system. Efforts to establish an effective

commodity exchange in Kuala Lumpur have been hampered by domestic information systems that seemed unattractive to dealers.

Telecoms' critics point also to other instances where slow decision making or unnecessary obstacles have hindered or sometimes prevented applications. The communications officer for a major multinational company said that the land lines available for data communications are often of poor quality. Some international links--for example, the carrier exchange from Kuala Lumpur to Kuantan and the land lines around Kuala Lumpur--are very good. Elsewhere, Telecoms has only voice grade circuits that limit usage to low speed equipment. Telecoms, he said, is slow in answering requests for new lines, in repairing breakdowns in service, and in approving new equipment. Telecoms requires that all new equipment for systems using its lines receive specific approval. Approval for terminals, copying machines, modems, and other devices is often not given, he said, and it always entails a long delay.

Some other commercial users confirm many of these comments. Several companies have experienced long delays in getting approval for new types of equipment. Approval has been denied in many instances. This has been puzzling in certain cases when the equipment was being sought in order to carry out a stated policy objective of the Malaysian government. Although the government is encouraging companies to set up data processing inside Malaysia--for example, by requiring that customer billing for financial services have a mailing address in Malaysia--advanced equipment for data processing may not be approved. And companies that use leased lines are required to limit use from one point to another. They are not permitted to install any form of

switching device on leased lines or interconnect through a terminal in a second site to a third site.

Some of Telecoms' commercial customers disagree with the critics cited in the foregoing paragraphs. Or they may consider the complaints not entirely relevant. The head of an international data service company said that his firm has never been refused a leased line. The brief delay in getting one is the result of a lack of capacity, not bad management. On the other hand, he said, users who have good management and foresee line needs are not hurt if they have to wait a while before getting one. Another communications director of a multinational company flatly disputed the assertion that high capacity equipment cannot be used on the Malaysian system. His company, he said, has high capacity equipment in several locations in Malaysia and has not experienced difficulty in using Telecoms lines except when operators use their equipment improperly. Several said that they had no difficulty in getting equipment approvals when standard specifications followed by Telecoms were involved.

Even Telecoms' strongest critics recognize its reputation as an outstanding performer and consider that its record as a public servant is superior. It seems fair to conclude that much of the criticism reflects Telecoms' history as a public service institution in the traditional sense. Telecoms does not appear to envision itself as a leading edge for moving the Malaysian economy into a high tech phase of a long term development strategy. Most of its R&D work is associated with training of personnel, which has first priority, leaving limited time and resources for initiating projects on new technology adaptations.[5] None of the Malaysian businessmen interviewed regarded

Telecoms as taking initiatives to open the way for their use of sophisticated equipment. All of the international business community interviewed said that Telecoms was helpful when requested, but otherwise passive in bringing the domestic economy into the information technology era. Several considered that permitting the private sector a greater role in some of the new technology areas of communications would improve performance, and a few supported privatization of all telecommunications functions.

Malaysia Telecoms has a different and contrasting role to Singapore Telecoms. The latter's function is that of an initiator and a leading edge in an intensive strategy. Malaysia Telecoms role, on the other hand, is that of a trailing edge in a passive atmosphere. Although Malaysia's expectations are clear, it has no master plan for either information technology or industrialization, and Telecoms practices are consistent with this basic fact. Specific objectives are set by the course of events, not masterminded by Telecoms.

Computerization

Computerization of the economy is a second area where Malaysian policy is advancing industrialization through information technology. The government's efforts in computerization are directed by the Modernization and Manpower Planning Unit in the Prime Minister's office. This unit provides guidance and consulting assistance to all elements of the government. It is also responsible for leading the nation's effort to correct the stringent shortages of professional and technical manpower in the computer fields.

Prime Minister Mahathir has taken a personal interest in government computerization by instructing his cabinet members to look into using

them in operations of all federal and local organizations. Special feasibility studies have been conducted for some of the organizations and others are independently preparing for enlarging and upgrading their computer systems.

Several government bodies have been pioneers in the use of computers and have had data processing installations in operation for a decade or longer. Some of these, such as Bank Negara (the central bank of Malaysia), the Employees Provident Fund, and the Statistical Office, have been instrumental in bringing electronic equipment and office information systems into the country.

The National Electricity Board has used computers extensively in all of its hydroelectric and thermal power generating plants, as well as in its transmission stations. The computer functions were set up originally for data acquisitions with controls carried out manually. These are being upgraded in both existing and new plants to combine data acquisition and control operations in the individual installations. NEB expects to move on to central computer controls of electricity generation throughout Malaysia, and current practice is to install each station on this assumption. But this step will have to await a reliable and comprehensive data communications network.[6] NEB also has an agreement with the Public Utilities Board of Singapore and the Electricity Generating Authority of Thailand for computer use in power system planning, operation, and control. These international arrangements will be made more effective when their computer operations are linked through advanced data communications networks.[7]

The principal purpose of this government effort is to improve efficiency and reduce costs of government. A secondary purpose is the

demonstration effect of government usage. A third purpose is the stimulation given to the computer services industry within the country. A growing community of local software service companies has come into being. They are able to offer computer programming services on government contracts, sometimes as principles, more often as sub-contractors. Almost all of the hardware contracts are negotiated with foreign suppliers. These suppliers must operate local service units, hiring a large number of local employees. The service units have had to provide training for their local employees. Thus, one side effect of the local service units is the appeal that their training units have had. A number of American multinational suppliers have expanded their training units and are offering computer programming and data processing training to the general public.

Raising the competency level and increasing the number of professionals and technicians is essential for the future. The present shortfall has been variously estimated. Minister of Science, Technology, and Environment Stephen Yong has given the shortage as 5,000 professionals to meet near term needs, compared to about 2,000 who are presently working in the field.[8] The most serious shortages are professionals who are educated at graduate level in computer science and computer technology. The Malaysian government is intending to meet these future requirements through the universities and existing technical institutions, and by allotting scholarships for education abroad. New specialized training institutions to meet special needs are not included in the present thinking. The University of Malaya in Kuala Lumpur and the Science University in Penang, as well as other higher education schools in the country are expanding their computer programs,

as are the technical schools like the MARA Institute in Petaling Jaya. The Ministry of Education has recently introduced computer science into the curriculum of secondary schools.

Many company officials are not convinced the Government is doing enough to provide for skilled manpower.[9] They fear having to scrounge for unavailable technical personnel in the future, though none are having great difficulty at the moment. On the other hand, some service companies and others have pointed to the numerous private sector training schools that have grown up in recent years. Several software companies provide regular training programs as do most of the multinationals that have branches in the country. In addition, a number of privately operated special schools have opened up. The GOON Computer and Management Studies Center is headed by the President of the Malaysian Computer Society and has two schools in the Kuala Lumpur area for introductory training in computer studies. S.G.V. Kassim Chan, affiliated with Control Data Corporation, provides training for computer programming.

By far the largest number of workers in the computer industry are employed in electronics assembly. About 70,000 are now working in these plants, the largest single industry in the country. Most are located in four industrial parks on the West Coast. They are factories primarily owned by U.S. and Japanese companies who have been attracted by low wages, accessible power and transport, "pioneer tax" concessions, and special import arrangements that permit duty free entry and minimal customs red tape.[10] Electronics is also a substantial trade item, currently approaching $1 billion annually in exports to the U.S., earning in excess of $250 million greater than the imported

components.[11] Electronics production is predominantly simple assembly with low skilled labor producing low value added products. Although Malaysia's production of consumer electronics products is rising, it is probably not more than $2 million a year at the present time.[12]

Computer usage in the private sector is not widespread at the present time, though a boom in sales of microcomputers in the past three years may change that situation rapidly. Multinationals have been the principal users and a large number have one or more computers in operation in the country. Several of the large Malaysian-based trading companies--Sime Darby Holdings and Harrison and Crossfield, for instance--have as many as 35-40 minicomputers in various branches around the country. Rubber and oil palm estate owners, such as Dunlop Industries, have computer installations. Office networks were introduced into Malaysia about three years ago and are rapidly growing in popularity.[13] Electronic process controls, sensing devices, and automated equipment are used to a modest extent in Malaysian industry, usually by multinationals producing oils, chemicals, or textiles. These applications also are reported to be rising rapidly.[14]

The deepest penetration of information technology is in banking. Today, virtually all banks in Kuala Lumpur have computer installations. Some, with branches in the city, have installed systems connecting their various offices on line through the telephone system.[15] Many Malaysian banks have begun offering diversified financial services, which can only be done effectively with electronic data processing of very advanced technology. Bankers engaged in nationwide operations have found computer systems essential for exercising control over their diversified

service accounts. Chartered Bank made the first nationwide installation in 1976 and other nationally engaged banks soon followed.[16]

While banks in Malaysia make use of leased lines, they are anxious to have a high speed data network available. Many say that it will inspire greatly extended banking usage of computer networks. A public data network will enable SWIFT international service to become available in Malaysia, which bankers believe will provide an important stimulus for Malaysia's financial firms. In particular, the network should be a shot in the arm for Malaysia's long-held desire to bring commodity trading to Southeast Asia. The formal machinery for futures trading was initiated in the Commodities Trading Act of 1980.[17] Technical futures trading in tin, rubber, and palm oil--the commodities of greatest interest to Malaysia--is hampered by the lack of depth in communications, especially in on-line data bases that are vital to commodity dealers. A data network system could make it much easier to fill the communications gap and enable the inexperienced Malaysian traders to compete in markets where the Prime Minister feels keenly that the country "lacks its quota of clout in dealing with the industrial societies."[18]

An important by-product of expanded use in the private sector is a growing computer services and software sector. Some of these companies are subsidiaries of suppliers, but an increasing number are independent firms. Many operate under franchises or licensing agreements with foreign manufacturers or software producers. This services sector has mushroomed in recent years with the rapidly expanding demand for micros and home computers. Retail outlets for video games and similar home software have been doing a land office business--though some are in

trouble for selling pornographic tapes to minors.[19] Computer services companies are expanding sales to new buyers in the local business community, companies that install packaged systems initially and frequently upgrade to customized local information networks. A small but potentially important venture capital market is beginning to materialize in the financial community. This could, in time, channel significant funding into expansion of some of these firms that the most optimistic venture capital firms believe could develop into a modest Silicon Valley.

Increasing Momentum

Malaysian information technology appears to be moving ahead with considerable momentum. Its development, economists in the Prime Minister's Department say, has significantly picked up in the past five years.[20] The role of government has been an important factor in providing a favorable investment climate, minimal regulatory controls, and moral leadership in opening the doors to the new technologies. Long-term planning is based on the expectation that computer-communications technologies will be employed throughout the economy, in rubber and oil palm production, as well as other primary industries, and in manufacturing, finance, and commerce. Specific forms of employment, however, are to be left in the hands of the private sector, which is much better able to judge where cost advantages lie.

Malaysian strategy calls for encouraging increased usage but avoiding direct intervention for specific uses. In this respect, there is an important difference between the policy and strategy of Malaysia and that of Singapore. The latter has more precisely defined policy objectives--to identify specific instances where high value added

service or production is likely--and more direct implementation processes. Malaysia's policy includes a larger number of broadly defined productivity objectives and a more passive strategy for implementing them.

The current debate on Malaysia's industrial policy and the role of the private sector could lead to significant changes. Fiscal stringencies have forced the Government to look closely at expenditures, which have been going in large amounts for public investment in many enterprises.[21] A primary objective of industrial policy for the past decade has been to promote greater Malay participation in all spheres of industry and bring about a more equal balance in economic strength among the racial groups in the country. Some 500 public and semi-public corporations have been established in the past 10 years in an effort to place more Malays in executive and managerial positions. Mahathir's government has proposed that many of these companies could be "privatized" by selling them to private sector purchasers. Other public bodies, including those engaged in power production, telecommunications, and sea and land transport have also been mentioned as possible candidates for privatization.[22] One specific step toward privatization has been the granting of a license for a new television channel to a group of private investors.

The second area of current debate arises from the belief of many Malaysians that the nation's industrial policies no longer serve the best interests of the country. They rely excessively, it is claimed, on processing of primary products that are sold in volatile international markets. Prime Minister Mahathir and some of his economic planners have advocated a "heavy industry strategy" for the country's current stage of

development. The proposed strategy is the product of dissatisfaction with existing patterns of industrialization and Mahathir's open admiration for Korean and Japanese industrial policies. Manufacturing in Malaysia is predominantly labor intensive and technological upgrading from foreign enterprises has been disappointing. The new strategy would move towards capital and skill intensive industries. Tentative steps have been taken. Contracts agreed in May 1983 call for a car manufacturing plant near Kuala Lumpur for producing 120,000 automobiles a year. The first auto is expected to be produced in 1985. A sponge iron plant is under construction in Trengganu. Both are joint ventures between the Heavy Industries Corporation, a statutory body for industrial ventures with private participation, and Japanese interests, Mitsubishi and Nippon Steel.[23]

Strong objections have been voiced about the proposed new strategy, mainly on the ground that the specific ventures are not competitive and would be prime candidates for many years of protection and government subsidies. Some critics have objected to increased government intervention in private sector industry and reject Mahathir's view that government-private collaboration is the way to end conflict between the two sectors.[24] Much of the criticism reflects on Mahathir's style in pressing impatiently for radical changes.

The prolonged debate on industrial policy has engaged the entire Malaysian society. Deputy Prime Minister Musa Hitam recently commented that "we are trying to sort out our involvement and identify areas that the private sector could handle."[25] Tan Siew Sin, an influential leader of the Chinese community and Chairman of Sime Darby, has warned that each venture should be looked at carefully for "after all, the primary

consideration is profit."[26] The debate may not be resolved soon. Given the growing belief that labor intensive industrialization is reaching a dead end and the recurrent uneasiness over excessive dependence on primary products, it is unlikely that the discussion will wind up without significant, but progressively introduced refinements in the nation's industrial policy. It is very likely that the refinements will provide for strong and increasing emphasis on information technology and value added production innovations associated with the technologies.

4. Indonesia in Quest of Jobs and High Tech

Indonesia's size and low standard of living dictate a significantly different approach to high tech development than either of its neighbors. With more than 150 million people, Indonesia is the world's fifth most populous country and the sixth largest in area. The nation's ambitions match its size, but income and trained manpower limitations necessitate a patient strategy. Although Indonesia's long term industrial objectives are pointed toward a "knowledge intensive" society, its economic planning must be devoted to a step-by-step formula that will assure momentum in the desired direction.[1]

President Suharto's two decades of "New Order" have prepared Indonesia for this move. His government has restored much of the lost confidence in authority. Respected for its accomplishments, though less admired for some of its political methods, the "New Order" has made genuine progress in constructing a unified nation. Officers from the military command have usually occupied positions of leadership in the Administration. But Suharto has gradually relaxed controls over

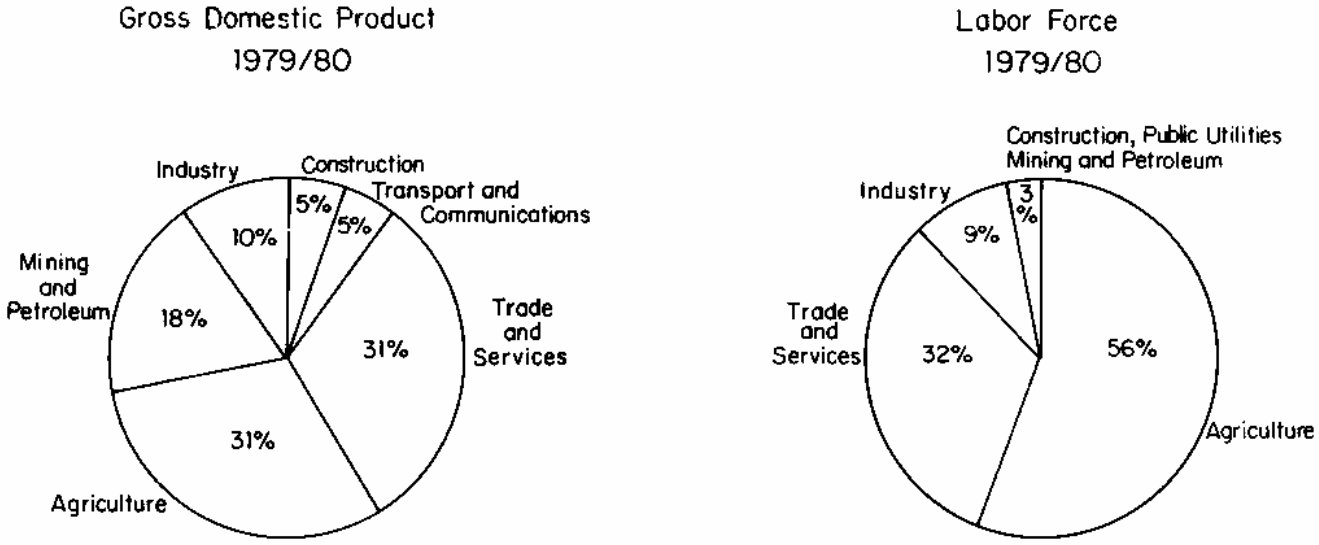
political activities and has permitted the private sector increasing opportunities in industry and commerce. Suharto's economic planning system has become increasingly professional, and its forecasting and implementation have improved. Corruption and graft, though still greater than desirable, have been noticeably scaled down.

