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Publication Date

1994-08-01

**INTERNATIONAL TRENDS AND POLICY ISSUES IN
INFORMATION SERVICES**

Findings from the Asia-Pacific Region

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Prepared for the Symposium on
"The Information Market and International Cooperation"

October 6-8, 1994
Beijing, People's Republic of China

Working Paper #PAC-056

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August, 1994

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Abstract

The character of the IT industry is changing dramatically. Although hardware continues to be the largest segment of the computer market, growth in that segment is modest, around 5% annually. The greatest growth is in software and services, with each growing around 15% annually. Growth in the IT services sector is expected to increase even more in the future. The Asia-Pacific region reflects these global trends.

A strong IT services sector provides the means for developing IT use within the economy. It also represents a sector with considerable export potential for direct IT services and for packaged software first developed from custom programming for domestic markets. Government policy can be used to promote development of a successful IT services industry. Our research and that of others suggests eight major policies for promoting development of the IT services industry:

1. Promote the use of IT broadly within the economy and society.
2. Provide communications infrastructure.
3. Develop human resources needed to deploy IT.
4. Provide capital for investment in IT services.
5. Target professional and network services.
6. Use alliances to develop capabilities and access global markets.
7. Keep markets for IT products and services open.
8. Enforce intellectual property protection to stimulate innovation.

INTERNATIONAL TRENDS AND POLICY ISSUES IN INFORMATION SERVICES

INTRODUCTION

Discussions of the information technology (IT) industry often revolve around the latest leap in semiconductor technology, battles between rival operating systems or construction of the information superhighway. IT is seen by many as consisting of hardware running software against databases, and increasingly linked by telecommunications networks. If information services are mentioned at all, it is usually in the form of online services or multimedia. However, there is a large and rapidly growing services segment within the IT industry which is critical to the productive application of IT in the economy and society. This sector, which we refer to as IT services, is becoming a highly contested market in the industrialized countries. Traditional hardware providers such as IBM, DEC, Siemens and Fujitsu compete with established service providers such as EDS and Computer Sciences Corporation. In addition, many smaller new firms are entering the industry and competing successfully with these established giants.

The IT services sector also offers exciting opportunities for newly-industrializing and developing countries. As a link between IT producers and users, IT services can greatly improve the effectiveness and productivity of IT use within a country and can also become an important industry in its own right. The interaction of IT service providers and user organizations develops capabilities on the part of both—capabilities which benefit the entire economy.

TRENDS IN INFORMATION SERVICES

Information Services: Definition

The information services industry is part of the IT industry, and is comprised of four major sectors as shown in Figure 1: professional services, maintenance, network services, and data services. Professional services include: custom software development and contract programming; outsourcing and facilities management; systems integration; consulting and reengineering; education and training. Maintenance services include maintenance and support of hardware and software systems. Network services include network construction, network operations and remote processing services. Online data services include: databases and multimedia; online information and analysis; and market analysis and forecasting. For the purpose of this paper, we focus on the first three, which we refer to as the IT services industry.¹

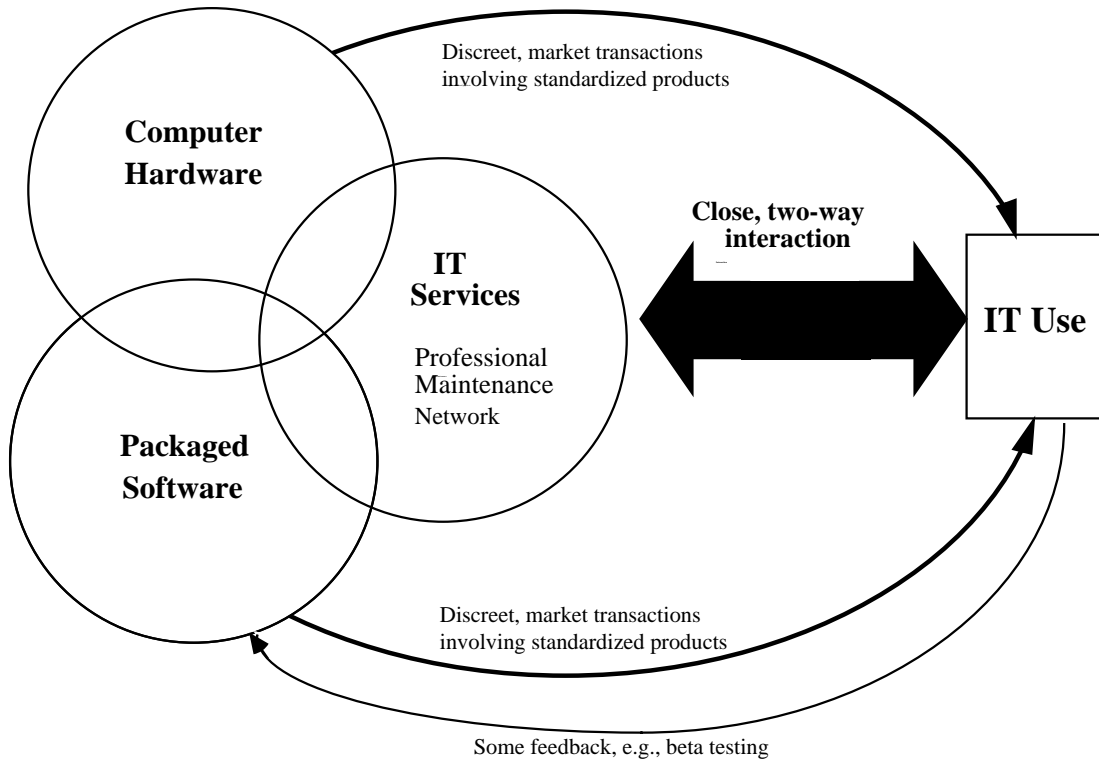
¹ We only discuss professional, maintenance and network services for two reasons. First, they make up a set of services that involve the application of professional skills to support the use of computers in organizations, while data services involve the marketing of information products such as databases to users. The focus of the paper is on the benefits of interaction of producers and users, and the role of IT services in that relationship. We recognize that the importance of online data services is growing rapidly, but feel it

As also shown in Figure 1, the IT services industry is in a unique position with regard to IT production and use. Hardware and packaged software tend to be developed as standardized products which are purchased in discrete, arms-length market transactions. Their development and production involve limited interaction with users, mostly in the form of market research and product testing (e.g., beta testing). In contrast, IT services involve close, two-way interaction between providers and users. Also, many hardware and software purchasing decisions are made or influenced by IT service providers, such as specialists in systems design, development and integration. Such professionals provide a link between buyers and sellers of hardware and packaged software. For these reasons, we place the IT services industry at the junction of IT production and use.

should be dealt with in future research. Second, our data sources only provide comparable data across countries on professional, maintenance and network services, not online data services.

The U.S. online data services market in 1991 was estimated at around \$10 billion. The market is dominated by professional services including brokerage, credit, travel, and legal services. The consumer market accounts for less than 5% of the total market, but is growing rapidly. The professional services market is growing around 5-10% whereas consumer services is growing around 30-40% (Davidson, Hubert and St. Croix, 1993).