Luck, in the form of unexpectedly increased oil revenues, has helped Indonesia build up its economic infrastructure more rapidly than predicted. One of the regime's greatest accomplishments has been the development of a national body of educated and trained personnel. Professionally schooled administrators, engineers, scientists, and educators are available to organize and operate the public and private offices, factories, colleges, and laboratories that a few years ago were almost totally lacking in trained manpower. A core of professional leadership for building a knowledge society has been formed. A serious attempt to develop a large highly qualified force of substantive professionals and technicians is a feasible next step.

But it is only the core that exists today. The Indonesia of 1983 possesses little more than the rudiments of high tech. Important as these are, the economy is made up primarily of small holder agriculture, export-oriented estate agriculture, timber, mineral, and petroleum extraction, and a large service sector.[2] Industrial production is the most rapidly growing sector, but as yet is of modest proportions. The prominent role of agriculture and services is evident in the following figure showing in particular the 88 percent of the labor force in these two sectors. The country's demographic profile--one half of its people are under 20 years of age--is evidence of the large numbers of young workers entering the labor force every year. This situation, to many

Figure 6

Distribution of Production in the Indonesian Economy



Source: The Republic of Indonesia, Repelita III: The Third Five Year Plan. Translated by the Embassy of the Republic of Indonesia, Washington, D.C. International Centre for Industrial Studies, Industrial Development Profiles of Indonesia. UNIDO, Vienna, 1980.

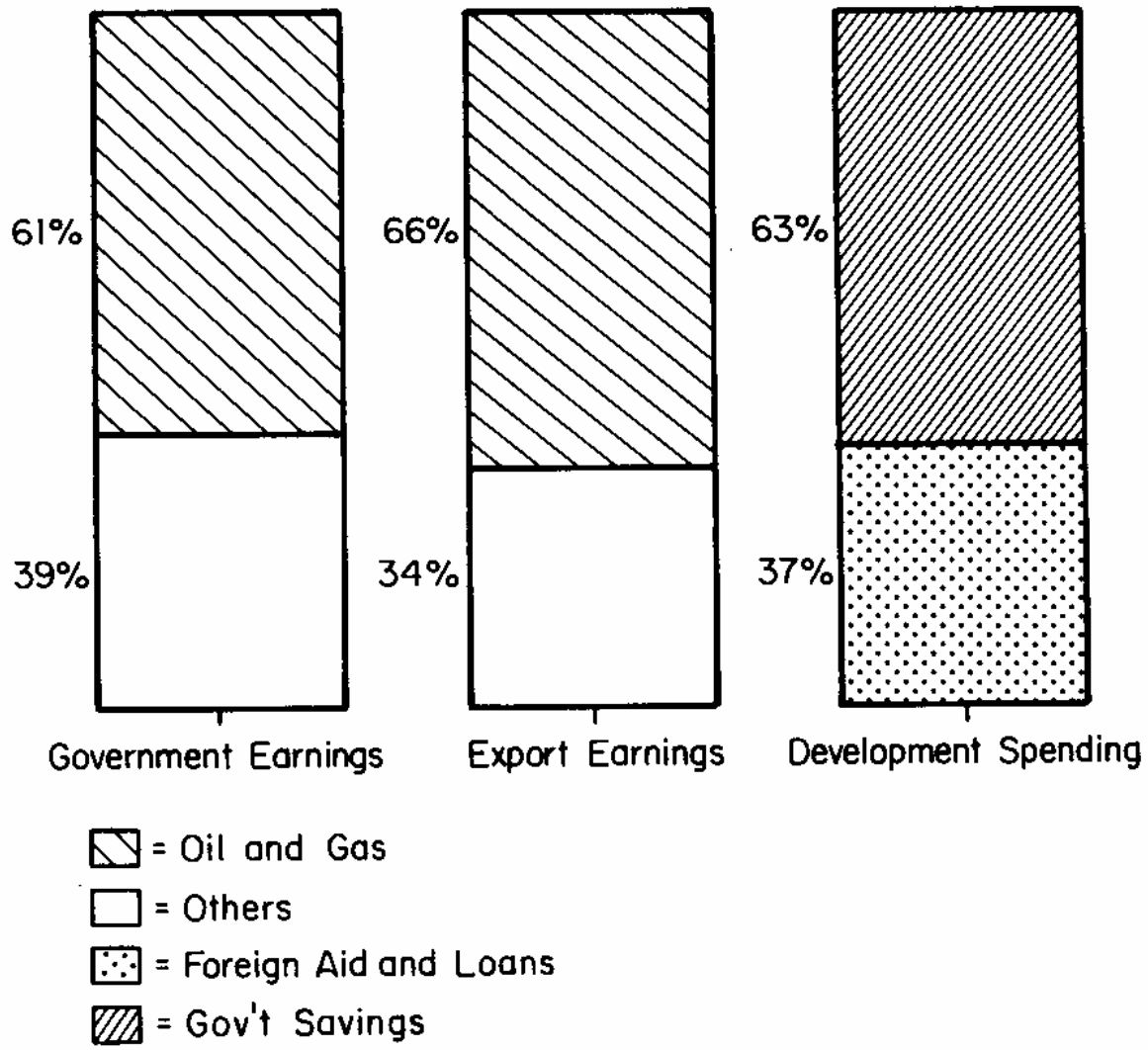
planners, calls for labor intensive industry to absorb the untrained and unskilled workers.[3] The huge agricultural sector of more than 87 million people, moreover, means that Indonesia has a large potential market that can serve as a natural outlet for manufactured consumer goods. Continued growth in the agricultural sector, to match the 4 percent in the past decade, would not only increase food self-sufficiency and provide exportable raw materials, it could also assure rising purchasing power for buying goods from an expanding industrial sector.[4]

A dominating factor in recent years has been the vital role of the oil industry. Petroleum and gas production requires few workers, but

the high rate of tax collections from the industry is of greater relevance. The industry provides disproportionate shares of government revenues (61 percent), funds for development spending, and export earnings (see Figure 7). Oil tax revenues are indirectly responsible for the impressive savings performance of Indonesia, making possible a relatively high self-sufficiency in capital formation. Indonesia's

Figure 7

Oil and Gas Earnings in the Indonesian Economy



Sources: a. Replita III, op. cit.
b. Hong Kong and Shanghai Banking Corporation, Indonesia, 1982.

economic development has followed a sequence that leads from oil export earnings, to government revenues, to public savings, to public investment in developmental projects. One important consequence of this development pattern is the prominent role it has given to public investment in the industrializing of the country. Publicly financed firms are prominent in virtually every industry in the country.

Industrialization in Indonesia has pursued a wide spectrum of specific product lines, consistent with its broad resource base and its large national market. Growth has been most pronounced in timber, paper, chemicals, pharmaceuticals, and textiles where Indonesia's primary materials and resource base have provided advantageous costing conditions. Efforts to promote machine tool production, engineering products, steel, cement, and heavy construction and transport equipment have been supported by subsidies, customs restrictions, and price controls that have resulted in a modest beginning in heavy industry. Foreign investment has had a crucial role in Indonesian industry. It has come mainly from Japan. About 60 percent of foreign investment approvals (excluding petroleum industries) in the 1967-77 period were for Japanese investments, nearly 10 times the amount from U.S. investors.[5]

The skeletal infrastructure of modern industry that has been erected has been accompanied by a complicated array of bureaucratic regulations, price controls, tariffs, and quota restrictions. The system has favored import substitute industries that have sometimes overproduced in protected markets, while falling short of cost competitiveness in international trade. Red tape and regulatory induced inefficiencies have also detracted from international competitiveness.

More than 90 percent of manufactured output is marketed domestically. Local content of auto and truck production has risen to more than 50 percent of gross output despite high costs.

The price distortions that have left much of Indonesian production isolated from world market conditions have become a drag on development of Indonesian industry. The Government has recognized for some time that the private sector was severely handicapped by the maze of regulations in the country. Falling oil revenue has spurred a look for other exports. In 1983 the Indonesian Government launched a major effort at streamlining bureaucratic procedures and minimizing red tape. Although, considering the depth of the problem, significant improvement will require a long term effort, the Minister for Economic Coordination, Ali Wardhana, says "we view progress in this area to be essential in creating the kind of environment necessary to support the expanded role we see for the private sector in the coming years."[6]

A series of liberalizing measures have been enacted that are intended to move Indonesian manufacturing toward a more competitive environment. A 40 percent currency devaluation in March 1983 has had a salutary effect. It has encouraged Indonesia's integrated textile mills to turn from the oversupplied domestic market. Some firms expect to export as much as 70 percent of output.[7] Equally important, many of the small high cost producers are being allowed to close down. Other price rationalization schemes have included phasing out of fertilizer subsidies and raising domestic oil prices by 140 percent since January 1982.[8] In each case, economizing on domestic use of basic raw materials has improved the cost competitiveness of upstream industries (chemicals, petrochemicals, steel), enabling them to take advantage of currency

devaluation in export markets. The low cost credits and export insurance that have become available in the past two years have been further inducements to export oriented industrialization.

Liberalization and redirection away from the excesses of import substitution policies is a measured effort, and by no means irreversible. The Indonesian regime seems to be seeking a balanced industrial policy that is both inward and outward looking. President Suharto's address to Parliament in April 1983 stressed industrial development "to reduce dependence on imports as well as to stimulate the export of industrial products."[9] Planning Minister J.B. Sumarlin has promised further action toward a better balanced industrial policy in calling for the next five year development plan (Repelita IV, 1984-89) to achieve "substantial improvement in efficiency" and to "increase sound competition throughout our economy."[10]

Computerization

Use of microelectronics in Indonesian industry is still in a preliminary stage. Only a small number of domestic companies have installed central computer systems. A larger number have purchased microcomputers in the past three years. Multinational and joint ventures usage is significantly greater. But overall use is still on a limited scale and primarily in the trading and services industries. Banks and financial firms in the large cities make extensive use of internal computer systems, but are restrained from wider uses by the difficult communications within the country. For this reason, many firms limit their outside uses to international links.

The principal domestic users of computers are in the Indonesian Government where computer systems are employed extensively within all of

the major ministries. These systems are continually expanded and upgraded, and there have been efforts to merge or unify the government systems. A Government Information Network that is scheduled to begin functioning in 1984 is a successful effort to improve computer efficiency through communications. BAPPENAS, the National Development Ministry, has proposed that a super computer be set up for consolidating government information and data. The proposal has run into difficulties because of system incompatibilities. The Indonesian Institute of Science (LIPI) has also proposed an information network that would tie together research and development agencies. The network would permit fast access to scientific and technological documentation as well as facilitate joint research between agencies. This idea was strongly recommended by UNESCO studies as early as 1970 and in a more recent survey in 1982.[11]

Telecommunications

As in other Third World countries, a leading consumer of computer technology is the telecommunications system. Indonesian telecommunications is operated by PERUMTEL, the Public Telecommunication Corporation that functions under the Department of Communications. The system began as a modest inheritance that the Dutch had built up, but it had undergone 25 years of poor maintenance when Sukarno fell in 1966.

The systems' performance has improved dramatically in the past decade. Service has been expanded, new services have been added, and the quality of all services has been significantly upgraded. Telecommunications has a high development priority, with the 1982-83 budget providing for $1.2 billion, nearly 12 percent of the total development expenditure. The PALAPA satellite system is the most

striking improvement. But land line service has also grown; long distance lines and direct dialing services have expanded about 12 percent a year, and new telex installations have been added at about 10 percent annually. Important modifications have been made in financing also, which remove system improvements from the political arena of budget setting. PERUMTEL, along with other public corporations, has been given greater liberty in raising funds from public security sales. PERUMTEL has also been permitted to retain earnings for capital development.

Demand for business communications has been mounting with the growing trade and production capacity of the country. Both business and telecommunications officials agree that corporate requirements have been rising more rapidly than the capacity of the system. One consequence is inadequate lines, low quality transmission, slow response to service breakdowns, and disgruntled businessmen.

Some adjustments have been made possible through temporary concessions that the Department of Communications has granted to private companies and government bodies. Concession holders are permitted to operate their own networks. Some of the concessional networks are operated by government agencies for public purposes, such as police, railroads, aeronautics, and shipping. Others serve commercial purposes, such as those for oil and gas producers, multinational companies, state enterprises, and trading companies. The private concession networks usually have installed high quality microwave circuits that permit high speed data communications equipment to be used. They are not allowed interconnect rights, however, and access from one concession network to another is limited severely.

These concessions provide a pragmatic answer to a problem. They are not a solution, however, nor are they permanent. PERUMTEL expects to recall the concession rights when it is able to provide comparable service.[12]

Not even temporary help is provided for the far more numerous local and multinational companies that are compelled to limit computer networking to the public telephone system. Trading, banking, and financial companies are among those who say that their operations are restrained by inadequate communications. In many cases such companies have installed complex computer systems for internal use, but are unable to communicate with systems in branch offices or with outside suppliers or customers.

One senior officer complained about the inadequacy within Jakarta. His company has offices in different locations in the city, with computer installations in each of them. They must use a "motorbike interface" for transmitting computer readouts that could easily be sent electronically if they had a satisfactory line. But many of the cables inside Jakarta were laid by the Dutch many years ago; buried under a foot of concrete, these cables are impossible to repair or maintain.

Another corporate official said that his problems usually arise because of switching deficiencies. Exchanges have obsolete, worn out equipment, as well as insufficient capacity to handle high volumes of traffic. Many of his customers in other parts of Indonesia have local computer installations, and business transactions could be more efficiently handled through a data communication circuit. Private lines could be an answer, but they are in short supply, obtainable only at high cost, and provide no escape from poor switching. Their cost is

multiplied because PERUMTEL does not allow customers to use switching devices on official lines. Mysterious administrative difficulties continually come up whenever a firm is seeking a dedicated line. This creates an air of uncertainty as to whether an under-the-table payment is sought. Such difficulties are economically damaging to multinationals, but they are even more detrimental to domestic companies whose business transactions outside of Jakarta are much more extensive than the multinationals'.

These complaints and problems are known to the Indonesian telecommunications authorities, who believe that they are acting expeditiously to correct them. A shortage of lines does exist, with a backlog of requests for residential lines of 3-4 years. Filling this backlog is the first priority for PERUMTEL, and most of the new line capacities are allotted to this purpose. A public switched data network will soon be installed, although a definite date for beginning it has not yet been made. Feasibility studies indicate that a public network would be profitable.[13]

In the meantime, a number of modern microwave circuits have been installed in many parts of the telephone system, which have improved data carrying capacity on these links. The Java-Bali microwave network services Jakarta and other principal cities on Java and Bali. Another microwave network connects Jakarta and Southern Sumatra. PERUMTEL says that these circuits are suitable for data communications, but recommends that equipment on these lines should not be used to exceed 4,800 bits per second. A notable improvement in the telephone system will be the installation of digital switching beginning in 1984. The Siemens factory that is making the circuit boards has already begun production

in Bandung. As these installations are completed, the switching difficulties encountered in using telephone lines for data transmissions should be diminished.[14]

Intercity satellite service is also scheduled to go into operation in 1984. Called PACKSATNET, the network uses the PALAPA satellite for communications from one city to another and special VHF circuits to augment local connecting service. PACKSATNET will offer packet switching to those who desire it. In addition, an intergovernmental network, Government Information Network (GIN), is now being installed in Jakarta. GIN is a loop of 70 kilometers of cable and fibre optic links and will permit high speed data transmissions among the connecting governmental offices.[15]

The prize accomplishment of Indonesian telecommunications is the PALAPA communications satellite system. The two satellites in the system were placed in orbit in 1975 to serve as a domestic communications system. The first PALAPA satellites had a life expectancy of seven years. Their replacements, the PALAPA B duo, were expected to be in orbit and operating by the end of 1983. The first, PALAPA B-1, was put into orbit by the space shuttle flight of June 1983, and PALAPA B-2, a duplicate reserve unit, was to be added later in 1983. The latter, however, was lost in the shuttle launching. Although the older satellites can probably continue in reserve until a substitute B-2 is ready, adjustments in service may be necessary.

The PALAPA B system has a greater capacity than the first generation, partly because the number of transponders has been doubled from 12 to 24, and partly because of technological improvements resulting in more efficient components. Capacity of the PALAPA B system

will exceed Indonesian needs despite a great increase in these requirements. The excess will therefore be leased to other ASEAN members. The ASEAN circuits will be used for both domestic and international telecommunications, and will include television, voice, and other services. The leasing arrangements were worked out in extensive meetings of ASEAN communications and economic officials who jointly arrived at service requirements for ordering the satellites.[16]

More than 100 earth stations located throughout the islands have also been constructed in Indonesia for receiving and transmitting signals from the PALAPA system. The greater power of the PALAPA B system permits use of smaller antennas, and since the cost is lower for the smaller stations, sixty additional ones have been constructed for use with the PALAPA B service. One is on remote Rauai Island in the South China Sea where CONOCO and Marathon oil are drilling and exploring.[17] The stations can be used for the entire range of communications services, television, radio, telex, telephone, and data communications. They will require, however, extensive construction of auxiliary facilities to implement the full capabilities of the system.

PALAPA owes its birth to the political objectives of providing a unifying medium for Indonesians living on 8,000 widely separated islands. In no other way could Indonesia have brought the whole range of modern communications to all of its people in a few short years. A secondary purpose was to introduce high technology into the nation, to familiarize the public with advanced communications, and to develop a cadre of professionals and technicians operating the system. Indonesian personnel can now carry out all of the systems operations, the operation and maintenance of the earth stations, the design of systems expansion,

and the control of the satellite's position in space. Directly involved in the system's operation are 600 skilled personnel.[18] With the basic objectives for inaugurating the system accomplished, the country must now turn to the difficult tasks of utilizing its economic and industrial potential.

Research For Development

If PALAPA opened the door for Indonesian entry into the information age, the National Program on Research and Technology is expected to send Indonesian industry through it. But not immediately. This will come about, says the Minister of Research and Technology, B. J. Habibie, through "realistic and concrete programs of production which incorporate a systematic step-by-step increase in the degree of comprehension and mastery of successively more sophisticated technologies."[19] The National Program provides for the research and development institutions needed to master sophisticated technologies. Immediate goals of the Program are directed to simpler technologies, especially in agriculture and small industry. But more complex technologies are never neglected. The ultimate aim, Habibie explains, is to bring "Indonesian technology and industry up to the levels of the industrialized countries like the U.S. and Japan."[20] The step-by-step approach, he says further, is implemented through licensing foreign technology and adapting it in the Program's research and development institutions. In this way, Habibie says, Indonesia will obtain sophisticated technology applications for a wide variety of its industrial activities.

Habibie is the leading figure in Indonesian technology. He was a senior executive in the Messerschmitt Company in Germany when he was personally recruited by President Suharto in 1978 to head the Ministry

of Research and Technology. The program that he leads is carried out by a sprawling collection of research agencies and centers that are found in 20 separate ministries, plus several other separate agencies that are within his own ministry.[21] His ministry also has the authority to engage in industrial production that is related to technological development. For example, PT Nurtanio, an aircraft manufacturing company in Bandung, is expected to turn out its first turboprop airframe by 1984.[22]

Coordination of the diverse research activities follows the five point National Program adopted in 1978.[23] The program is based on recognition that future economic advancement depends on Indonesia's manpower capacities in a wide spectrum of scientific and technological pursuits. Earlier development placed greatest emphasis on agriculture and raw material processing industries. Current policy emphasizes manpower in labor intensive industries. Future development will depend increasingly on promoting industries that are technology based and that will produce industrial machinery for light and heavy industries. The objective of the National Program is the development of human energy and skills for (1) professional, scientific, and technological manpower, and (2) technical engineering and administrative capabilities in an increasingly knowledge-based labor force.[24]

The principal bodies for research and development in the National Program are the Indonesian Institute of Sciences (LIPI), the Agency for Development and Application of Technology (BPPT), and the Center for Research, Science, and Technology (PUSPIPTEK).[25] LIPI's responsibilities are in scientific knowledge and research, while BPPT is charged with the development and application of technologies in all sectors of the

economy.[26] Much of the effort of these two agencies is brought into focus in the facilities of PUSPIPTEK. The center was begun in 1975 and is expected to be completed in 1986. It is located on an 865 acre site on the outskirts of Jakarta, and includes 11 major laboratories, a data center, and conference and administrative facilities. LIPI's electronics and instrumentation laboratories have been moved from Bandung and enlarged. PUSPIPTEK is intended to serve as the center for adapting western technology to Indonesian needs and as a technology interface that will furnish ready made designs and other services to industry. Its research will be supportive and practical, not basic or theoretical. PUSPIPTEK is in many ways comparable to Tsukuba Science City in Japan and will include about 30 percent of all governmental laboratory assets and 40 percent of all research manpower. Most of the laboratories are operated by LIPI and BPPT.[27]

Each of these bodies for implementing national policy is expected to encourage research on the employment of information technologies in specific industrial applications. A joint panel of Indonesian officials and American scientists in 1982 concluded that "Indonesia must rapidly develop its capacity to utilize microelectronic technology effectively in support of industrialization."[28] The panel, which reviewed the entire National Program, recommended that R&D resources should be used primarily for advanced development programs in the utilization of microelectronics. Manufacturing of microelectronics devices presents fundamental difficulties for Indonesia in the near future. Thus, priority should be given "to applications of microelectronics (as opposed to product development) and to development or adaptation of software."[29]

A Distant Goal

The Indonesian objectives in high technology are extremely ambitious and a knowledge society is clearly a distant goal. Only a high tech economy can fulfill the nation's national and international ambitions. There can be no reasonable doubt about the Suharto regime's intentions and its commitment to a high tech future. But there are several uncertainties that stand in the way of its accomplishment.

One of the most pervasive uncertainties concerns the conflicts in priority between providing jobs for a fast growing labor force and raising the skills for a high tech labor force. Both are essential goals, but overexuberance in one puts the other at risk. A balanced policy would seem essential, one that is both sustainable over a decade or longer and will permit balanced answers in innumerable specific situations.

Of critical importance in the next 10 years is the priority given to telecommunication development. Steady improvement in providing operable nationwide communications can progressively tie the nation's industry and finance into one market. Without significant accomplishment in this direction, one of Indonesia's greatest assets--its large internal market--will remain unutilized and its businessmen will be unable to develop the competitive enterprises necessary for sustained economic advance.

The largest uncertainty has many political dimensions and concerns the future of the Indonesian Government. Indonesia will face two tests in the near future; the announced intention of President Suharto to retire at the end of his present term in 1988, and simultaneously the

recurring question of the balance of authority between military and civilian leadership in the country.

How Indonesia responds to these interrelated uncertainties will not only determine the course of its modernization and industrial development. It will also be a measure of how deep the principles of Suharto's "New Order" have taken root in the Indonesian society.

PART II

Information Technology Strategy in Southeast Asia

Singapore, Malaysia and Indonesia differ significantly in demography, technological infrastructure, resource endowment, and level of industrialization. Yet despite many differences in detail, the three countries follow policies that have in common three basic elements of an information technology strategy.

Each government regards information technology as a national interest that justifies financial support, planning assistance, special incentives for private investment, and other forms of official encouragement. All three nations perceive the policy as a way to accentuate comparative advantage and regard the special support as necessary to the most efficient and productive use of all their resources.

Each nation gives greater prominence to applications of computers and communications in industrial and commercial usage than to manufacture of microelectronic products. Adaptation to productive usage is, to them, the quickest and surest route to immediate technological capability; it is also an opening to eventual competence in the higher reaches of microelectronics technology. The immediate objective is to strengthen perceived economic advantages in the most cost effective way, particularly in industries where other productive resources are already committed and are competing internationally.

All three nations desire to avoid costly expenses on research and development that has been done elsewhere. Their attitude stems from a realistic assessment of the prevailing structure of microelectronics

manufacture and of the likely frustrations of a frontal entry: "Why reinvent the wheel or try to produce here what we can buy cheaper abroad?" Commercialization of known, easily exploited technology is the primary objective, not mastery of the intricacies of manufacturing exotic products.

5. Looking East: The Japanese Precedent

Japan is an inevitable model for a Southeast Asian information technology strategy, just as it has been an indispensable precedent in the earlier phases of national development. Southeast Asians see themselves in circumstances comparable to those of postwar Japan. They may show a visible reticence in Looking East, as all of their top leaders have important reservations about following in Japan's footsteps where their own conditions and interests clearly differ. Their reservations are reinforced by political compulsions in every capital to pursue a uniquely national way. For these reasons, the Southeast Asians depart in significant ways from Japan's institutional precedents, even when adapting many of the economic precepts to their own political and cultural institutions. But Looking East, as shown by the 1984 meeting of the Economic and Social Commission for Asia and the Pacific, is "only too natural for developing or newly rising countries" that are the neighbors of Japan.[1]

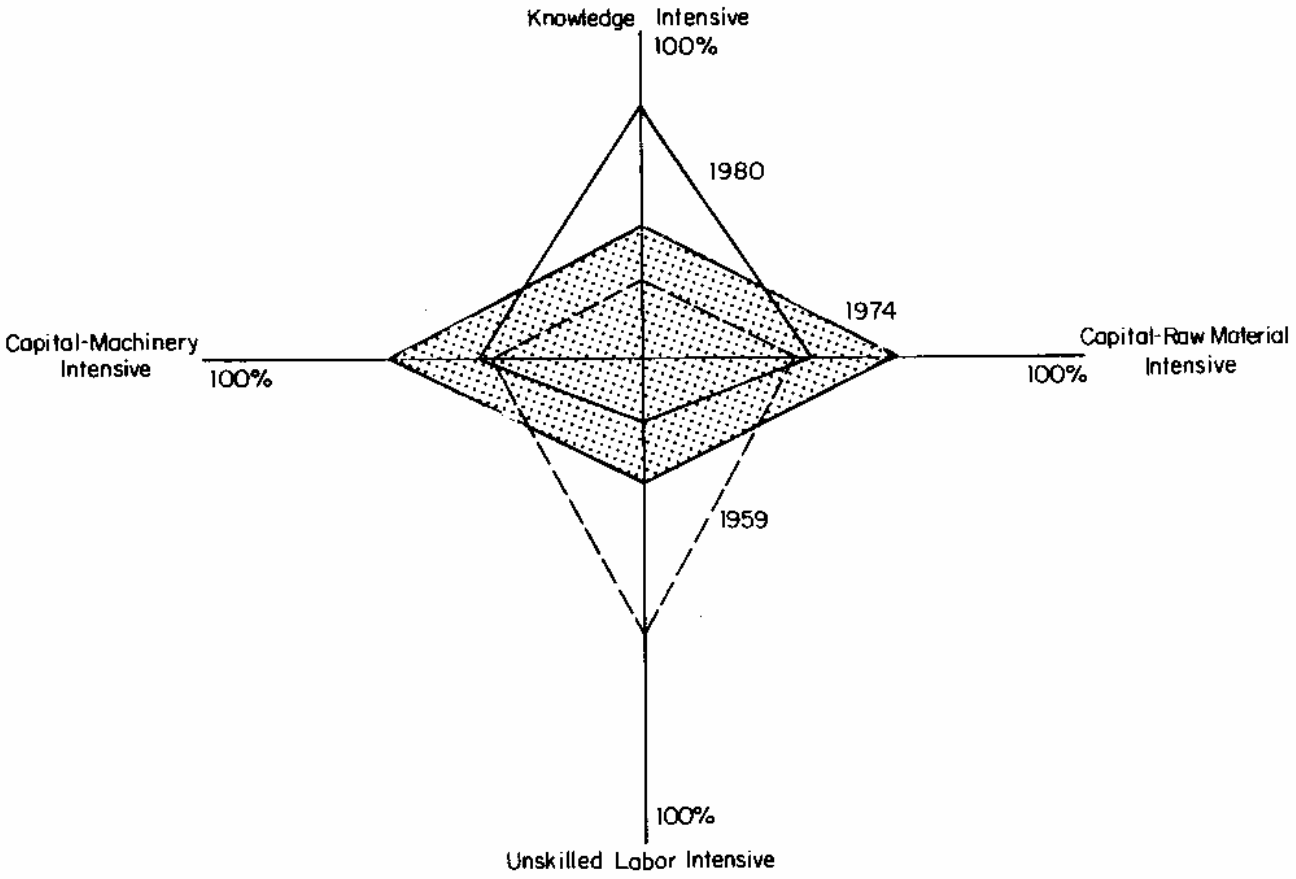
The Southeast Asians are not alone in admiration of the Japanese precedent. Many developing countries have been attracted and are trying to emulate Japan's route to high technology industrialization.[2] With step-by-step simplicity it plots an evolutionary linkage from pre-

development to the knowledge society and superpower. The Japanese conception of industrialization causally relates the pace and progress of a nation's economy in four distinct industrial sectors: (1) unskilled labor intensive industry; (2) capital-raw material intensive industry; (3) capital-machinery intensive industry; and (4) knowledge intensive industry. The following graphic (Figure 1) shows the concept, with its four points that are established on each industry axis by the percentage of total industrial exports represented by exports of that industry.

What this industrialization strategy portrays is a pathway for progress and advancement in industry, a pathway where success is represented by a diamond that moves upward over time. Progress and advance are measured by "value added by manufacturing." The upper portion of the graphic represents exports of industrial and production technologies that have "higher value added" in the manufacturing process. Japan's exports in 1974, as compared with 1959, show higher proportions of machinery, steel, computers, and electronic products being exported, and lower proportions of shoes and clothing; the 1974 diamond is flatter in the lower portions and more extended in the upper regions. By 1980 the diamond is even more elongated in the upper, knowledge intensive sectors, contracted in the lower, and somewhat narrowed in the middle portions. Moving up the industrialization diamond means that Japan's exports are more concentrated in industries where company revenues are higher. A larger sum is available for payment for Japanese resources, higher wages can be afforded and net company earnings can be increased. Moving up the industrialization diamond means that a higher proportion of the nation's industrial output and of gross national product, not just exports are concentrated

Figure 8

Strategy of the Industrialization Diamond



Source: Economic Planning Agency of Japan. Quoted in Ira C. Magaziner and Robert A. Reich, Minding America's Business, Vintage Books, New York, 1983. P. 80. Diamond for 1980 is based on Crawford's estimates.

in higher value added products. Cost competitive exports, by this reasoning, led Japan into higher productive sectors, accounting in large measure for the nation's high growth rates during the 1960s and 1970s.