Figure 1. Relationship of IT Services to Hardware, Software and IT Use



The role of the IT services industry is important for countries that are relatively new to IT because of its function in IT use and in developing capabilities. The services industry provides the means for applying IT within user organizations and the economy. The two-way interaction between service providers and user organizations gives each party valuable

knowledge and experience. Working closely with the service provider, the user is able to learn how to more effectively apply IT. The user organization can also suggest improvements in the services being employed, helping increase the effectiveness of both the provider and user. This constant feedback from users enables the service provider to upgrade its products and services and make them more attractive to other potential users, both domestically and abroad. At the national level, this type of interaction improves the productivity of all sectors of the economy, including the public sector. It also helps a country to develop high quality niche products and services which can be exported and are unlikely to run into direct competition with giant mass market companies.

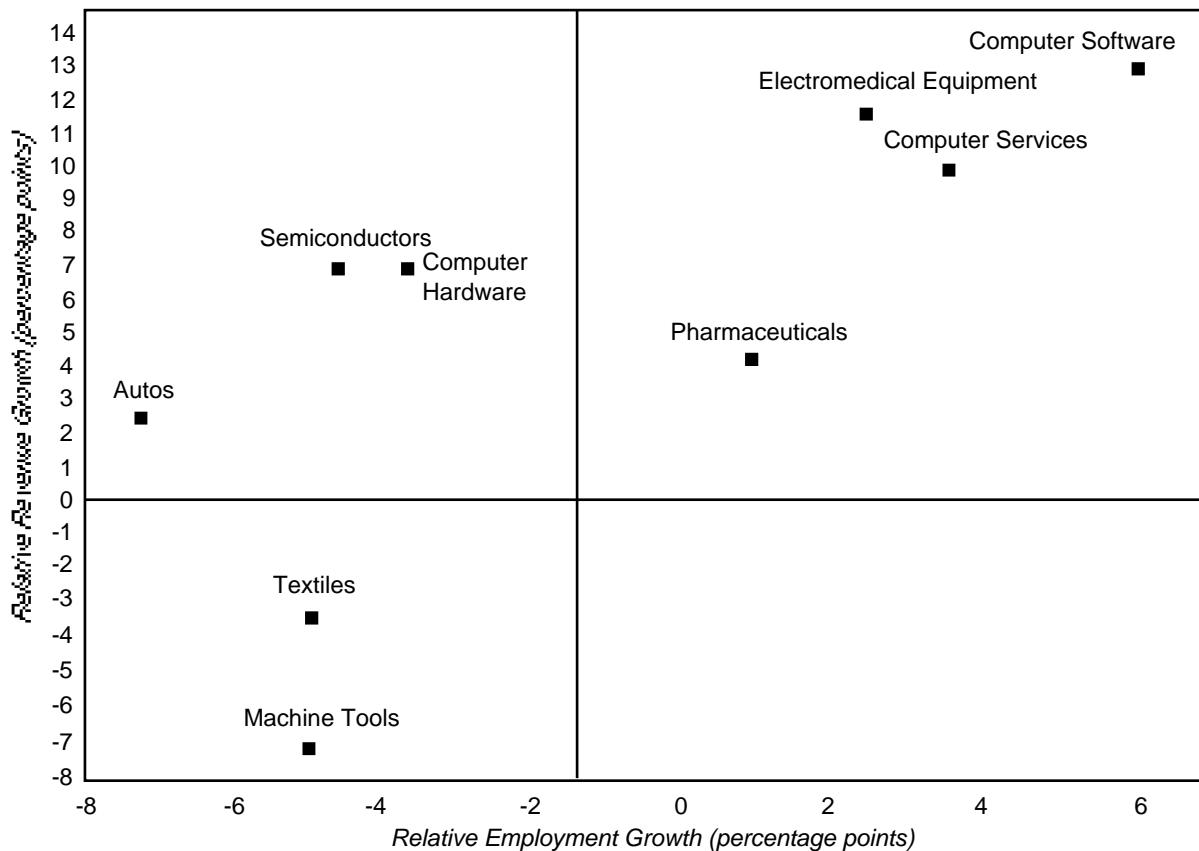
In the early days of the IT industry, most IT services such as application programming and computer operations were provided by the hardware vendors and private service bureaus because expert staff was very limited and hardware was expensive. During the sixties, seventies and eighties, user organizations developed their own capabilities to operate and maintain the technology although they also continued to rely on outside sources for applications. Today, as the technology has diffused broadly within organizations and to individual end users, corporate managers have become concerned about the overall costs of IT, and the seemingly endless increase in spending for IT. As a result, there is a movement towards outsourcing more IT activities. Applications development continues to be the largest single IT activity that is outsourced. It is followed by systems integration, network services (including remote services) operations and maintenance, and education and training. Other activities, such as development of strategic applications, internal networking and overall IT planning and management, tend to be retained inside rather than outsourced because they have competitive implications.

The situation of many developing countries is akin to the early days of the IT industry. Although the technology is relatively inexpensive, many user organizations lack the capability to apply that technology to their own needs. Therefore, users find it faster and more effective to turn to IT services companies to provide needed capabilities and expertise. However, many developing countries lack an experienced IT services industry and users must either get by while they develop the necessary skills internally, or they must contract for services with multinational firms. Thus, it is in the interest of developing countries to build their own IT services industry. This option is all the more attractive because the size and growth of the global IT services market provides unprecedented opportunities for exporting IT services.

Overall Trends in the IT Industry

The IT industry remains one of the major growth industries in the world, but growth among the sectors of the industry is changing dramatically as illustrated by the experience of the U.S. (Figure 2). While the software and service industries presently are smaller than the computer hardware industry, they are growing much more rapidly. Figure 2 shows that revenues in the hardware industry grew less rapidly than those in software or services industries during the period 1987-1991. Moreover, employment in the hardware industry declined during this period while it grew sharply in software and services. Thus, software and services rank among other rapidly growing high-technology industries.

Figure 2. Growth of Major U.S. Industry Sectors, 1987-1991^a



^a Relative revenue growth is the difference between the average annual revenue growth rates of selected industries during 1987-91 and the average annual growth rate of U.S. gross domestic product. Relative employment growth is the difference between the average annual employment growth rate of selected industries and the average annual growth of U.S. private sector employment.

Source: USITC staff and U.S. Department of Commerce. 1993 U.S. Industrial Outlook (Washington, DC: GPO).

The IT Services Market: Worldwide²

The global market for information services (including maintenance, custom software development, systems integration, consulting, disaster recovery, facilities management and outsourcing) is estimated at US\$95 billion, or about 26% of the total global IT market (McKinsey, 1993)³. The services sector has been the fastest growing segment of the

global IT market, with a compound annual growth rate of 15.9% from 1987-1992 (Table 1). Within the services sector, the fastest growing segment was professional services, which grew at 24.5%, while maintenance services grew at just 3.9%. During this time, hardware revenues grew at 5.5% per year and software grew at 15.4% .