This evolutionary path is what attracts the Southeast Asians and makes the Japanese industrialization model an irresistable, if imperfect, precedent. Many developing countries have been able to

embark on the lower portion of the model, using abundant unskilled labor in factories based on simpler technologies. Several have moved on to the middle portion of the model, where they have capital intensive factories doing large scale manufacturing and utilizing medium level or moderately advanced technologies. Low wage rates in the middle industries have given the developing countries a decided competitive edge in several of these heavily traded product lines. A few developing countries have already moved into the upper portion of the industrialization diamond and are producing knowledge intensive goods, while others are beginning to take the first steps in that transition.

Southeast Asian adaptation of the Japanese strategy has made two important modifications. Both place information technology on a plane with other productive resources. The first reflects the rise of the services sector in international trade, preeminently in the form of communications and information services. This has been an important factor in Singapore's emergence as a regional center, especially in providing services for international finance and for petroleum exploration and drilling. The rise of information and communications services as a resource in the advancement and functioning of specific industries gives an industrialization strategy another dimension that is especially important for developing countries.

The second modification reflects the universal potential for microelectronic applications. Microelectronics can be applied to many levels of existing production processes and techniques, in particular in the marketing, distribution, and management branches of a firm or industry. The technologies for these applications are standardized. This means that many options exist for competing in computerized and

automated production in smokestack and extractive industries. Its importance lies in the possibility of high value added employment in some segments of labor intensive industries and in agricultural industries.

6. A Framework For The Strategy

Converting a Japanese concept of industrial evolution into a Third World action program for industrialization requires machinery for guiding the national economy. Indeed, the colonial territories that have made the greatest development transformations as independent nations have been those with formal government machinery for that purpose. A formal structure is not a cure-all and there have been many failures. Much of the Third World's anxiety over its prospects for the information age has reflected uncertainty about how to organize for making the technological leap. That is why the search for workable mechanisms has a high priority in all parts of the developing world.[1]

These questions have also occupied policy makers in Singapore, Indonesia, and Malaysia. Their answers have often been tentative, and some of their solutions have been discarded when they failed to produce expected results. The machinery that has evolved reflects the fundamental cultural and political beliefs of each nation, as well as its unique economic and manpower parameters and state of advancement. There are also several important common characteristics.

Thus, the machinery can be described in terms of a general information technology model, one that may be applicable to any Third World nation following a high tech development strategy. What follows

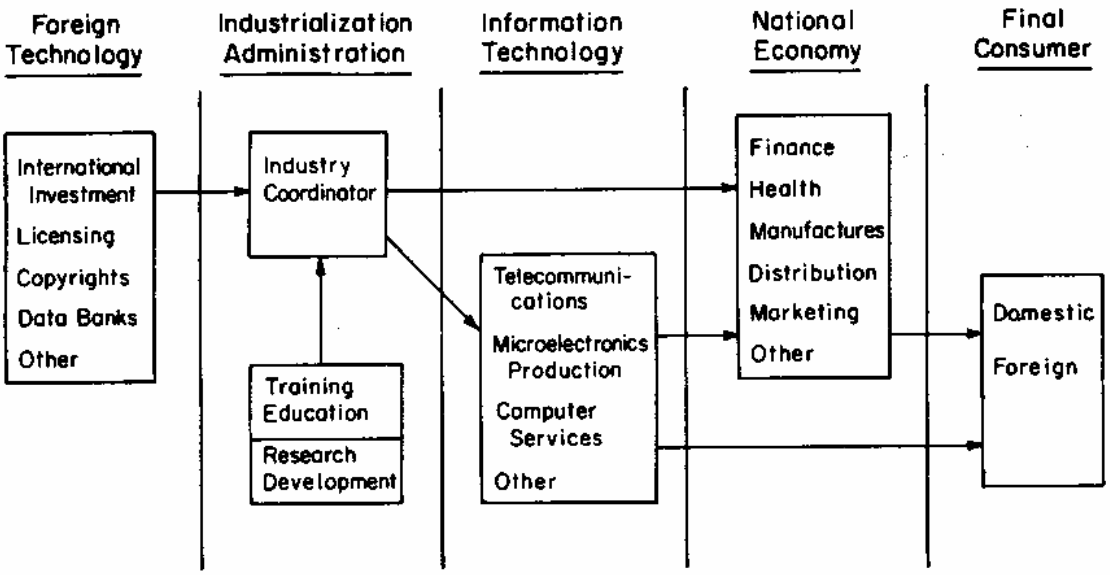
in the remainder of this chapter is a schematic representation of the complicated administrative and decision making machinery found in these countries, as well as an analysis of how the methods employed and the problems encountered in actual experience are portrayed in the schematic model. The model is based on empirical observation of national development planning and is intended to display a simplified framework in which complex activities can be seen in relation to a comprehensive strategy. The model rests on two assumptions regarding national development: that information technology can be dealt with as a unique, separable sector of the national economy, and that the driving force in an industrialization strategy is "controlling" the flow of technology, especially that related to the information technology sector.

In this hypothetical reconstruction, the national economy is conceived as having five interacting sectors.[2] Each sector represents an economic area that is subject to unique technology decision criteria; conversely, interaction between any two sectors represents a critical decision point in the flow of information technology. The five sectors are (1) the foreign sources of technology, (2) the industrialization administration sector, (3) the information technology production sector, (4) the national production sector, and (5) the final consumption sector including foreign as well as domestic consumers.

The model portrayed in Figure 2 places the industrialization coordinating body at the critical juncture of the process. The coordinating body is at the decision point where the rules and conditions are established under which foreign technology will enter the country. This is also where the rules and conditions are made governing the uses technology will serve throughout the economy. ANOTHER DECISION

Figure 9

An Information Technology Strategy



point concerns training and education and research and development, which must be correlated with projected manpower and technological requirements in the productive sectors of the economy. Another group of decision points involves the relationship between specific forms of information technology and requirements of industrial and other users and final consumers. At each point the strategy coordinator is able to exert moral, economic, or regulatory pressure on the independent decision maker. How well this is done will be a major determinant of success for the strategy.

Two principal instruments of policy are used in "controlling" the flow of technology, "Technological Fusion" and "Development Levering." Technological Fusion is a merger of technologies that is guided by the

objectives of the development strategy and is, therefore, an object of policy making as well as a technological phenomenon. "Controlling" Technological Fusion is the heart of the strategy, for it is in the application of a specific computer-communication product or service in a specific industrial or commercial operation that a development objective will, or will not, be achieved. Development Levering is achieved when the Technological Fusion is advanced from simple to more advanced levels of complexity.

A relatively uncomplicated illustration of the two instruments of policy may be drawn from the experience of the National Electricity Board of Malaysia. Computer operations that were initially used only to collect data in generating plants have gradually been given control tasks in separated installations. The Technological Fusion of the computer and the generator was levered upward on a limited scale. Soon Development Levering will be elaborated more. As telecommunication potentials have improved, computer controls are being extended to inter-plant operations and distribution centers. Eventually, the system may be expanded across the South China Sea to provide a computer controlled power grid between East and West Malaysia.

Even a relatively uncomplicated instance of the Development Levering process suggests that a scenario for the strategy can never proceed along an unbroken line from technology entry to final consumer. To the contrary, the scenario is an intricate set of planning and implementing decisions in which market and resource estimates are essential and technological requirements are developed in a context of expectations and forecasts regarding the full process. The scenario is dynamic, giving implementation feedback a special place in onward

planning of the strategy. In Southeast Asia, consensus is the prescribed method of decision making; thus, the standard scenario includes close intersectoral collaboration between planner and performer, and between public regulator and private entrepreneur.

Many different versions of a strategy scenario are possible. "Controlling" may, for example, be loosely pursued, or it may be rigorously carried out; it may be directed primarily toward export, or mainly toward domestic markets. Some possibilities have been described in Part I of this paper where each of the three nations has been considered in some detail. It is useful to summarize some of their principal characteristics in relation to the framework of this model.

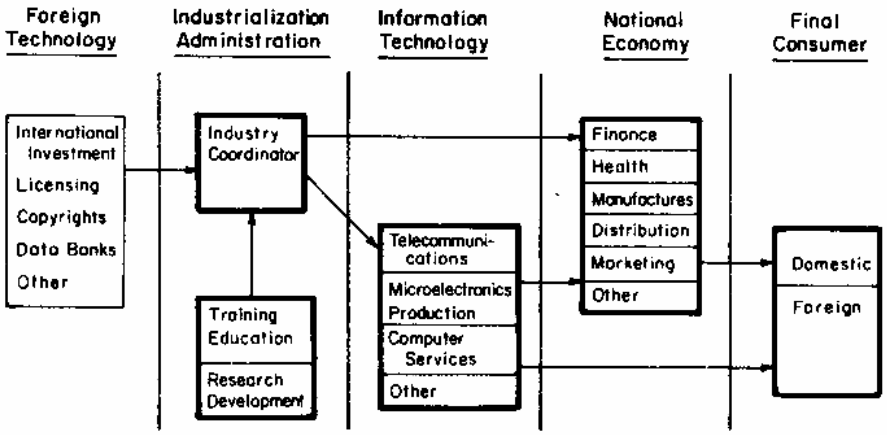
The Strategic Model And Southeast Asia.

Two preliminary observations are in order. It is evident (see Figure 3 where a thickly drawn line is an indication of high activity) that Singapore is more active in more sectors than the others. Malaysia shows fewer areas of concentration, and Indonesia the smallest number. The intensity of concentration is especially important when considering the role and function of industry coordinator. Singapore, as a small city-state, has a tightly organized system and is able to integrate operating components, obtain up-to-date marketing information, maintain a close watch over foreign trade and investment, and judge how well the economic system is working. Malaysia and Indonesia, with much larger territories, many more governmental units to administer, and more diversified trade and investment structures, have more decentralized systems. All economic management in these countries is less intensive than in Singapore, and administration of the information technology strategy follows the same pattern as other economic administration.

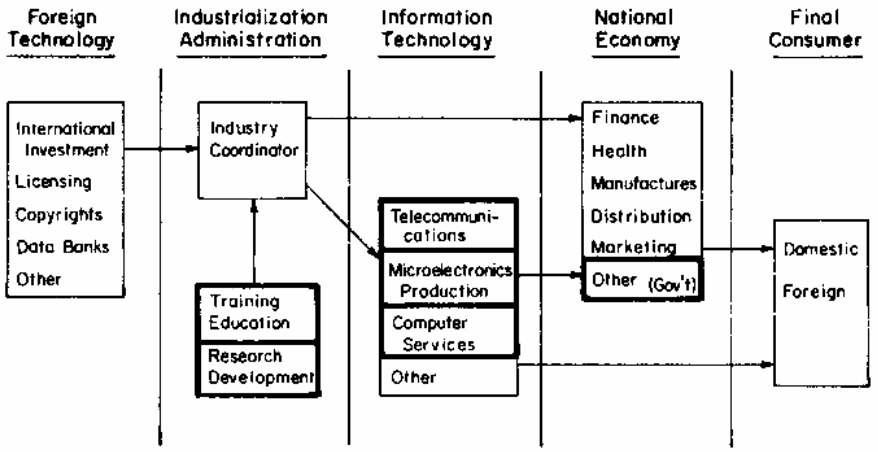
Figure 10

Comparative Models of Information Technology Strategy

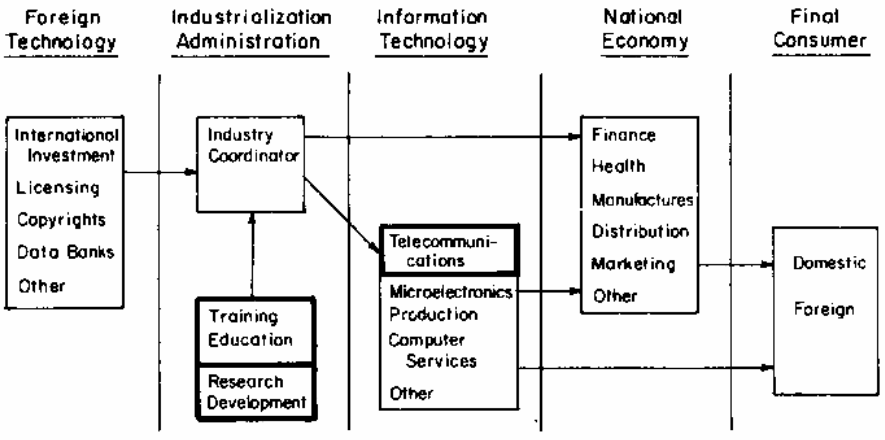
SINGAPORE



MALAYSIA



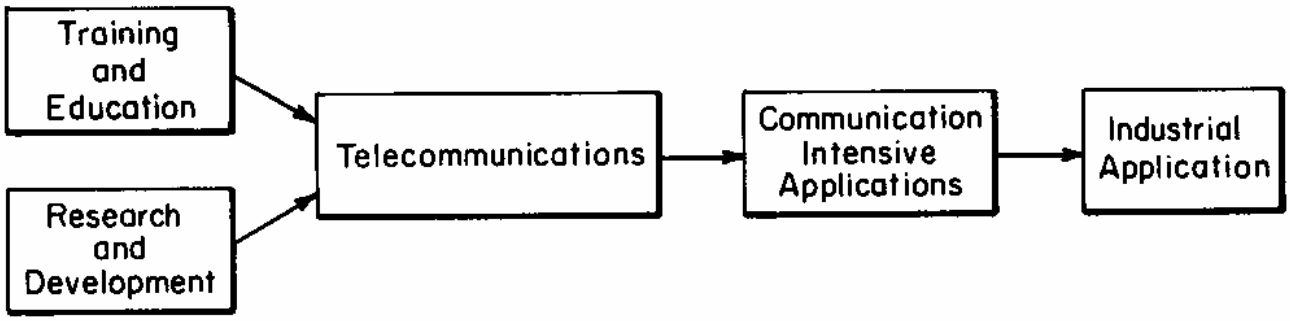
INDONESIA



A second observation suggests a tentative hypothesis of an evolutionary progression that leads from basic foundations of information technology to more and more elaborate applications. This progression--which may be intuitively evident in Figure 3--is corroborated by the course of events in each of these countries. (See the country descriptions in Part I.) Moreover, their experience points to some of the specific content of the evolutionary process. It is apparent that all three nations are giving high priority to training and education and to research and development. This is testimony to the fundamental importance of these areas of concentration in the strategy. A further step in the developmental progression may be indicated by the relatively high priorities given to telecommunications and to applications that tend to be communications intensive. This line of

Figure 11

An Evolutionary Hypothesis On Information Technology Development



progression might be expected from an information technology strategy that is intended to accelerate industrialization, since to accelerate national industry it is necessary first to develop and extend national or international markets that are based on and make intensive use of reliable communications systems.

Four Standards For Administering The Strategy

In order to accomplish a coherent strategy, uniform answers must be given to policy questions that arise at different points in the strategic scenario. Success for the strategy may hinge on the degree of consistency in responding to questions that arise in different guises throughout a scenario. For example, the economic gains from building up a high powered communication system could be nullified by regulatory restrictions and technical standards placed on the internal hardware or computer networks of banks and other commercial users. Similarly, development of high tech industries that have no prospect for becoming cost competitive internationally could end up detracting from, not adding to, national development. Sensible, segregated policies are not enough. The industrial coordinating body also has to worry about maintaining consistent and steady standards in both the method and the content of the strategy. There are four decisive standards for dealing with these recurring situations.