Table 1. World IT Market, 1992

	Market size US\$ billions	As % of Total	Annual growth Rate, 1987-1992
Hardware	195.4	57.8	5.5
Packaged Software	47.0	13.9	15.4
Services	95.6	28.3	15.9
Total	338.0	100.0	8.0

Source: McKinsey, 1993

Table 2 shows the size and growth rates of the three major regional IT markets (including hardware, software and services). The Asia-Pacific market is still smaller than North America and Europe, but is the fastest growing market of the three. Given the economic dynamism of the region, it is likely that the Asia-Pacific market for IT will soon pass Europe and possibly even North America.

² Data on the information services industry is limited because most market watchers did not even include it as a market segment about which to collect data before the mid-eighties. In addition, different data sources use different definitions of information services so it is difficult to derive consistent information, especially over time. Our data are drawn from two primary sources: McKinsey and Company's annual report on the computer industry, and a confidential industry source. The advantage of both of these sources is that they maintain consistent data definitions over time and their broad trends are consistent with one another as are their market estimates.

³ This figure is likely to understate the total size of the information services market, since the McKinsey data is based on larger companies and many service companies are small and medium-sized firms. IDC (1993) shows services accounting for 39.1% of the Japanese IT market and 33.3% of the U.S. IT market, suggesting that a more likely figure for IT services is about one-third of the total market.

Table 2. IT Market by World Regions, 1992

	Market size US\$ billions	As % of Total	Annual growth Rate, 1987-1992
North America	128.5	38	8
Europe	114.9	34	8
Asia-Pacific	94.6	28	14
Total	338.0	100%	8%

Source: McKinsey, 1993

The IT Services Market: Asia-Pacific Countries

Table 3 shows the relative sizes of the hardware, software and services markets in Asia-Pacific countries. Hardware accounts for 52.5% of the market and packaged software for 10.4%, in each case a slightly smaller proportion than in the world IT market. Services, at 37.1%, represents a larger share than in the world market. The difference might be partially explained by the prevalence of custom programs over packaged software in many Asia-Pacific markets, particularly Japan. However, the fastest growing market segment is packaged software, a fact which might be attributed to the shift to personal computers, which generally use packaged, rather than custom software.

Table 3. IT Markets in Asia-Pacific Region

	Total Spending (US\$ million)	As % of Total IT Investment	Annual Growth Rate 1987-1992
Hardware	49,809	52.6	13.3%
Software	9,839	10.4	21.7
Services	35,019	37.0	17.5
Total	94,667	100.0	15.6

Source: Confidential industry sources

Table 4 shows that the largest segment of the services market in the Asia-Pacific region is professional services, including system design, system integration, custom programming, consulting, and educational services (training). This segment accounts for about 59% of the total services market, and is growing more than 20% annually.

Table 4. IT Services Market in Asia-Pacific

	Spending 1992 (US\$ million)	% of Total Services	Growth Rate 1987-1992
Professional services	\$20,591	58.8%	20.61
Network operation/services	\$7,604	21.7%	22.02
Maintenance/support	\$6,824	19.5%	12.01
Total	\$35,019	100.00%	17.50

Source: Confidential industry sources

The fastest growing segment of the services industry is network operations, which grew at an average annual rate of 23% between 1987-1992, 22% in 1992, 13% in 1993 and is forecast to grow at 15% in 1994 (confidential industry sources). This trend shows that the Asia-Pacific region, like the United States, is moving rapidly to develop networks to enable organizations to share information and realize greater benefits from computerization.

Table 5 shows that the largest IT markets, both in absolute size and as a share of GDP, are those in the developed countries of Japan and Australia/New Zealand. Those countries have the longest experience with IT and the best IT infrastructures, in addition to having the capital to invest in IT. Singapore ranks with the developed countries in the size of its IT market as a share of GDP. It is followed by the other newly industrializing economies (NIEs), and then by the developing countries.

Table 5. Asia-Pacific IT Markets by Country, 1992 (US\$ million, %)

Country	Hardware spending	Software spending	Services spending	Total IT spending	Total IT as % of GDP
Japan	41,257	7,731	30,786	79,774	2.17
Aust/NZ	2,300	878	1,980	5,158	1.51
S. Korea	1,816	285	654	2,755	.93
Taiwan (P.)	1,092	225	398	1,715	.83
Hong Kong (P.)	519	121	236	876	.91
Singapore	360	154	168	682	1.48
Malaysia	191	54	107	352	.70
Indonesia	195	35	69	299	.25
Philippines	72	21	42	135	.26
Thailand	204	39	98	341	.36
China	832	171	293	1,296	.30
India	973	125	187	1,285	.47

Source: Confidential industry sources

Table 6 shows that Japan and Australia/New Zealand are also the largest IT services markets, both in absolute value and relative to total IT spending. This is partly due to the size and capabilities of the IT services industries in those countries, a factor related to the maturity of IT use. Other factors include the privatization of government data processing shops in New Zealand and Australia, which moved government computing to an outsourcing basis. In Japan, a factor is the desire of user organizations to outsource rather than develop capabilities in-house in order to minimize staffing in light of Japan's lifetime employment practices in large corporations and legislative restrictions on staff size in governments.

The next three countries in terms of IT services as a percent of total spending were the developing countries of Malaysia, the Philippines and Thailand. The reason for such high spending in these cases is different from the developed countries. The developing countries lack the professional skills to support rapid computerization, either in user organizations or in the IT services industry. Thus, they tend to turn to foreign IT services firms to provide the necessary capabilities to support their computerization efforts. This practice does develop some local capabilities in programming, but usually uses expatriates for more advanced functions such as system design and integration.

Table 6. Ratios of Hardware, Software and Services

Country	Hardware as % of total IT	Software as % of total	Services as % of total
Japan	52	10	38
Aust/NZ	45	17	38
S. Korea	66	10	24
Taiwan (P.)	64	13	23
Hong Kong (P.)	59	14	27
Singapore	52	23	25
Malaysia	54	15	31
Indonesia	65	12	23
Philippines	53	16	31
Thailand	60	11	29
China	64	13	23
India	76	10	14

Table 7 shows that the fastest growing IT services markets are Korea, India, Taiwan (Prov.) and Singapore. Each of these countries was starting from a small base and is now catching up. The rapid growth in each country also reflects the high growth rate in hardware spending. Growth in hardware investment naturally leads to increased spending in IT services, as users need various types of professional services in order to develop, integrate and support information systems in their organizations.