Style has to do with the manner and method of planning and management of the industrial policy. Closely coordinated administration can regulate resources and objectives effectively. A tight ship is generally regarded as a well-run ship, and given the best chance for success. But this isn't the answer for every situation. What works in Singapore may be disastrous elsewhere because cultural differences and economic circumstances alter the prescribed "best" answer. Where resources are diversified and many governmental units exist, looser techniques may be more effective. An intensive style in Malaysia and Indonesia could be counterproductive. Finding the style that fits may

be more important than trying to adapt technically efficient methods to a hostile environment.

Staging is related to the level of economic advancement and the technological capabilities of the nation. Decisions that push technology strategy beyond the current capacities of the nation will not succeed. Even when they work from a technical point of view, the product may not be wholly useful, and results may be less beneficial than from a less ambitious effort. Staging is more difficult in implementation than in planning, and difficulties are magnified in a decentralized environment. On the other hand, decentralized programming can anticipate that built-in corrective machinery will help, not always possible in centralized systems.

The Singapore system has elaborate safeguards for assuring proper staging. They don't always work as planned, but the managers are adept at making changes. Both Malaysia and Indonesia are currently debating policy on staging. The issue in Malaysia is the pace of technological advance in the past decade. Several advisors in the Prime Minister's department believe that staging has not been sufficiently aggressive and that affirmative government investment policies are called for that will move the country into higher tech industry on a large scale. In Indonesia, the levels of budgetary support for the PALAPA satellite communication system as well as for a research and development center are in question. Several influential economists argue that these represent staging that is too aggressive, and that greater emphasis should be given at this time to labor intensive staging.

Foreign trade considerations enter every question in an information technology strategy. It is easy to see why. The strategy affects the

foundations of foreign trade by seeking to alter the national resource base through creating, enlarging, and deepening knowledge resources. It is based on a new trade doctrine that is a departure from conventional explanations of why trade takes place, as well as from traditional concepts of comparative advantage and of what determines the gains from international trade. This does not mean that the economic gains from following comparative advantage principles are lost; indeed, they may be multiplied. The new concept of dynamic comparative advantage that is now advanced is a 1980's version of the earlier doctrine. It generalizes the infant industry justification for supporting new producers during an initial period of high costs, on the ground that support can be ended when economies of scale and experience take hold and costs come down.

According to the new doctrine, the high technology industries are based on systematized knowledge, a resource that has the capacity of revitalizing other resources as well as of recreating itself. As it is an acquired resource its acquisition requires maturation. Scientific knowledge and technologically employed knowledge must go through a learning and incubation period before becoming commercially viable on their own. Knowledge industries, therefore, cannot be judged by traditional standards of comparative advantage. If high tech industry is supported through the learning and incubation period, however, the national economy will move to a higher plane of comparative advantage and acquire in the process the technological capacity for international competitiveness. In the new doctrine a nation maximizes gains from trade by departing from static comparative advantage and creating its own dynamic comparative advantage.

The practicality of dynamic comparative advantage has been demonstrated many times. The new principle has also been abused many times. The possibilities of abuse are many, and the costs are high. Abuse initially deprives the abuser of objective pricing criteria for making allocation and output decisions; it eventually leads to misallocation of the nation's resources and retards its development. The problem for the industrial coordinating body is to seek out the dynamics and avoid the abuses: (1) to find step-by-step methods of achieving reasonable technological targets while avoiding technological gaps that are too wide, and (2) to integrate dynamic comparative advantage with known resource advantages, while avoiding commitments to targets that require periods of support so lengthy that they nullify eventual gains.

Singapore, Malaysia, and Indonesia have devised several practical ways to answer these problems. One is to focus on older technologies rather than to attempt the newer frontiers before adequate preparations have been made. A second, particularly applicable to Malaysia and Indonesia, is to relate information technology strategy to applications in industries where they have known cost advantages, for example, in their primary producing sectors. Singapore has concentrated on international trade and banking services, where it has long recognized economic assets. Important also is the practice in all three countries of aiming research and development at adaptive, not experimental objectives, and of devoting subsidized support primarily to education and training.

In actual practice, both Singapore and Malaysia have good records on industrial trading. Indonesia has had comparatively more

overprotected and uneconomic producers. The Suharto regime has taken some steps to correct these misallocations, but a history of import substitution could prove an important impediment to the information technology strategy. Malaysia has shown some inclination to over-protect its rising software and services trade, though these have been of minor consequence so far. Singapore's efforts to achieve Development Levering have sometimes had the practical effect of restricting some activities--e.g., consumer finance--to domestic companies.

Investment climate is another central factor in decision making, possibly the most important influence in employing foreign technology. While foreign technology may be obtainable without foreign direct investment, the disadvantages are often overriding. Many of the most attractive and potentially beneficial advanced technologies are held by firms that prefer direct participation. Moreover, except when the domestic licensee has independent access to top notch managerial experience or the technology has easily solved production problems, difficulties in employing it competitively may be insurmountable. Foreign direct investment is all but essential for a successful information technology strategy, and in most instances in large amounts. Hence, the importance of investment climate.

Investment climate is a product of scores of small items, and cannot be satisfactorily established in terms of a few criteria. Tax rates, joint venture requirements, wage rates, accessible transport, and excellent infrastructure are primary considerations. For many high tech investors management control and marketing opportunity are vital factors, particularly for those giving high priority to technological integrity and hoping to expand corporate activity. Because high tech

investors are looking at long range expectations they are not likely to consider any single factor, or any single set of factors, apart from its relationship in the context of everything that goes into the investment climate.

The investment climate objective of the information technology strategy is two-fold: to attract foreign investors in ventures that will produce the goods and services needed, and to assure that an adequate transfer of technology takes place through the venture. These can be conflicting objectives--for example, by such lenient foreign investment terms that technology transfer is minimal. But they need not be. The problem for the industry coordinator in the strategy is to establish an investment climate that provides a satisfactory balance between the two objectives.

The investment climate in Singapore has been studiously cultivated for two decades. The effort has been successful, which makes it easier to attract desirable technology into the country. In Malaysia, the investment climate has been clouded for the past decade by racial laws that impose quota requirements on all aspects of new investment. These do not obstruct technology investment, but they have hampered it. Although Indonesia's past reputation has been blemished by a large number of minor obstacles, more than from major ones, the investment climate has improved dramatically in the past decade. There is still room for improvement.

Ultimately, what the Four Standards show is the provisionality of an industrialization strategy. The terms "targetting" and "picking winners" that are elementary vocabulary in the voluminous literature on industrial policy in the advanced nations, have little relevance for an

industrializing strategy. What is relevant is determining where natural forces are leading and establishing conditions that will accelerate their movement. An industrializing strategy is not engaged in picking winners; it is intended to devise a framework that will enable real winners to stand up in real international competition. It is easy to go wrong and easier to fall short of ideals, but the Southeast Asians are showing that a workable framework is possible.

7. The Human Element

Adapting and administering an economic strategy in tune with international realities may solve several key developmental problems. But will it actually achieve development purposes? Why should Southeast Asians expect an information technology strategy to serve them when some of the more advanced nations that have tried have not been outstandingly successful? Why believe they can beat many years of Third World thinking about information technology that has been predominantly pessimistic and has made a popularly accepted case for its dismal expectations?

-- Microelectronics in the multinational companies would create a self-perpetuating technological gap that would intensify Third World inferiorities in industrial and economic strength.

-- The Third World at best faced a "Catch 22" choice; it could watch its labor intensive industries go under from computerized competition, or it could create its own stratified society of "haves" and "have nots" with computerized multi-national factories.

-- A former United Nations official predicted in 1981 that the Third World nations faced the prospect of turning into "deserts through the exclusion from the communications club."[1]

These bleak views seem out of place today, except perhaps for the poorest nations that have not yet been able to break out of the poverty cycle. In much of the Third World, the prospects are much brighter. In many, opinions and expectations are much more optimistic. Few Southeast Asians regard microelectronics and computers as the sure fire answer to their economic future or fail to see the social issues that may arise. Many believe that microelectronics can be harnessed and made into a national asset that will give people who use it prudently an edge over their competitors. Even the pessimists acknowledge that competitive forces may make non-computerization a more vulnerable strategy than computerization.

Four reasons account for the optimism prevalent in Southeast Asia. Mutually reinforcing, they add up to a growing assurance that these Third World nations can compete against the high technology lead of the industrialized world. The attitude of hope is partly psychological; it is founded on fundamental perceptions of the economics of industrial information technologies.

1. Labor Costs. The Southeast Asians have been capitalizing on the knowledge that a major motivation for technology investments in the Third World is to take advantage of lower wage scales. The principle is as applicable to high tech as to labor intensive industry, provided trained employees and technically skilled professionals can be found in the developing country. Education and technical training in computerization and computer controlled production has a high priority

in each Southeast Asian country. The learning curve for a worker in an automated steel or motor vehicle plant in Southeast Asia may be longer than for a worker in Detroit or Pittsburgh, but still not detract from the difference in wage scale. Although wage rates may rise faster in Southeast Asia, the increase is not likely to compensate where very high wage rates exist in the U.S. or other industrialized competitors. Automated production is accepted as necessary today for meeting international competition in such industries as textiles and timber processing.

2. Industrial Interdependence. The Southeast Asians anticipate a growing role in high technology based on the complexity of advanced industry. Production in the modern industrial corporation is not a single progression from raw material to a finished product that is then delivered to a customer. It is a series of discrete steps in a complex process. A single corporation is likely to engage in only a small portion of the entire process, with final product manufacturers often serving as little more than assemblers of components made by sub-contractors in accord with the manufacturer's design. Some American companies--most notably IBM--have incorporated Southeast Asians into this process, and Japanese corporations are also beginning to sub-contract in the region. It is still a relatively limited phenomenon, but the Southeast Asians expect to enlarge their activity in complex production and to employ information technology in increasing their role.

3. Technology Transfer. Despite international controversy over access to technology and much concern over the terms of its transfer, many developing countries have not found access an insuperable problem.

Increasing diffusion of the knowledge underlying the scientific principles can be expected to make the technology even more widely available. A congenial attitude towards foreign investment helps technology flow inward; the Southeast Asians can look with guarded confidence to multinationals for high tech engineering and design and for production processes through licensing, joint ventures, and turn-key contracts. Much of the most important technology for industry is the property of engineering firms or manufacturers of robots and other automated machinery. The technology is marketed internationally and is sold as readily to developing countries that can employ it as it is to the industrialized nations. Proprietary technology in the possession of final product manufacturers, who may want to discourage competition in the Third World, may not be as accessible. Even proprietary technology is subject to the competitive processes, however, and eventually becomes available internationally when its owner decides that earning licensing royalties is better than watching a competitor earn them. Competition among the technological leaders is insurance that high grade technology will be available on competitive terms and prices.

4. Self-Confidence. Twenty years of rapid growth has created a public expectation of economic progress and an atmosphere of confidence that economic problems are manageable. If the inertia of colonization can be overcome, why should high tech be more difficult? Southeast Asians see the immediate challenge in commercial terms. The objective is not to overtake technological leaders, or even to challenge them on technological grounds. The Japanese example demonstrates that technological pioneering is not necessary for commercial success, that

innovation on the production line and in the market place are often more advantageous than scientific leadership. Adopting and adapting is a proven technology strategy and can be as commercially profitable for Southeast Asia as it has been for Japan and other parts of East Asia.

PART III

International Consequences of the Information Technology Strategy

The national development policies of Singapore, Malaysia, and Indonesia described in this report show a common and growing reliance on the use and technological intensification of computer-communication applications in industry and commerce. It will be many years before policies are fully evolved and their international consequences are worked out. But the initial impact of the trade and investment patterns and the structural changes they are generating is already being transmitted abroad. These new patterns and structural changes could have significant implications for other countries within this decade; (1) increasing Southeast Asian technological component requirements for capital imports and foreign investment and a growing demand for imports of computer-communication products and services; and (2) the emergence of a Southeast Asian growth center of increasing international significance.

A comprehensive investigation of these international consequences lies beyond the scope of this study. This inquiry into questions of trade and investment touches on broader implications, but does not consider them in depth. It includes a brief analysis of Japan's changing role as the principal external influence on the area's industrial advance. It focusses on the impact that the changing structures in Southeast Asia are having on (1) the trade and investment opportunities that are opening up, (2) the regulatory culture that is forming, and (3) the public policy issues that are being posed for other governments.

8. Trade and Investment in Southeast Asia: Japan Sets the Pace

Japan's industrialists have the biggest outside stake in Southeast Asia's aspirations for high tech industrialization.[1] Japan has been the number one outside industrial force in these countries for a decade or longer. The area's markets have been major outlets for export and investment, and its oil, timber, and other primary products have fed the industries of Japan for many years. The trading relationship has been generated by exports of low priced consumer goods and machinery, and especially of capital goods and technology associated with investments in primary products and in factories and plants of lower and mid-level technologies. Official encouragement and diplomatic backing along with material support in the form of export credits, low interest loans and tax concessions have helped the Japanese corporations. But their success has been much more attributable to their own entrepreneurial behaviour; to aggressive marketing, low cost management, and thorough knowledge of local conditions.

The data in Figure 8 below are an indication of Japan's leading position. They show Japan with a 20 percent share of a $59 billion market in 1982, compared to 12 percent for the U.S. Japan's exports were about 10 percent of its total exports, but U.S. exports were only 3 percent of its totals. Official investment data are not available by country and, partly because many oil-related investments are omitted, the figures that are officially released are ambiguous. With this qualification, the indicators of industrial investment in Figure 8 appear to show a decided lead by Japan in both Indonesia and Malaysia, but probably a U.S. lead in Singapore. (See the explanatory footnote

b /.) Japanese investments tend to be diffused throughout light and medium industries, electronic products, trade, primary products, and transport while U.S. investments are concentrated more in higher technology applications, principally petroleum drilling, oil refining, banking and financial services, and electronics.

Figure 12

Trade and Investment of the U.S. and Japan in Southeast Asia

	Market Share (a)		Foreign Investment (b) (Excluding Petroleum)	
	U.S.	Japan	U.S.	Japan
Indonesia	11%	28%	6%	35%
Malaysia	14	20	Fourth	First
Singapore	12	15	31	30
Total	12%	20%		

a. The figures refer to percent of total imports that each nation obtains from the U.S. and Japan. Data are for 1982 and are from International Monetary Fund, Direction of Trade, various issues. Total imports of the three nations in 1982 were $59 billion.

b. The figures refer to the relative position of the U.S. and Japan in relation to total foreign investment. Indonesian percentages are from the Investment Coordinating Board Report for Foreign Investment Projects During 1967-81, and are cumulative for the 1967-81 period. The Singapore figures are also cumulative for 1972-81, and are taken from the Economic Development Board Annual Report, 1983. As the categories reported by EDB are for "North America" and "Asian" investments the U.S. percentage includes Canadian investments and the Japan figure includes, among others, investments from Taiwan, Hong Kong, and Indonesia. Malaysia does not issue statistical data on foreign investment by source. Various publications of the Malaysian Industrial Development Authority refer to the relative positions of foreign investors, i.e., Japan is currently in the leading position and the U.S. is in fourth position. It should be explicitly noted that the figures contain obvious ambiguities whose net effect is probably to understate the relative investment position of the U.S.

Japanese activities in Southeast Asia have not been as systematically pursued as some writers suggest. Many Japanese corporations, however, have established investment patterns that have coincided with the advancement of the Japanese economy. The symmetry was not perfect, but it was good enough to materially affect the investment and growth patterns of both areas. Rising high tech employment inside Japan stimulated investment in rising low tech employment in Southeast Asia. Success for Japanese firms often rode on taking advantage of a situation that enabled them to transfer at great profit their labor intensive factories from Japan to Southeast Asia. These investments, in turn, generated more trade in supplies and equipment and greatly enhanced Japan's role as an economic power in the area.

The question now is whether past corporate strategies will continue to be as effective as the underlying rationale changes. The Southeast Asians are moving progressively toward higher tech employment, thus distorting symmetrical patterns. Local demand for low cost consumer goods is growing, but local producers are increasing output and upgrading their plants and, along with producers from other developing countries, are moving into and aggressively competing in these markets. It is therefore questionable whether a trade and investment strategy of the 1960's and 1970's makes sense in the 1980's. There are clear indications that the evolving economic structures in Southeast Asia are causing new thinking about future trade and investment in Tokyo boardrooms.

Past corporate strategies were related to official policies in Japan that encouraged movement out of labor intensive industries. In its own upward advance, Japan was pursuing a policy of moving domestic resources from lower to higher levels of "value added" and trying to do so without

forcing companies to pay excessive dislocation costs. But the necessary shifting was in fact an exceedingly difficult adjustment for the companies. Eleanor Hadley and others have shown how these firms faced wholesale disruptions or bankruptcies in staggering numbers.[2] Moving abroad was an alternative to shifting assets at home or to going broke. To make the adjustment more palatable the Japanese government provided special incentives to companies to move out. Many firms accepted low interest loans and tax concessions for making this adjustment and shifted their operations to other parts of Asia. Low wage rates and abundant labor provided further economic inducements for Japanese firms to establish subsidiaries or, more often, to form joint enterprises with local Southeast Asian business interests.

The tracks of a profit making enterprise following a symmetrical strategy have been traced by Professor Terutomo Ozawa:

> Asian countries account for about 40 percent of Japan's overseas investment in manufacturing .... mostly labor intensive, low technology producers. This newly evolving trade system enjoys not only the low cost production available in developing countries, but, and more important, the marketing networks so extensively developed by Japanese firms, notably the trading companies in world markets.3

In short, the investment strategy worked out by Japan's companies resulted in transferring the low value added manufacturing portion of electronic products, textiles, and garment production to ventures abroad, while retaining the high value added marketing portion under their own corporate control. Because the Asian investments provided built-in marketing arrangements their investors greatly diminished the risk that the joint venture producers would find themselves with warehouses full of unsold or unsaleable inventories.

The functioning of the strategy required open external markets for the Japanese trading companies and for the new producers in the developing country. It worked at lower technological levels when these markets could be reasonably assured. But this was, in part, an accident of history. There are two reasons for suspecting that this productive investment strategy may not work as well as the Southeast Asians move into higher and more complex technologies.

1. Market adjustments at lower technological levels have in practice been only partially borne by Japanese domestic markets; indeed, Trezise and Suzuki believe that domestic markets were hardly opened at all to these imported products.[4] In any case, the markets were soon closed as the labor intensive textile and electronic firms that went bankrupt or moved to other parts of Asia in the 1960's were replaced by integrated and automated factories in the 1970s. Many of the joint venture factories have had to look elsewhere to dispose of production. Much of the output of the Japanese invested textile and electronic factories in Southeast Asia has been marketed in Europe, North America, and elsewhere. This pattern might be much more difficult to repeat today.

2. The task of finding markets for past Japanese joint ventures has been eased by the trade preferences accorded manufactured products from developing countries. Under the trade preference schemes agreed to in the United Nations Conference on Trade and Development, industrialized nations in North America, Europe, and Japan have permitted certain industrial products from developing countries to enter at reduced tariffs and customs duties. Such preferences are not likely to be available for the higher technology goods and services. Moreover,

in the past decade many Asians have acquired marketing expertise in consumer goods; they no longer need Japan's trading companies for marketing these products.

With such difficulties in repeating past performance, it would be surprising if Japanese firms were not looking about for new trading relationships. One answer: if labor intensive investments are losing appeal, cost-cutting by upgrading the technology may work. This is a route for several mid-technology firms, under pressure at home to adjust for the knowledge society mode. Another answer might be investment in Southeast Asia for domestic rather than export markets, seeking, if necessary, protection from international competition.

Professor Miyohei Shinohara of the Institute of Developing Economies in Tokyo has described a different form of trading relationship that is developing as a result of changing structures in Asia. Shinohara distinguishes the new "horizontal" interrelationships from the "vertical" trade patterns that have characterized trade between the former colonial areas and the former seats of empire.[5] As colonies, trade relations were relatively uncomplicated: the Asians exported primary products that were processed in Europe or North America and received in return finished goods for consumption along with some capital goods. Post-colonial trade has followed the same patterns, or closely similar ones. But these vertical patterns have been gradually shifting, Shinohara says, as the production of manufactured goods has grown in Southeast Asia and exports of finished goods have risen. Although Southeast Asia continues to export large volumes of timber, rubber, palm oil, petroleum and other primary products, the interchanges are increasingly "horizontal." Intra-industrial relationships are

increasingly prevalent in the trade of Southeast Asia. Trading patterns are becoming more like those of the advanced nations. And, Shinohara thinks, Southeast Asian trade will in time resemble intra-EEC exchanges or that between the U.S. and Europe.

Shinohara's hypothesis seems well taken. It points to further proliferation ofcorporate trade strategies, and a widening spectrum as the Southeast Asian economies as well as the Japanese economy become more complex. No single strategy is suitable for every company and in an economy as comprehensive as Japan's, many corporate strategies are valid. Some Japanese corporations are leery about deviating from resource exploitation and labor intensive production in Southeast Asia.[6] Others are not, and are prepared to move into new modes of production and investment. For these, aggressive commercial enterprise requires a steady succession of new forms of trade and investment. Horizontal trade matches the Southeast Asian concept of employing information technology in interdependent production and their growing interest in high tech sub-contracting. It calls for new forms of organizing production and investment, and not just for a transfer of production facilities from one location to another.

The wider spectrum of corporate strategies is a logical response to technological advancement in Southeast Asia. It could provide the basis for a new era of trade and investment for Japan's corporations, one that is characterized by a gradual shifting to emphasize the horizontal more and the vertical less. Considering the high stakes involved for Japanese firms that come up with a strong and responsive strategy, the Southeast Asian area is likely to see them actively initiating high tech answers to the information technology strategy.

9. Looking West: The American Opportunity

How will the Americans perform in competition with the initiatives of Japanese corporations? They are favorably situated technologically, and, contrary to instances of subsidized terms for some Japanese trade, U.S. banking predominates in the area's competitive international finance. American high tech corporations enjoy esteem as the leading firms in most computer-communications product and service lines. Japan may be the overall pace setter, but the habit is deeply ingrained of looking west for advanced technologies. Many American firms have strong, established positions which put them in an opportune place for responding to Southeast Asia's movement into the information age.

The importance of this advantageous position must be measured in relation to how it is employed. Where others have advantages of their own, results depend as much on how corporate resources are used as on what resources the corporation controls. In the Southeast Asia of the 1980s, effective corporate strategy depends on understanding the dynamics of this part of the Third World and on finding realistic answers to the changing economic structures of the area. The final pages of this study, accordingly, are devoted to more detailed definitions of three critical questions that the economic dynamics of Southeast Asia pose for the United States and the international community.

The first of these questions is: What should American and other external suppliers anticipate from the increasing demand for capital equipment for upgrading production technologies through the use of computer-communication applications?

-- Technological Fusion is a fundamental part of the information technology strategy. It leads to growing requirements for production and distribution systems in which computer-communications are efficiently employed. In many cases external suppliers can satisfy demand through standard systems or by simple adaptations of systems employed elsewhere. This is true of many distributional service requirements for marketing, office administration, inventory controls, and others. In other cases, requirements will necessitate custom designed systems that make special use of conventional equipment and software. Demand for both types of systems is rising rapidly in all three countries.

A new form of technological fusion is becoming increasingly important in Malaysia and Singapore and is likely to mount rapidly in Indonesia during the coming decade. The new requirement is for specially designed systems that combine and mix other technologies with computer-communications for enterprises functioning on a national or international scale. It includes a comprehensive design for production and marketing, covering in particular a plan for training and production, intra-firm coordination, and research and development. What is called for is more than a computerized factory; it is a computerized industry system, suitable for conditions in a developing country.

Such requirements are mostly likely to be satisfied through direct investment and joint ventures, often with state-owned enterprises. In some instances they may involve orders for turn key factories or plant construction designs. Several fields in which such technological fusion requirements are likely to arise in the 1980s include paper and printing, food processing, rubber processing and products, oils and

fats, transport, microelectronic products and services, photographic supplies, medical equipment, health services, textiles, finance, banking, retailing, insurance, and metals and engineering fabrications. Before 1990, technology fusion requirements are likely to be mounting in traditional heavy industries. In Indonesia, government agencies probably will have greatly expanded requirements, just as Malaysia and Singapore are already deeply committed to official uses of the technologies.

-- Integrated Production. Adaptation to specialized Southeast Asian production could in many cases provide a profitable way to organize multinational production. Many Southeast Asian businessmen expect to concentrate on a small niche within an industrial process. By the same token, those who produce around that niche may concentrate equally on high productivity tasks necessary in the production process. This can be done either through sub-contracting or through more permanent inter-firm supplier arrangements. It might make sense for some multinationals to plan a production strategy around micro-applications where Southeast Asian natural comparative advantages lie, or where their improving capabilities in technical operations can be made into a new comparative advantage.

The rewards for organized production in the knowledge industries are for innovators who can see potential before their competitors do. Complex production that can use the skilled inputs from the Southeast Asians is a contest of industrial management. Even firms too small to engage in large scale international production with their own resources may be able to expand through a managed array and linked chain of small, highly efficient producers. An innovative American entrepreneur

recently revealed his start-up plans to compete on this basis in the market for office typewriters and word processors:

> We are anxious to keep this a United States company and will start assembling the machines here, but the economics of building Prototype machines in the Far East are irrefutable.

-- Small Business. Until recently, data communications systems were used exclusively in the larger businesses of Southeast Asia, but introduction of microcomputers altered this market. Smaller companies (e.g., real estate, insurance, retail and wholesale trade, trucking, repair shops) have been buying them throughout Southeast Asia, partly from curiosity and partly to explore their value in a small business setting. The latter objective has taken over as these business users have expanded from budget systems to other software packages. The inauguration of public data communications network services in Malaysia and Indonesia open new prospects for computer system usage by small business. Smaller companies have been virtually shut out from networking because of the high cost of leased lines, heretofore the only available option. A public system will provide innumerable new networking uses for small companies. Demand for more complex packages and custom made software systems is likely to rise rapidly. Demand for data base services could also increase as small companies gain in experience and see the potential that such services could offer. Local entrepreneurs are beginning to market data base services in Malaysia and Singapore, generally as an extension of computer hardware services.

-- Technology Transfer is one of the principal stakes in any high technology investment in Southeast Asia. The most difficult hurdles are managerial, rather than technical or legal. The western possessor of the most advanced technology is not necessarily at an advantage in these

circumstances. The Southeast Asian entrepreneur is looking for commercial gains from a technology transaction. This may be more substantial when buying a less than optimum technology, depending on the terms of sharing detailed technological data as well as on licensing and royalty fees. The key is performance in production, and the technology package that is bug-free and contains managerial assurance through the trial stages will be preferred over the latest developments. It can be assumed that several alternatives will be available that can be very attractive on commercial grounds to a Southeast Asian buyer.

An important consideration is the willingness of the technology supplier to work with his Asian counterparts in raising the technological level of a joint venture production or a licensing agreement during the period covered. Development levering has been a vital part of Singapore's technology strategy for many years, and will almost certainly become an element of increasing importance in development administration in Malaysia and Indonesia. This means that standard criteria for investment approval will be the inclusion of contractual provisions for upgrading technology and for active research and development programs. Investment proposals that explicitly provide for these criteria are going to be better received than those that do not.

-- Correcting Indonesia's Telecommunications Bottleneck is a requirement of special importance for the nation's economic future. Without a vastly improved and deepened system, nationwide marketing is fatally handicapped and new industry cannot reach output levels where low cost production is possible through economies of scale. The communication bottleneck is a major hindrance to development and

correcting inadequacies is a priority goal of the current plan for 1984-89.

The framework for a nationwide system has been started in the past decade by the building and operation of the PALAPA I satellite communication system. Orbiting of PALAPA II opens a new phase where the system is potentially usable throughout the sprawling island nation. In order to integrate and supplement the satellite system, it is necessary now for the Indonesian telecommunication agencies to concentrate on expanding and upgrading terrestrial communications. Indosat also is expected to focus on earth stations, and has been moving on this problem by constructing more than 100 of them, an increase over the 40 available earth stations for PALAPA I.

With this large increase in earth stations, local transmission and usage becomes of paramount importance. These neglected areas in the Indonesian system are going to be dealt with in the present plan period. The PACKSATNET is intended to permit data communications over most of the country. Local lines will be extended and upgraded to handle commercial traffic, particularly in and between major cities, and telephone installations are to be doubled in the next five years. Terrestrial microwave and land cable lines will be installed to make effective use of and to backup the satellite communications. Television and radio broadcast services will be expanded, resulting in increasing requirements for both services and equipment. Production and assembly plants are also expected to be constructed for supplying a part of the equipment that will be needed.

-- Telecommunication Equipment Suppliers have a marketing opportunity here amounting to several billion dollars over the next five

years, and rising even further into the 1990s. Except for satellite communications, this is a market where until recently American suppliers have shown little interest and have not had a significant place. This is partly a matter of historical accident and partly a matter of technical standards (see below for further commentary on the question of telecommunication standards in Southeast Asia).

While European and Japanese manufacturers may have the advantage of history, many American companies have been working hard to compensate for their disadvantages not just in Indonesia, but in Malaysia and Singapore as well. They have a big handicap to overcome. AT&T has a special problem because of its size, its monopolistic past, and because it is a newcomer in the area. When a Telecom executive asks "where have they been" he means that Southeast Asia expects the company to prove itself. Until wary Telecom managements observe how AT&T is going to behave, a careful attitude is likely when bids are considered. Many months may be required before AT&T is as fully accepted as some of the European, Japanese and other American firms that have been active in the region for many years. In the meantime, AT&T might accelerate becoming a member of the "community" by carefully planned support for infrastructural and institution building.

The second question posed by a technologically emerging Southeast Asia is: what should multinationals look for in the new regulatory cultures that are brought about by technological fusion, rapid development, and advancing technologies?

-- Regulating High Tech raises new problems for Southeast Asian governments. They are undergoing strains similar to those seen in the U.S., Western Europe, and Japan whose regulatory bodies don't know what

to do either when industrial lines become blurred and unprecedented situations come up. Deregulation has been tried but often is a misnomer when it only means a different form of regulation. More frequent is regulatory lag, where agencies continue to administer rules and standards that are obsolete or that may even run counter to new policy objectives. Telecommunication administration often fails to keep up with the needs of the industry. A different kind of lag is reflected in the inability of any government to regulate illegal copying of patented and copyrighted products.

Another attribute of the changing regulatory culture is increasing differences among agencies responsible for technology decision making. Singapore Telecoms may technically approve new equipment for installation in banks, but other government agencies may restrict it for other reasons. National agencies in Indonesia and Malaysia often follow wholly different guides than state or regional authorities. These discordant forms of regulatory culture are a growing phenomenon and are likely to be encountered in all three countries with greater frequency. It is a problem that is bred by success. The purpose of the information technology strategy is to encourage computer-communication applications that cut across industry boundaries. The more successful the strategy, the more likely it is that the regulatory authority will be unable to keep up the pace. When two or more regulatory bodies are involved and both are falling behind the industry they are trying to regulate, conflict and confusion are unavoidable until new lines of authority are sorted out -- and new regulations are approved.

-- Information Flows have not yet become a major issue in Southeast Asia. The privacy regulations that have been a matter of extensive

negotiation in the industrialized world are not found in this part of Asia. Data protection laws have not been legislated. However, other forms of restrictions on data and information flows, though not extensive, are found in all three Southeast Asian countries.