Table 7. Average Annual Growth Rates in IT Markets, 1987-1992

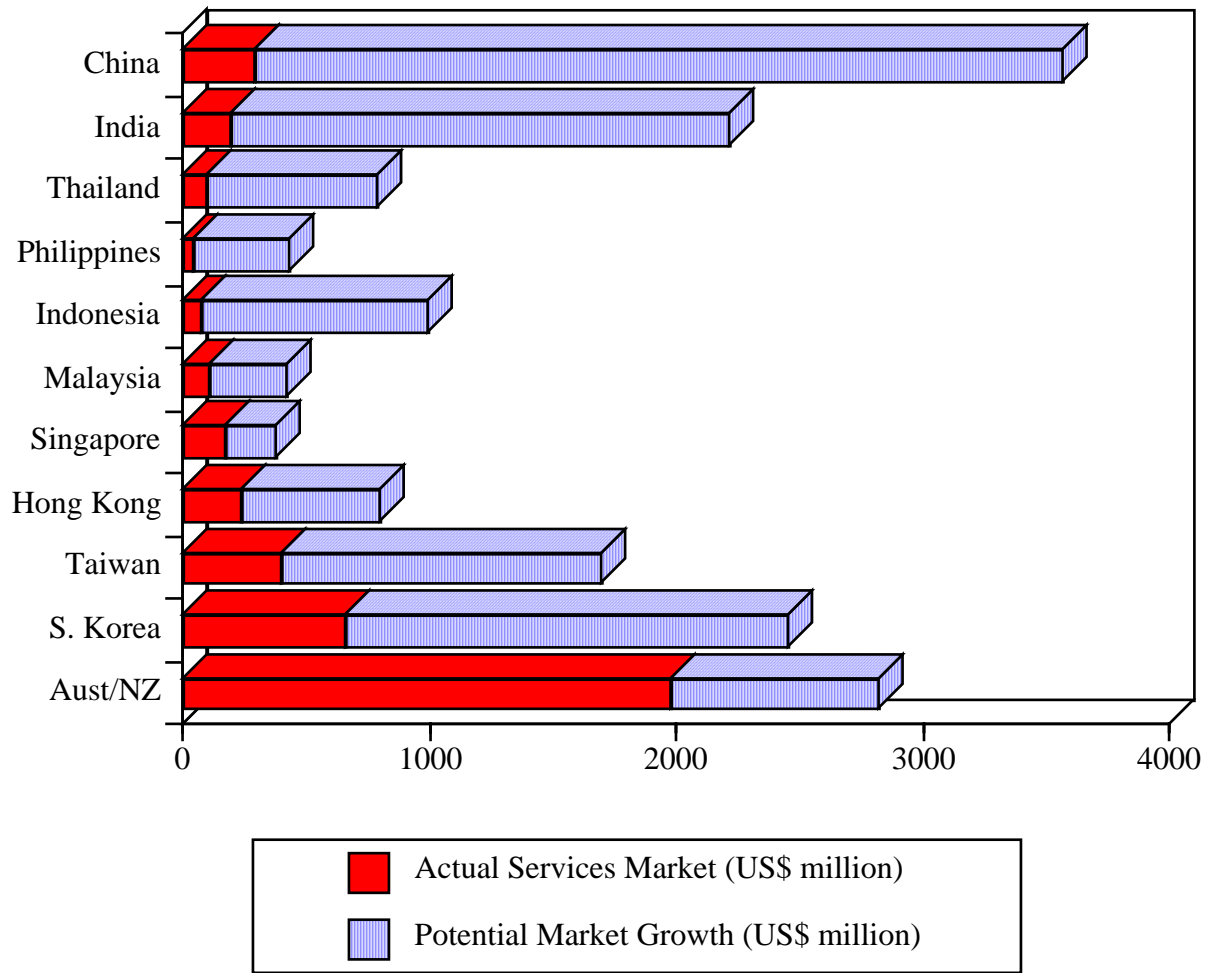
Country	Growth in Hardware (%)	Growth in Software (%)	Growth in Services (%)	Growth in Total IT (%)
Japan	8.42	22.65	16.38	12.31
Aust/NZ	-6.88	6.79	4.55	.54
S. Korea	28.85	32.06	28.65	29.46
Taiwan (P.)	13.85	26.30	21.90	17.04
Hong Kong (P.)	11.03	13.11	15.75	12.42
Singapore	20.01	32.27	21.33	22.77
Malaysia	13.94	35.47	12.30	15.40
Indonesia	14.79	22.83	18.87	16.65
Philippines	11.58	16.29	15.73	12.85
Thailand	20.09	23.11	18.74	20.49
China ('89-'92)	4.74	8.06	12.43	6.74
India	19.44	20.87	22.92	20.96

Source: Confidential industry sources

IT Services: Market Potential

Figure 3 shows the market potential for IT services in Asia-Pacific countries assuming continuation of the current relationship between spending for information services and overall IT spending in each country. The estimates are derived using a technique suggested by Flamm (1990), which we have previously applied to the IT industry as a whole (Kraemer and Dedrick, 1993).⁴ The figure shows the actual level of IT services investment in comparison to the potential market growth assuming each country were to achieve the same level of investment, as a share of GDP, as Japan. It shows that the greatest potential for growth is in the developing countries, namely China, followed by India, Indonesia, Thailand and the Philippines. The developed and newly industrializing economies of Australia/New Zealand, Singapore, Hong Kong (Prov.), Taiwan (Prov.) and Malaysia exhibit less potential as might be expected.

⁴ The technique for estimating market potential involves comparing each country's current spending to a standard, and then calculating the difference between this standard and current spending for the potential market. The Japan spending level as a percent of GDP is used as the standard because of its relatively high level of use and because it is inside the Asia-Pacific region. Our market potential figure represents what the market in a particular country might be if it spent at the same level as Japan, given that country's wealth as measured by GDP. It is not time-dependent although one could estimate how long it would take to achieve that potential using historical growth rates for the IT industry and its various sectors.

Figure 3. IT Services Market Potential

Summary

The foregoing findings on the IT services industry can be summarized in three categories: the role of IT services; market trends in IT services; and market potential for IT services.

1. Role of IT Services

The IT service sector stands at the junction of IT production and use. While the hardware and packaged software industries are marked by discrete market transactions of standardized products, the IT services sector involves close, ongoing interaction between providers and users. IT service providers serve as a link between buyers and sellers of hardware and software, often making or influencing such purchases by users. The interaction between providers and users of IT services can be a mutually beneficial relationship, developing the capabilities of each.

2. Market Trends

IT services is the fastest growing segment of the IT industry, both worldwide and in the Asia-Pacific region. Spending on IT services is highest in the developed countries, which have the highest levels of installed hardware and hardware investment as a share of GDP. However, the fastest growing markets are developing countries such as India and Thailand, and newly industrializing economies such as Korea, Taiwan (Prov.) and Singapore, which are in the process of catching up. The level of IT services spending is driven by the quality of information infrastructure (human resources, telecommunications, capital), which is highest in the developed countries. It is also closely linked to the level of investment in hardware, as investment in hardware creates demand for services.

3. Market Potential

The largest potential IT services markets in the Asia-Pacific region are China, India, South Korea, Taiwan (Prov.) and Indonesia. These countries also have had some of the fastest growth rates in recent years, and it is likely they will continue to experience continued high growth. There is no doubt that the large multinational service firms are looking at these countries as potential markets, but there are great opportunities for domestic firms and smaller firms in the region as well. As the developing countries in particular build their communications infrastructure and continue to invest in hardware, the demand for IT services will no doubt keep pace.

GOVERNMENT POLICY TOWARDS INFORMATION SERVICES

Given the growing importance of the IT services sector, how might national governments think about policy for promotion of the IT services industry? The policy issues in government promotion of IT services are best seen by examining some of the tradeoffs in promotion of IT production, use, and IT services.

Tradeoffs in IT Production and Use

Previous debates over IT policy have focused on the question of production versus use. Most countries' IT policies focused on hardware production, and promotion of production and use were seen as conflicting goals. That is, countries could not pursue both simultaneously. Developing a domestic hardware industry was seen to require protection of the domestic market against competition from the dominant company, IBM. Many countries including Japan, India, Brazil and several European countries erected protective trade and investment barriers against IBM in order to promote production by domestic companies. Only Japan and Germany succeeded in creating an internationally active computer hardware industry able to compete with IBM, and both paid a cost in diffusion of IT use. For example, Japan lags 5-10 years behind the United States in level and sophistication of IT use (Kraemer and Dedrick, 1994a,b).

The personal computer revolution appeared to offer a new opening for countries as well as allowing companies to enter the computer industry. For example, Singapore, Korea

and Taiwan (Prov.) all developed their first national IT plans around 1980 and targeted industry development around the PC (Gurbaxani, et.al., 1990; Dedrick, Kraemer and Choi, 1994; Kraemer and Dedrick, 1994b). Hong Kong (Prov.) did it also, but without a national IT plan (Dedrick, Kraemer and Jarman, 1994). The PC industry was based on open technology standards and standard components. New companies could enter the market as producers of IBM-PC compatible computers as well as components and peripherals for those computers. IBM's initial dominance of the PC industry declined, in part because of competition from low-priced Asian clones. Asian companies also became important suppliers of commodity components and peripherals.

In the 1990s, however, the PC industry entered a brutal shakeout period. Leading vendors cut prices dramatically, and the industry's profits flowed increasingly to the owners of critical proprietary technology. These are Intel in microprocessors, Microsoft in operating systems, and the large Japanese companies in memory chips, monitors and flat-panel displays. Market share in the PC industry is concentrating in the hands of a few large producers (IBM, Compaq, Apple, NEC) and a number of second-tier producers. IBM's near-monopoly of the mainframe era is being replaced by an oligopoly structure in the PC era. This new market structure provides opportunities for companies and countries that are able to integrate themselves into the global production structure, but doing so requires open trade and investment policies rather than protectionism, and active efforts to establish links with the major multinational producers. Singapore and Taiwan (Prov.), and to a lesser extent Hong Kong (Prov.), are thriving with such a strategy, while Japan and Korea have struggled in recent years, in part because of their history of discouraging imports and foreign investment in the IT industry.

For newcomers to the IT industry, there are opportunities to break into the global hardware production chain, as China is doing in labor-intensive segments of the industry. However, it is difficult to succeed these segments of the industry. They are not very profitable because they face intense price competition in markets abroad and require the costly importation of critical components. Most importantly, they do little to develop local capabilities (except in the niche production sector) or to encourage the diffusion of IT use domestically. IT use has been shown to increase productivity at both the company and national level (Brynjolfsson and Hitt, 1993; Lichtenberg, 1993; Kraemer and Dedrick, 1994). However, IT use has been treated as a separate issue from IT production in most countries, and in most cases has been given less emphasis. Among the Asia-Pacific countries, only Singapore has focused equally on production and use, and explicitly considered the linkages between the two (Gurbaxani, et.al., 1990).

Synergy of Information Services with IT Use and the Development of Packaged Software Products

The information services industry not only offers an opportunity for many countries to enter the IT industry, it offers an opportunity to gain synergy between services and use and the development of packaged software products. IT services is truly a domestic activity and does not face the entrenched global leaders or the brutal competition found in the hardware and software sectors. Unlike hardware and software production, which can be developed with little interaction with local users, the IT services industry sits at the

junction of IT production and use (see Figure 1 shown earlier). The IT services industry provides the means whereby countries can apply the technology to business and society. The better and more developed the industry, therefore, the better the application of the technology.

In addition, IT services play a major role in the development of packaged software products. Much of the successful packaged software on the market today was originally developed as a custom product for one client. This is illustrated by Microsoft's DOS operating system which was originally developed for the IBM-PC. The DOS operating system was the basis upon which the entire Microsoft software products were built. Moreover, through continuous improvement of the operating system (i.e., Windows) and applications (Word, Works, Excel, etc.), Microsoft has been able to expand its competitive advantage.

Custom programming was also the basis for Singapore's EDI software in Tradenet and Taiwan's (Prov.) software for bicycle shops, laundries, and other small businesses. The original software for Tradenet was provided by IBM, but Singapore Network Services used its experience in developing Tradenet with IBM, and its subsequent experience operating Tradenet, to develop its own EDI software which it now uses in other applications within the country and also sells abroad (King and Konsynski, 1990). Similarly, Taiwan (Prov.) software houses are developing applications for small businesses such as bicycle shops and laundries. Although developed for specific local clients, it is intended that these applications will be refined as experience is gained over many clients. The applications will then be packaged for sale to these niche markets in Chinese-language communities, domestically and abroad (Kraemer and Dedrick, 1994c).

In summary, it seems that the IT services industry might well be promoted as a matter of public policy, especially given its size, growth and benefits to IT use. Worldwide trends show the greatest growth in the IT industry is occurring within the services sector. IT services play an important role at the junction between production and use, helping newcomers to the IT industry to develop local capabilities. Services are truly a domestic industry which can be serviced locally or through alliances with foreign companies, and can lead to both services and products for export. In this context, a key question is how might government policy promote development of the information services industry?

Government Policy for Promoting Information Services

Our research and that of others (Mody and Dahlman, 1992; Schware, 1993; Corey, 1994) suggests eight major policies for promoting development of the IT services industry:

1. Promote the use of IT broadly within the economy and society.
2. Provide communications infrastructure.
3. Develop human resources needed to deploy IT.
4. Provide capital for investment in IT services.
5. Target professional and network services.
6. Use alliances to develop capabilities and access global markets.
7. Keep markets for IT products and services open.
8. Enforce intellectual property protection to stimulate innovation.

Following is a discussion of each.

1. Promote the use of IT broadly within the economy and society.

Promoting IT use within a country helps to provide the domestic market for IT services. A strong domestic services market is important for exports as well. The local market provides the venue wherein private firms can develop capabilities, create, test and enhance new products and services, form alliances with multinationals for distribution, and ready products and services for export (Flamm, 1990; Kraemer and Dedrick, 1994a,b; Schware, 1992).

IT use is key to developing local IT services because use generates demand that can be met by domestic companies, which have the advantage of familiarity with local business practices, languages, customs and regulations (Kraemer and Dedrick, 1994a,b). The use of IT refers to both the number of user organizations and households in a country, and the extensiveness of their use. Every time a new user organization is introduced to IT, a whole stream of expenditures results for IT services, including operations, maintenance and support, education and training, end user applications, databases and information sources, and communications within and between user organizations. Because the cost of computer hardware continues to decline, the initial cost of adding new user organizations (or individual end users within them) is relatively low. Therefore, growth in the number of end users of IT will continue to increase and the attendant expenditures for IT services will increase at an even higher rate.

The earlier analysis of trends in the computer industry shows that while computer hardware comprises about 50% of total IT spending, IT services currently comprise 30% and are growing at an annual rate of 16%. Greater IT use will also generate a demand for hardware and packaged software as production and use are intertwined. However, hardware and software might be better supplied by outside producers whereas domestic providers have natural advantages in IT services.