Press censorship is practiced in the area, a tradition that has been extended to television, films, and more recently to public sales of video tapes and computer software. While enforcement is usually directed toward moral, social, or political objectives, the censor's offices have also used their authorities to restrict legitimate economic transactions or to improve local commercial earnings. In a straightforward case, the official Malaysian news agency, Bernama, recently announced that after May 1, 1984 it would be the sole subscriber and distributor of foreign news agency services. Bernama's General Manager candidly disclaimed any intention of exercising any editorial or other censorship. To the contrary: "Bernama's new role is a business, not a political story."[2]

Financial data flows have been restricted by Singapore in connection with regulatory measures that were necessary to control banking operations and maintain an orderly money policy. The Monetary Authority of Singapore, for example, does not permit bank accounts to be processed internationally when such processing could result in evasion of regulations intended to control the supply of money, or when they could lead to a violation of banking reserve requirements. Although foreign exchange transactions are not prohibited, banks are required to submit daily reports on active accounts. These regulations have now been incorporated in legislated amendments to the "Banking Act."

There are many restrictions in Indonesia and Malaysia on the uses of telecommunication links. All three Telecom authorities require specific approval for any equipment that is attached to the telephone system. In Malaysia, requests to install forwarding devices are denied, and equipment for automatically transferring incoming calls into a firm's branch office to the head office is not acceptable. Both Malaysia and Indonesia restrict use of leased lines, and will permit only point-to-point communications, which limits efficiency and increases the cost of networking. Singapore rarely imposes restrictions on line usage and then only when the equipment is clearly incompatible with the system and would cause unacceptable disturbances. But other agencies may restrict even when Telecoms approves. Banks, for example, are permitted to operate automatic teller equipment through telecommunication links but the Monetary Authority will permit them to be installed only in branch banks.

The ASEAN members have considered the possibility of a regional agreement that would facilitate the flow of information and data and would limit unnecessary restrictions that are detrimental to other members. They have agreed on some common practices in connection with the use of the PALAPA satellite system. ASEAN has not, howver, reached any binding, formal agreements on dealing with transborder data flows.

-- Telecommunication Standards. Rightly or wrongly the Telecom authorities in Indonesia and Malaysia tend to follow standards set by CEPT, the Coordinating Council for European Posts and Telecommunications. U.S.-made equipment and software are not automatically approved--to the detriment of both the manufacturer and the user. A financial service company in Malaysia, for example, has been considering

installing a main frame computer that would replace its present dependence on the computer in Singapore. Import duties of 25-30 percent on computer equipment have been lifted and a new installation in Malaysia would circumvent a hefty surcharge on transmissions to Singapore. But this company is hesitant to go ahead because Telecoms approval has been withheld in similar past situations.

Telecoms officials acknowledge their hard-nosed attitude toward telecommunications and computer equipment and software that does not conform strictly to the CEPT standards. Few of their personnel are capable of testing and analyzing data that may be submitted on non-CEPT standard products. Telecoms organizations want to use this expertise sparingly in equipment appraisal. Analysis that would provide unqualified answers is costly. It is easier and more economical to follow known standards closely and take no chances. A consultant to the Ministry of Communications in Indonesia explained his conception of the system. Decisions are made by consensus. When a standard is approved it is a consensus decision. Nobody wants to go out on a limb and recommend an exception to the consensus, especially when very little internal analysis of the standard is available.

American company representatives reject these explanations, insisting that the equipment in question would be compatible with existing systems. They may be correct. They have not, however, made a case that overcomes Telecoms objections, with the result that U.S. suppliers and users are at a disadvantage. The cost of not resolving the standards problem could accumulate if U.S. suppliers in telecommunications and data communications markets continue to function with this handicap.

-- Export Processing Zones have served a dual purpose in cutting through conflicting regulatory concepts and at the same time in employing large numbers of unskilled and semi-skilled workers. They have provided profitable ways for many American multinational companies to take advantage of an elementary complex production arrangement. The EPZs permit regulation free entry of materials--such as micro chips--into the host country for such things as watches, television sets, or computers.

Despite these advantages recent U.N. studies have concluded that the EPZs have not been very effective in raising the technological level of the host country. These studies have suggested that the EPZs are passe and should be phased out.

The conclusions of the UN reports are disputable. All three countries will continue indefinitely to need many employment opportunities for unskilled and low skilled workers, jobs that EPZs can provide. Both Singapore and Malaysia continue to use the EPZs as much as before for simple assembly of semiconductor devices, and to use bonded warehouses for other industrial purposes. Indonesia would like to expand employment in these zones and is greatly increasing its use of the EPZs. They will probably continue as a channel for attracting investment in high technology, especially when a priority technology is involved.

The EPZs provide a unique way for Southeast Asians to develop a specialty in a single phase of a complex industry, or to develop a production unit in an integrated multinational plan. Technologically, they perform a valuable function for the host country as a training ground for managerial personnel and as a place where technically trained

professionals can gain experience at increasing levels of responsibility. Even untrained workers use EPZ employment as an entry job and move on as better qualified workers in other industries.

By the same token, American high technology manufacturers and service companies have found EPZs a useful site for investing in Southeast Asia. They provide an environment that minimizes difficulties with the regulatory obstacles that inhibit investment elsewhere. When the EPZ operations can be integrated economically into corporate production planning, they can provide for technological upgrading that benefits the host country and is profitable for the multinational as well. Indeed, some of the emerging regulatory culture problems might be averted by more extensive use of the EPZs.

-- Corporate Representation has always been a vital factor in international business, and its importance is not likely to lessen in the future. Southeast Asia's increasing reliance on computer-communication applications could bring many new problems for corporate representation. In the changing regulatory culture, representatives who can explain corporate problems in terms that are understood and appreciated by local authorities might make the difference between a profitable investment and an intolerable and worsening situation.

There are no set formulas for successful corporate representation. Many American companies are directly represented in branch or joint venture operations. In such cases they usually have a corporate relationship that is suitable to the unique competitive environment in Southeast Asia, with national representatives who have been in the area for several years and know their way around. U.S. firms also send non-Americans into Southeast Asia, drawing on qualified personnel from

corporate branches in Europe and Asia. A unit of an American financial service company in Kuala Lumpur, for example, is run by a Malaysian who heads a non-American staff of about 90. Multinational representation, in short, appears to have many satisfactory options, so long as the representatives know their territory and their company and are authorized to pursue company interests responsibly.

On the other hand, corporate headquarters are often much less cognizant of opportunities or pending problems in the Southeast Asian branches. Some U.S. multinationals might be cited as models of intra-corporate communication. Other companies communicate essentially on technical and production questions and corporate headquarters is either not informed, or chooses not to be informed about local conditions that can have important ramifications for business. This is especially true when representation is through licensing or franchises. The common lament of the local licensee is "they don't know what the hell we do." Much more could be gained from capable and high motivated individuals who would respond to guidance from corporate headquarters. Licensing and franchising are essential for distribution of many high technology products and services, and this form of distribution will loom much larger in future competition in Southeast Asian markets.

Larger firms might consider a branch official in each Southeast Asian country, or, for some, an ASEAN network. A regional representative in Tokyo or Sydney, though possibly desirable in other respects, is not likely to be a productive substitute for team managers leading a "hands on" competitive effort in Southeast Asia. But new and imaginative efforts may be necessary to provide the quality of professional-managerial representation needed for distribution of

American high tech products and services without being overcome by the great expense that local representation can entail. One promising approach to the problem is that of the HONEYWELL High-Tech Trading Inc. which began operations in January 1984. A subsidiary of Honeywell Incorporated, the Trading Company will provide distribution services to small and medium sized high-tech firms wanting to export their products. Another answer for some U.S. firms might be co-ventures with Asia-wise Japanese or Europeans.

The third question raised by the dynamics of Southeast Asia is: What public policy issues does the information technology strategy pose for the U.S. and other technologically advanced nations?

The technology strategy may alter policy options for other governments even more than for their multinational companies. The principal issues sound familiar, but the context in which they appear is changed and the effect of specific decisions may be greatly different in the future.

-- Regulatory Issues are sure to get increasing attention in the capitals of the advanced nations. As official intervention is an essential part of high tech policy in Southeast Asia, multinational companies are likely to have frequent encounters with regulatory agencies. Yet there are no clear guides on how public interests are best served when regulatory conflicts arise internationally. Paradoxically, the pressing issues for the U.S. have concerned too little or misdirected, rather than too much, regulation. The U.S. has protested against the growing production of counterfeit microelectronic products and software and has explored with East Asian governments how they might improve and tighten controls on the industry. Many of the

telecommunication issues that are troubling multinational companies also involve questions of how regulations are established and enforced, not whether they are necessary. Both sets of issues arise in areas where international agreements have existed for years, but these are often inoperable today because their technologically dated provisions give uncertain guidance that is hotly disputed. This suggests that new international arrangements may not be a promising answer in the near future for new international regulatory problems.

The principal question posed by regulatory conflict is whether public interests are best served by public action, and if so, when, where, and how. This is not a new dilemma. But growing reliance on high tech in Southeast Asia -- and other Third World areas -- not only increases the frequency of regulatory conflict, but can also result in situations that cannot easily be resolved without government intervention. In particular, when many governments are simultaneously pursuing technology development policies, differing or contradictory regulatory practices in some fields could create serious international disorder. Thus, it is essential that public policy makers stay abreast of and understand the regulatory cultures as they develop. It does not necessarily follow that involvement is inevitable or desirable. Answers to this question must be decided in specific circumstances and in well prepared judgement as to whether involvement can serve a useful purpose.

The financial regulatory culture in Singapore demonstrates the difficulties confronting public policy elsewhere and at the same time provides a foretaste of the complexity that other industries can anticipate. Over the past two years financial regulations have undergone significant alterations, several of which have been referred

to in earlier portions of this paper. The overriding purpose has been to assure monetary and foreign exchange stability for the nation. But the changes in regulations have also had incidental effects, as well as other purposes, such as protecting small banks by restricting competition in areas such as consumer finance; levering financial development upward by encouraging foreign banks into higher tech forms of international finance; and coping with technological and information flow problems.

How should public policy deal with this kind of complexity in the regulatory culture? While monetary and exchange stability may be the foremost considerations for the U.S. as well as for Singapore, should other incidental effects or purposes be overlooked? Conversely, would Singapore's sovereign right to control its money be challenged if incidental effects and other purposes were taken up separately, apart from the international financial context in which they arise?

Given the present lack of consensus on international regulatory conflict, public interests might be served best through monitoring alone, provided it is perceptive and enables policy makers to give reliable advice to the multinational companies. This is not easy to accomplish, especially with the level of resources now available for such monitoring. This is a task for public policy, determining how the job can best be done. At a minimum this may necessitate new channels that would inform public policy makers of private sector interests before they become explosive issues. It may also require establishing more extensive monitoring and listening posts in Embassies, formal arrangements with Southeast Asian governments for obtaining information and exchanging views on some critical areas.

-- Telecommunications Development is increasingly recognized as a claimant on assistance from bilateral and multilateral lending agencies. The World Bank report on "Telecommunications and Economic Development" attributes a much more instrumental role to communications in the development process. The International Telecommunication Union is now surveying areas where technical assistance may be necessary and justifiable. This study of Southeast Asia, also, has shown developing countries giving high priority to establishing and upgrading telecommunication systems because of their integrating function in industrial development.

The question for public policy is to determine new parameters for telecommunications assistance that take account of this greater claim but do not overdo it. Telecommunications is a costly development item. The capital costs can often be paid off in relatively short order unless subsidized users are allowed to dominate the economics of the system. Because user fees are collected in local currencies and much of the capital costs are payable in foreign currencies, many developing countries encounter debt service difficulties in financing telecommunication systems. For many of them, particularly those in Southeast Asia, supplier credits and other private financial accommodations can be arranged. Even so, there is a strong case for liberalizing the parameters for financial support from international lending agencies.

Most developing countries, moreover, have personnel requirements that cannot be satisfied through financial accounting of a telecommunications system. The evidence of this study indicates several areas of particular importance for external assistance, such as facilities for training of operations and maintenance personnel, and for education of

technical professionals and scientists needed for research and development. Other priority requirements include international exchanges on telecommunication regulation, operations administration, standards evaluation, and technology appraisal.

-- Trade and Technology Flows. The technology strategy brings a new dimension to an old debate: free trade versus protection. A successfully implemented program is one that, operating on open market principles, will lead to new growth centers that substantially outperform established industrial countries. A vital assumption is that the resulting speed-up in industrialization will not be impeded by closed external markets or by inability to obtain foreign technology. This could be a questionable assumption if Third World industry displaces production in the advanced countries and these nations turn to protection for domestic industry and labor, or to restrictive controls on the export of technology.

The ultimate result of such action by the advanced countries would be detrimental to their own interests, undermining a development strategy that is attuned to the principles of open markets. It would endanger the prospects of Third World growth centers that can stimulate activity in the slower, older economies. Advanced nations who turn to protection against developing countries, moreover, would be protecting low value added production for home consumption while sacrificing high value added production for export in the Third World.

The critical issue for the advanced nations is that of finding a new and different perspective on economic relations with developing countries. Today's perspective inadequately reflects economic changes that have taken place in many developing nations in the post-colonial era. It reflects even less the dynamism represented by high tech

policies in such places as Singapore, Malaysia, and Indonesia. Third World countries are still seen as passive suppliers of cheap manufactured goods and primary materials for the world's industry. Causality in this interdependent relationship is commonly perceived as a one-way street, with the economic health of the Third World considered as wholly dependent on what happens in the advanced nations: "When the U.S. sneezes, the rest of the world catches cold." This may be true; but it is only one-half of the story.

This study shows Southeast Asian nations in an activist role, responding to favorable and unfavorable conditions abroad with a spontaneity that is producing economic growth far more rapidly than the U.S. and other industrialized countries. It decribes dynamic markets that increased imports more than ten-fold in a decade when U.S. domestic market activity was rising no more than 30 percent.

The continued transformation of Southeast Asia into a major growth center makes the common perception of interdependence more and more obsolete. Trading with these and other high growth developing nations is becoming an increasingly important source of economic stimulation in the advanced nations. Interdependence is becoming a two-way street that requires a balanced perspective for public policy making: "When high growth developing countries prosper, the U.S. is a healther place."

The advanced nations that grasp the new perspective and adapt it to trade and technology relations with the developing countries will prosper most in a global economy that is increasingly dependent on Third World growth. This may be the decisive factor in how much Southeast Asia will be Looking East and how much it will be Looking West a decade from now. It could also be a real test for economic leadership in tomorrow's world.

Appendix A: Interviews, Contacts, and Reviewers

Michael Adams
CAD-CAM Systems Pte.
Singapore

Adi R. Adiwoso
Pt. Realisi Komputer Nusantara
Jakarta, Indonesia

Christiano Antonelli
University of Calabria
Italy

Hedwig Anuar
National Library
Singapore

Susumu Awanohara
Far Eastern Economic Review
Jakarta, Indonesia

Abu Bakar Hj. Kamat
Motorola Malaysia Sdn Bhd.
Petaling Jaya, Malaysia

Ronald A. Bamberg
TYMSHARE
Cupertino, California

Rose Bannigan
National Research Council
Washington, D.C.

Jerome J. Bosken
USAID
Jakarta, Indonesia

Jane Bortnick
Congressional Reference Service
Washington, D.C.

Kenneth Bosomworth
International Resources
Development Inc.
Norwalk, Connecticut

John J. Brennan
Citibank
Jakarta, Indonesia

Ramesh Chandar
World Bank
Washington, D.C.