2. Provide Communications Infrastructure

Communications infrastructure has been identified in research as a key environmental factor associated with payoffs from IT use. Countries which have low cost, high quality, reliable telecommunications achieve greater productivity and economic growth from their IT investments than those that do not (Kraemer and Dedrick, 1994a Corey, 1994).

High quality, reliable and inexpensive communications help a nation's industry be more efficient and effective by driving down costs, speeding market coordination, aiding management of dispersed firms, and facilitating government promotion of industry, employment and trade. Advanced services, such as voice-mail, electronic mail, teleconferencing, file transfer, document interchange, and shared databases, provide competitive advantages to firms that are able to use them. Specialized networks for the IT industry are also an increasingly important part of the communications infrastructure needed to develop and support IT services. Such networks are being built within and between Taiwan's (Prov.) science parks to provide smart buildings with voice and data communications, software development tools that can be shared by many firms, centralized market intelligence, shared electronic distribution channels, and support of group work (Kraemer and Dedrick, 1994c).

The communications infrastructure must connect major urban areas and their peripheries, and in turn connect these to global networks. The importance of such infrastructure is that it provides the base for value-added information services such as Singapore's Tradenet and Hong Kong's (Prov.) Tradelink. For example, Singapore's Tradenet not only connects traders, shippers, carriers, forwarders and government regulators within the country, but provides a gateway for trade with the rest of the world (King and Konsynski, 1990). In fact, given Singapore's relatively small number of trading institutions (about 2,000) of which 600 are large, the gateway function is more important than the trade processing function because it enables both multinationals and Singaporean firms to participate in global markets and the global production system. The global connection is important in Hong Kong (Prov.), but support of trade processing is also important because the scale and complexity of the trading system is much greater than in Singapore. In Hong Kong (Prov.), trade is conducted by about 800 large, sophisticated trading institutions and 35,000 small, mainly Chinese-language institutions that lack any sort of computing capabilities (Dedrick, Kraemer and Jarman, 1994).

3. Develop Human Resources Needed to Deploy IT.

Human resources have also been identified in research as a key environmental factor associated with payoffs from IT use. Countries which have skilled, experienced professional, technical and managerial personnel achieve greater productivity and economic growth from their IT investments than those that do not.

Both IT use and IT services require professionals who can build computer systems and networks, and end users capable of operating computer systems and adapting those systems to specific local needs (Kraemer and Dedrick, 1994a). IT professionals are

systems designers and engineers, systems analysts and programmers, and information analysts who develop the technology, build the applications, and support end users—whether individuals or organizations. End users are functional specialists and general administrative staffs who use IT in the execution or support of their work.

It is important to have educated and experienced users in order to gain the benefits from using the technology. Studies show that investment in education and training is far more important to increasing the efficiency and effectiveness of individuals and work groups than investment in upgrading equipment or software. Experienced and sophisticated users also stimulate producers to innovate with information services. These users not only provide test beds for new services, but help producers to identify requirements for them.

Finally, it is important to have managers of user organizations who understand how the technology applies to their industry and know how to make good decisions about technology investments for their firm. Managers are usually left out of the equation when considering human resources for IT, but they are critical. When Singapore, Korea and Taiwan (Prov.) started to promote IT use within their countries, they started with educating corporate and government managers. Managers do not need to use the technology personally, although more and more do. They need to understand the uses and the business value of IT so they can make good decisions about the technology investment and deployment, and can pave the way for its implementation in their organizations.

4. Provide Capital for Investment in IT Services.

Investment capital is a key requirement of the IT services industry primarily because the industry is generally underserved by capital markets (USITC, 1993; Kraemer and Dedrick, 1994b).

Access to low cost, patient investment capital is a special requirement for the IT services industry, especially in Asia-Pacific countries. The IT services industry generally has difficulty raising capital in contrast to the hardware industry. The hardware industry is proven. Products can be seen, touched and understood. Firms have assets and inventory that can be sold if the investment goes sour. In contrast, IT services is largely a people business, nebulous and hard to grasp, and high risk. While the IT industry as a whole is new to the Asia-Pacific region, there are examples of successes with hardware, but few thus far with packaged software and services. Consequently, the IT services industry has a tough time gaining access to low cost, patient capital.

Given the limited private capital, there is a role for government in providing specialized sources of capital and capital "equivalents." Governments can invite foreign capital and provide a stable, lawful environment for those investors. Governments can provide sources of capital through banking institutions and government-backed venture firms that specialize in the IT industry. The government also can provide loan guarantees for private investors and low interest loans to industry directly through its own institutions which specialize in the IT industry. Further, governments can create advisory bodies comprised of specialists in IT who are extremely knowledgeable about the industry and therefore can help make good decisions about investments. For example, Singapore has an outside board of advisors for the NCB and Taiwan (Prov.) has a technology advisory council made up of key foreign specialists that advises government and industry on where to make R&D, capital, human and other investments.

Governments can also provide capital "equivalents"—support which has effects similar to private capital. One example is the provision of core support for private firms through large, multi-year government computing projects that allow firms to develop capabilities in the process of providing services to the government. Singapore's government did this with Computer Services Associates (CSA) and Taiwan (Prov.) is doing this with its large services firms as well as many smaller ones. Japan has provided support for private service bureaus (mostly run by the Japanese computer manufacturers) for many years through indirect measures. By placing limits on the size of government staffs, the central government indirectly forces central government agencies and provincial and local governments to contract out for a portion of their IT services—usually systems development and systems integration (Anchordoguy, 1989).

Another example is the centralized provision of market information similar to that provided by the Market Intelligence Center (MIC) of the Institute for the Information Industry in Taiwan (Prov.). The MIC not only provides continuing information on broad market trends, but it investigates specific market information required by various

segments of the IT industry, including niche segments, and it does so on an extremely timely basis so that firms can gain or retain competitive edge. This kind of centralized market intelligence is extremely important when there are many, small firms in an industry which is the case for information services. The centralized provision of such intelligence not only reduces each firm's information costs; it also reduces their search costs as they need deal with only one authoritative source. Moreover, if begun as a government-supported enterprise, such centers can be private or public; if public, they can be privatized once operating successfully, as may be the case with the MIC (Kraemer and Dedrick, 1994c).

A third example is R&D aimed at exploring niche services that have regional or worldwide markets. The Taiwan (Prov.) government provides funds for local software companies to develop Chinese-language applications for small businesses such as restaurants, hotels, bicycle shops, laundries, dentists, and small retailers. The aim is to develop the capabilities of services firms for serving specialized markets in areas that have large market potential regionally and globally, and where Taiwan (Prov.) has a natural advantage—Chinese-language communities (Kraemer and Dedrick, 1994c). If successful, these might be exported to other communities as well.

Finally, governments can reduce the costs of doing business for the IT services industry. It can do so by many means at government's disposal: reducing direct taxes for these firms; eliminating duties on equipment and software they must import in order to do their work; reducing government regulation of IT services businesses; eliminating corruption among government officials; providing health care and housing for industry workers; and providing cheap land and building rents through special science and technology parks. All of these policy instruments are already in use, although seldom all in one place or all at one time. Yet, there is some critical mass of supports required for positive impact.

5. Target Professional and Network Services

National IT plans should foster professional and network services just as they now foster hardware and software production. Most national plans do not currently target IT services for development, yet this sector needs encouragement if it is to be globally competitive. Government can build networks and encourage or require their use. Government can also upgrade its own use to serve as a model for others as well as create demand directly. Government can provide incentives for private sector use, such as treatment of software as a business expense for tax purposes.

We identified professional services and network services as the two major growth sectors within the information services industry, and it is these sectors which should be especially promoted (Figure 4).

Professional services offer good opportunities for local firms and IT professionals to gain experience and develop capabilities in a number of specialties, such as project management, system design and system integration. It also requires close interaction with users, as systems must be designed and developed to meet the unique needs of users. Even if projects are carried out by multinational firms, the work will mostly be done by local

professionals, who will be given the opportunity to gain experience and make a living without going abroad. A big problem facing many developing countries is that when they train IT professionals, those professionals end up leaving the country for better career opportunities. A strong domestic IT services industry can help prevent or reverse this "brain drain" and encourage more local people to enter the IT professions.

Figure 4. Professional and Information Services Sectors

IT Production			IT Use
Computer Hardware Mainframes, minicomputers PCs, workstations Peripherals	Information Services		IT Use
	<i>Professional services</i> Custom programming, bodyshopping Outsourcing, facilities management Systems integration Consulting, reengineering Education and training		Interindustry, intraindustry Organizational, inter-organizational Work group Individual, household
	<i>Network services</i> Network construction Remote computing services Network operations		
Packaged Software Operating systems Database management systems Application programs			

Countries such as India, China and the Philippines which have a large population of skilled programmers and analysts have tended to encourage body shopping or the hiring-out of these expert staff to foreign companies. Body shopping is a bootstrapping technique for getting employment and higher wages for domestic experts, but often fails to build domestic capabilities in information services except by accident (e.g., when a group of experts leave foreign employers and form an independent company which then contracts with multiple firms, sometimes including their former employer). Development of domestic IT services firms can be encouraged by creating special science and technology parks which bring together IT services professionals and co-locate them with domestic and foreign IT providers. Much of this occurs in Silicon Valley in Northern California or Software Valley in Utah in the United States. It can also be encouraged by providing education and training specifically targeted to the business and management aspects of the industry such as business finance, marketing and advertising, and the management of teams, projects and organizations.

There is a linkage between promotion of professional and network services and hardware and software products, as has been mentioned previously. The presence of established networks creates opportunities for entrepreneurs to offer value-added services over those networks. These could be vertical services targeted to industries like health, education, finance, construction or trade, or horizontal services such as electronic mail, news groups and bulletin boards, electronic data interchange and electronic commerce. Professional services are required in the building, maintaining and upgrading of such networks, so

networking services help stimulate the professional sector of the services industry as well. It provides opportunities for individuals and firms to gain capabilities in systems design, development and integration of both networks and value-added services. Finally, as a country develops a professional services subsector, it increases its capabilities for developing hardware and software products.

6. Use Alliances to Develop Capabilities and Access Global Markets

Many countries trying to develop information services have tried to go it alone just as they have in the hardware and packaged software sectors, but these strategies have proven to be less than successful in most instances. Countries which have been successful in developing information services, such as Singapore, Taiwan (Prov.), and Hong Kong (Prov.), have used alliances with other firms, including multinationals, inside and outside their country.

Alliances with multinationals help develop local skills and capabilities. Singapore used its alliance with IBM in Tradenet to build the system, but more importantly, to develop their own capabilities to build similar systems for other segments of society. In the process, Singapore is not only building these other systems, but has developed its own EDI technology and is now exporting both the technology and professional services in building large-scale, complex systems abroad. Hong Kong (Prov.) is now using its alliance with IBM and DHL to do the same thing. IBM provides the technology and experience with EDI, while DHL provides the interface between Hong Kong's (Prov.) 35,000 small traders and Tradelink—collecting documents from the traders, preparing them for EDI, sending them over the network, getting them back, and returning approved documents to the traders.

Alliances also provide an opportunity to learn what emerging trends mean for business or government. The Hong Kong (Prov.) example is particularly interesting in this regard. DHL, whose business EDI will eventually replace in part, joined the Tradelink alliance precisely so the firm could learn what the technology means for its business, how it can stay ahead of the coming changes, and what new business opportunities exist for it in those changes. Alliances allow individual firms to be at the forefront of advanced technology and to learn by doing from more experienced firms. This relationship can lead to a continued alliance and to new ones as well (Dedrick, Kraemer and Jarman, 1994).

It is in the interest of countries trying to develop the information services industry to develop and encourage alliances with multinationals within the country and outside. It is also useful to encourage openness to information, ideas and relationships through participation in global communities such as the Internet, and through participation in international conferences and research projects.

7. Keep Markets for IT Products and Services Open

Although open markets are often thought to advantage established producers, they are in the economic interests of all countries and firms because they foster the competition needed to keep firms efficient and prices low.

In the past, many countries established high taxes and duties on foreign imports of computer hardware in the belief that it was necessary to protect their infant IT industries. However, more than ten years of experience in India, Brazil and elsewhere has shown that such policies make the domestic hardware industry uncompetitive, hurt other segments of the IT industry, and make IT use expensive throughout the economy.⁵ For example, India found that its software services industry was earning more foreign exchange than the entire rest of its electronics and computer hardware industry combined. Yet, because of protectionist policies, the software services industry was being penalized by lack of access to the latest high performance foreign computers and by the high price of those computers when they could gain access. As a consequence, India reduced tariffs on imported hardware from over 100% to 35% and plans to reduce tariffs even further. Brazil has reduced tariffs dramatically also, and further opened their computer industry to foreign ownership in the hopes of getting better technology domestically and getting access to foreign markets.

Thus, the ultimate impact of government policies to enhance domestic industry performance through protectionism is problematic. Moreover, rapidly changing technology and commoditization, in combination with globalization, are making it difficult for countries to develop policies that can be easily targeted to protect their own firms. The overall experience indicates that it is useful for countries to promote their domestic IT industry through infrastructure and special programs, but it is actually harmful to other segments of the IT industry and the rest of the economy to do so through high taxes and duties on computer imports.

8. Enforce Intellectual Property Protection to Stimulate Innovation

Governments should provide the legal basis for copyright protection and enforce it. Without intellectual property protection, the incentives for local companies to develop new, innovative products are not sufficient and they cannot develop the human capital with which to continue to innovate. The services industry provides the human capital from which packaged software and information products are developed, and therefore intellectual property protection is important to the services industry.