Cheong Wai Chew
Economic Development Board
Singapore

Chia Choon Wai
Telecoms
Singapore

Chia Wai Peng
American Embassy
Singapore

John J. W. Chin
Komputer Sistems Pte. Bhd.
Petaling Jaya, Malaysia

C. C. Crawford
University of Southern California
Los Angeles, California

Herbert S. Dordick
University of Southern California
Los Angeles, California

P. G. Ellinghaus
International Business Machines
North Tarrytown, New York

Ali Bin Esa
Syarikat Perumahan Pegawai
Kuala Lumpur, Malaysia

Michael Flanagan
Computervision-EDB CAD-CAM Training Unit
Singapore

James Fu Chiao Sian
Prime Minister's Office
Singapore

Rene Fuentes
S.G.V.-Kassim Chan
Kuala Lumpur, Malaysia

Ahmad Kamal Gilani
CAD-CAM Systems Pte.
Singapore

Laslo Gross
ATT International
Basking Ridge, New Jersey

Manggi Habir
Far Eastern Economic Review
Jakarta, Indonesia

Penelope Hartland-Thunberg
Center for Strategic and
International Studies
Washington, D.C.

Robert Hinde
British Telecom International
London, United Kingdom

Hon Chee Won
Monetary Authority of Singapore
Singapore

Monir Hussein
Motorola Malaysia Sdn. Bhd.
Petaling Jaya, Malaysia

Meheroo Jussawalla
East-West Center
Honolulu, Hawaii

Victor Kanapathy
United Malayan Banking Corporation
Kuala Lumpur, Malaysia

Michael Kerwin
ATT International
Basking Ridge, New Jersey

Mark Lam
CAD-CAM Training Unit
Singapore

Alfonse La Porta
Department of State
Washington, D.C.

C.S. Lau
GOON Computer and Management Studies
Kuala Lumpur, Malaysia

Lee Lin Tuan
Monetary Authority of Singapore
Singapore

Lin Cheng Ton
Economic Development Board
Singapore

Mohd. Radzi H. Mansor
Malaysia Telecoms
Kuala Lumpur, Malaysia

Philip Markert
Citibank
Kuala Lumpur, Malaysia

John McLucas
COMSAT
Washington, D.C.

Tan Sri Raja Mohar
Prime Minister's Office
Kuala Lumpur, Malaysia

Dean Mohlstrom
Omnipraxis
Cliffside Park, New Jersey

Tony Moo
Automated Systems (Pte) Ltd.
Singapore

William G. Mould
American Express
Singapore

F.B. Murwanto
Posts and Telecommunications
Jakarta, Indonesia

Ng Kok Song
Monetary Authority of Singapore
Singapore

Ng Koon Huek
CAD-CAM Systems Pte.
Singapore

K.K. Ng
American Express
Kuala Lumpur, Malaysia

Bien Mei Nien
PAAC Management Sdn. Bhd.
Kuala Lumpur, Malaysia

Ooi Kim Biok
Telecoms
Singapore

T. John C. Pasaribu
Indonesian Institute of Science
Jakarta, Indonesia

Raymond J. Paske
American Express
Singapore

Kenneth L. Phillips
Citicorp
New York, New York

Malcolm Pick
Institute of Advanced Computer Technology
Kuala Lumpur, Malaysia

Eric Pringle
Eric White Associates
Kuala Lumpur, Malaysia

Donald A. Ryan
Department of Commerce
Washington, D.C.

L. John Rankine
International Business Machines
Armonk, New York

R.E. Sonstad
National Semi-Conductors
Singapore

T. Shanmulingham
Malaysia Petronas
Kuala Lumpur, Malaysia

Alaster M. Smith
Times Publishing Bhd.
Singapore

Daljit Singh
Ministry of Culture
Singapore

Kent Stauffer
Department of Commerce
Washington, D.C.

Graham Steady
Department of Communications
Jakarta, Indonesia

Sung Sio Ma
Telecoms
Singapore

Hashim bin Talib
American Embassy
Kuala Lumpur, Malaysia

Peter H. L. Tan
Dataware Sdn. Bhd.
Kuala Lumpur, Malaysia

Teh Kok Peng
Monetary Authority of Singapore
Singapore

Edmund K. Tham
National Computer Board
Singapore

Thong Pao Yi
National Computer Board
Singapore

Stephen Van Dijk
American Express
Jakarta, Indonesia

A.B. Van Rennes
BPP Teknologie
Jakarta, Indonesia

Christopher J. Vizas III
Orion Telecommunications Ltd.
Washington, D.C.

Geoffrey H. Walser
American Embassy
Singapore

Yoke-Lan Wicks
National Library
Singapore

William Wong Yen
Investment Banker
Kuala Lumpur, Malaysia

Yap Kim Swee
American Embassy
Kuala Lumpur, Malaysia

Yeo Khee Leng
National Computer Board
Singapore

Yeo Seng Teck
Economic Development Board
Singapore

Murray Zinoman
American Embassy
Kuala Lumpur, Malaysia

Notes

Chapter 1. The New Growth Centers

1.1 Sol Sanders, A Sense of Asia, New York: Charles Scribner and Sons, 1969, p. 180.

1.2 The legal formalities of independence for Malaysia and Singapore were not completed until 1963, after the constitution of the Federation of Malaya had come into effect (1953) and the State of Malaysia, including Singapore, had been formally established. The interim of 1948-63 was a period of transition in which self-government was gradually introduced. See Mohammed Suffian bin Hashim, An Introduction To The Constitution of Malaysia, Kuala Lumpur, 1972, for a summary of the legal record of this period.

1.3 John Wong, ASEAN Economies In Perspective, Philadelphia: Institute For The Study of Human Relations, 1979. Lau Teik Soon, New Directions In The International Relations of Southeast Asia, Singapore: Singapore University Press, 1973. Bernard Gordon, The Dimensions Of Conflict In Southeast Asia, New York: Prentice-Hall, 1966.

1.4 For a detailed analysis of economic growth in these countries, see Parvez Hassan, Growth And Structural Adjustment In East Asia, World Bank Staff Working Paper, Number 529, Washington, D.C.: The World Bank, 1982.

Chapter 2. Singapore's Intensive Economic Style

2.1 Lee Kuan Yew, Commemorative Lecture November 8, 1971, entitled "East And West, The Twain Have Met," delivered at Cambridge, England.

2.2 Unless otherwise stated, all dollar figures refer to U.S. dollars.

2.3 Annual Report of the Singapore Economic Development Board, Singapore, 1982.

2.4 Ibid.

2.5 Morris H. Crawford, Data Communication And Industrial Policy In Southeast Asia: A Summary of Interviews with Nine Government and Industry Leaders in Malaysia, Singapore and Indonesia. Cambridge: Program on Information Resources Policy, Harvard Univ., 1983, pp. 1-2.

2.6 "A Survey of Finance In The Far East," The Economist, November 13, 1982, p. 5.

2.7 Telecommunication Authority of Singapore, Telecoms Annual Report, 1981/82, Singapore, 1982.

2.8 Personal interviews.

2.9 Robert J. Saunders, Jeremy J. Warford, Bjorn Wellenius, Telecommunications and Economic Development. Baltimore: The Johns Hopkins Press, 1983, p. 51.

2.10 Telecoms Annual Report.

2.11 Ibid.

2.12 Far Eastern Economic Review, December 24, 1982, p. 30. Also Far Eastern Economic Review, April 21, 1983, p. 76.

2.13 Far Eastern Economic Review, December 24, 1982, p. 30.

2.14 Personal interviews.

2.15 Crawford, (see note 2.5), pp. 1-5.

2.16 Documentation provided by National Computer Board (NCB).

2.17 Ibid.

2.18 Ibid.

2.19 Crawford, (see note 2.5), pp. 3-5.

2.20 Economic Development Board Annual Report

2.21 T.D. Allman, "The Failure of Singapore's Success," Asia, May/June 1983, pp. 20-27.

Chapter 3. Malaysia Considers A 1980's Dilemma

3.1 Prime Minister's Department, Fourth Malaysia Plan, 1981-85, National Printing Department, Kuala Lumpur, 1981.

3.2 "Malaysia's Great Leap Forward," Far Eastern Economic Review, June 16, 1983, pp. 101-103.

3.3 See Annual Report, Bank Negara, Malaysia, 1982, Kuala Lumpur, 1983.

3.4 Malaysia's administrative competence is illustrated in the World Bank description of the National Institute of Public Administration (INTAN) in the World Development Report, 1983, p. 108. INTAN enhances its value by providing short field courses that fit specific problem situations.

3.5 Crawford, (see note 2.5), p. 16-22.

3.6 U.S., Department of Commerce, Industry and Trade Administration, Industrial Process Controls, Malaysia, Washington: GPO, 1979, p. 13.

3.7 Yap Kim Swee, Market Brief On Computers And Peripherals, Kuala Lumpur: American Embassy, May 1980, p. 6.

3.8 Werner L. Frank, "A Look At Computing In Southeast Asia," Computer World, March 9, 1983, pp. 29-30.

3.9 See Crawford, Data Communications, pp. 13-16.

3.10 U.S., Department of State, Climate for Foreign Investment in Malaysia, Airgram, June 29, 1982, p. 8.

3.11 U.S. Department of Commerce, U.S. General Imports, Schedule A By Commodity. U.S. Exports Schedule E By Country, 1982 and earlier issues.

3.12 Malaysia: Computers and Peripherals, Kuala Lumpur: American Embassy, 1982, p. 8.

3.13 Computer Systems Advisers Group, Annual Report, 1981. Kuala Lumpur, 1982.

3.14 U.S. Department of Commerce, Industrial Process Controls In Malaysia, 1979. Information updated by Yap Kim Swee, American Embassy, Kuala Lumpur.

3.15 Yap Kim Swee, Market Brief, p. 11.

3.16 Ibid., p. 12.

3.17 "Shaping The Future," Far Eastern Economic Review, September 29, 1983, p. 106.

3.18 Ibid.

3.19 Malay Mail, Kuala Lumpur, April 11, 1983, p. 1.

3.20 Personal interviews.

3.21 Far Eastern Economic Review, June 16, 1983. The Economist, April 17, 1982, p. 77.

3.22 "Malaysia Inc.," Asia Week, March 25, 1983, p. 27.

3.23 Far Eastern Economic Review, June 16, 1983, pp. 104-108.

3.24 "Malaysia Inc.," Asia Week.

3.25 Far Eastern Economic Review, June 16, 1983, pp. 101-104.

3.26 Ibid., pp. 101-104.

Chapter 4. Indonesia In Quest of Jobs And High Tech.

4.1 See Minister of Research and Technology B. J. Habibie's address before the International Symposium on Energy and International

Cooperation, Tokyo, March 27, 1982. The address was titled "Science, Technology, And Nation Building."

4.2 International Centre for Industrial Studies," Industrial Development Profile of Indonesia, UNIDO, Vienna, 1980, pp. 7-15.

4.3 See USAID/Jakarta summary of "Long Term Perspective On The Indonesian Economy To the Year 2,000," prepared by the Institute of Social and Economic Research, Jakarta, 1980, ten page summary and attachment.

4.4 The Republic of Indonesia, Repelita III: The Third Five Year Plan, Translated by the Embassy of the Republic of Indonesia, Washington D.C., no date, p. 28.

4.5 Statistical data are from Indonesia's Investment Coordinating Board, reproduced in UNIDO, Country Industrial Development Profile, pp. 39-40.

4.6 Ali Wardhana, "The Indonesian Economy -- The Next Five Years," Conference on Indonesia, Fletcher School, Medford, Massachusetts, October 6-8, 1983.

4.7 Far Eastern Economic Review, August 18, 1983, p. 43.

4.8 The Economist, September 24, 1983, p. 90.

4.9 Far Eastern Economic Review, September 29, 1983, p. 86.

4.10 Far Eastern Economic Review, August 18, 1983, p. 39.

4.11 UNESCO, Network of Scientific Information And Documentation, Indonesia, UNESCO, Paris, 1980, pp. 29-36.

4.12 U.S., Department of Commerce, Indonesia: Country Market Sectoral Survey, 1977, pp. 229-230.

4.13 See Crawford, Data Communications, pp. 30-31.

4.14 Ibid., pp. 28-32.

4.15 Ibid, p. 31.

4.16 PALAPA: Second Generation. Directorate General of Posts and Telecommunications, Jakarta, October 1981.

4.17 "Telecommunication Breaks The Isolation Of Riau," Indonesia Magazine, June 1983, p. 10.

4.18 PALAPA, (see note 4.16), p. 26.

4.19 B. J. Habibie, (see note 4.1).

4.20 "Development of Sophisticated Technology In 1985," Indonesian Observer, April 26, 1983, Jakarta.

4.21 ASEAN Ministers of Science And Technology, Research And Technology In Indonesia, Country Paper, Thailand, 1980.

4.22 "High Technology," Far Eastern Economic Review, August 18, 1983, p. 55.

4.23 ASEAN Ministers of Science And Technology, (see note 4.21), p. 4.

4.24 Science And Technology Planning And Forecasting For Indonesia, panel discussions sponsored by the Government of Indonesia and the National Research Council. Washington, D.C.: National Academy Press, 1983.

4.25 Indonesia Institute of Science (LIPI). The Institute, Bogor, Indonesia, no date.

4.26 BPP TEKNOLOGI, Agency for Development and Application of Technology, Jakarta, 1982.

4.27 PUSPIPTEK, The National Center For Research, Science, and Technology. The Center, Jakarta, no date.

4.28 Science and Technology Planning And Forecasting, (see note 4.24).

4.29 Ibid, pp. 28-30.

Chapter 5. Looking East: The Japanese Precedent

5.1 "Technology Transfer," The Japan Economic Journal, May 1, 1984, p. 3.

5.2 Japan's high tech strategy is best summarized in Japan's Industrial Structure: A Long Range Vision, Ministry of International Trade and Industry, Tokyo, 1975.

Chapter 6. A Framework For The Strategy

6.1 F.A. Bernasconi's address to the Intergovernmental Bureau For Informatics Conference of June, 1980, "Accepting the Challenge of New International Responsibilities," discusses efforts of 60 developing nations to formulate informatics policy. IBI, Rome, June, 1980.

Three official studies on formulating a framework for an informatics strategy are a French report by Simon Nora and Alain Minc, Report On The Computerization Of Society, MIT Press, Cambridge, Massachusetts, 1980; a Brazilian report, Transborder Data Flows and Brazil: Brazilian Case Study, United Nations, New York, 1982; and a Japanese report The Vision of MITI: Policies In The 1980s, Ministry of Trade and Industry, Tokyo, 1980.

6.2 F.A. Antonelli of the University of Calabria made useful suggestions on this hypothetical framework, though the author is responsible for any shortcomings that appear.

Chapter 7. The Human Element

7.1 Philippe de Seynes. "The Relevance of Future Movements," in Intermedia, January, 1981, pp. 20-26.

Chapter 8. Trade And Investment in Southeast Asia: Japan Sets the Pace

8.1 The Japan Economic Journal, May 1, 1983, p. 3. Shun-Ichi Furukawa, "Japan Stands To Benefit From Industrialization of ASEAN," The Japan Economic Journal, October 12, 1982, p. 19.

8.2 Eleanor M. Hadley, Japan's Export Competitiveness in Third World Markets, Washington D.C., Center for Strategic and International Studies, Georgetown University, Washington, D.C. 1981, p. 41.

8.3 Terutomo Ozawa, Multinationalism, Japanese Style, Princeton, Princeton University, 1979, pp. 24-25.

8.4 Philip H. Trezise and Yuhio Suzuki, "Politics, Government, and Economic Growth in Japan," in Hugh Patrick and Henry Rosovsky, Asia's New Giant, Brookings, Washington, D.C., 1976, pp. 753-811.

8.5 Miyohei Shinohara, "More NICs In Time," Far Eastern Economic Review, April 28, 1983, pp. 66-67.

8.6 The Japan Economic Journal, (see note 8.1), May 1, 1983, p. 3.

Chapter 9. Looking West: The American Opportunity

9.1 "Prototypes Inventive Leader," The New York Times, May 29, 1984, p. D-2.

9.2 Far Eastern Economic Review, March 1, 1984, pp. 12-13.