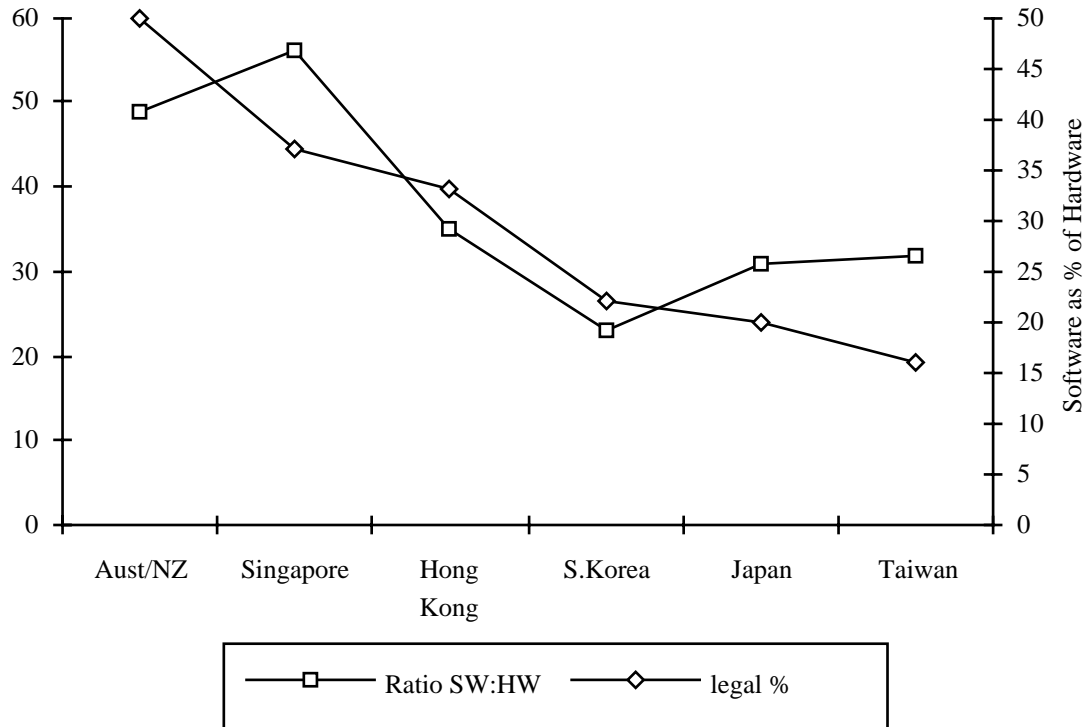
Some countries argue that because the benefit from use is greater than the benefit from developing software and services, they can gain more by pirating software and information than paying for it or developing it on their own. This is a false argument which might work in the short term but is extremely destructive to the domestic IT

⁵ The only exception is Japan, and that is unlikely to be repeated in the present era.

industry in the long term. Pirating is harmful at any level, but in the long term it creates a business culture which does not respect the intellectual property rights of local producers any more than foreign producers. Consequently, it robs firms in the information services industry of needed incentives. Without assurance of intellectual property protection, individuals and firms lack the incentive to innovate and produce software that might have large domestic or foreign markets. Capital markets also lack the needed incentives.

In addition, user organizations need more than software *per se*. They need applications tailored for the nature of local operations, implemented in the local language, and supported over time in order to get successful implementation and use from which the real benefit derives. If there is no local information services industry because pirating destroys the incentive, this is a long term loss to users and to the economy as a whole.

Some countries which looked the other way at pirating in the past now face serious problems as they try to develop their own software and services industry. While the government's attitude towards intellectual property protection has changed, the business culture has not. This can be seen dramatically in piracy statistics. Figure 5 shows that the size of the packaged software market seems to be related to the prevalence of software pirating.

Figure 5. Relationship between Software Piracy and Software Spending

Sources: BSA, 1994; Confidential industry sources

In countries such as Korea, Taiwan (Prov.) and Japan, where software pirating rates are high, the ratios of software to hardware spending are lower than in markets such as Singapore and Australia/New Zealand, where pirating is less common. Countries which want to develop the software and services industry will not only have to adopt and enforce piracy legislation, but they will also have to change business culture. Such change is not accomplished quickly or easily and therefore, must be begun simultaneously with efforts to develop the software sector.

SUMMARY AND CONCLUSION

There is an old Chinese saying, "May you live in interesting times," which is ambiguous about whether it is a blessing or a curse. These are certainly interesting times with respect to information technology. There is tremendous change within the IT industry. With the change come opportunities for new entrants into the industry. Whether the times turn out to be a blessing or a curse depends in large part upon what government and the private sector does with respect to investment in the IT industry.

Many developing countries are considering how to develop domestic IT industries and where to invest. They frequently target computer hardware or software, but tend to overlook IT services. Yet, IT services is the fastest growing sector in the IT industry and one where developing countries can build capabilities. Unlike hardware and software, which are dominated by large multinational companies, require huge capital resources and rely heavily upon technical expertise, the IT services sector offers opportunities for new entrants among domestic small and medium enterprises, whether alone or in alliances with multinationals.

The IT services sector also offers the opportunity for developing countries to create a segment of the IT industry within their resources and capabilities, to expand those capabilities, to advance domestic use of IT, and to create products and services for export.

Research on the experiences of other countries shows that national technology policy can be effective in developing a domestic IT industry. Singapore, Korea and Taiwan (Prov.) have all become successful PC and component manufacturers in the last 15 years, just as Japan did 30 years earlier. They are now targeting the software and services sectors.

It is the special role of governments to develop an approach to the IT industry that is suited to its country's unique capabilities, resources and opportunities, to create policy and incentives for private sector investment, and to provide the coordination needed to develop the industry effectively. The difficulty of figuring out such an approach is why these are interesting times in which we live.

REFERENCES

- Anchordoguy, Marie, 1989. *Computers, Inc.: Japan's Challenge to IBM*. Cambridge, MA: Harvard University Press.
- Brynjolfsson, Eric and Lorin Hitt, 1993. Is information systems spending productive? New evidence and new results. *Proceedings of the 14th International Conference on Information Systems*, Orlando, FL., December: 47-64.
- Corey, Kenneth E., 1994. Information technology policies in Southeast Asian development. *Proceedings of the International Conference on Information Technology*, Kuala Lumpur, Malaysia, August: 90-118.
- Davidson, William H., Ronald Hubert, and Edward St. Croix, 1993. Telecommunications infrastructure policy and performance: a global perspective. Los Angeles, CA: Center for Telecommunications Management, University of Southern California.
- Dedrick, Jason and Kenneth L. Kraemer, 1993a. India's quest for self-reliance in information technology: costs and benefits of government intervention, *Asian Survey*, 33(5), May: 463-492.
- Dedrick, Jason and Kenneth L. Kraemer, 1993b. Caught in the middle: information technology policy in Australia, *The Information Society*, 9(4): 333-363.
- Dedrick, Jason, Kenneth L. Kraemer and Sheryl Jarman, 1994. Supporting the free market: information technology policy in Hong Kong, *The Information Society* (forthcoming).
- Dedrick, Jason, Kenneth L. Kraemer and Dae-won Choi, 1994. IT policy in Korea. Irvine, CA: CRITO, University of California.
- Flamm, Kenneth, 1990. Globalization in the computer industry. Background paper prepared for the Directorate for Science, Technology and Industry of the OECD. Paris: OECD, December.
- Gurbaxani, Vijay, Kenneth L. Kraemer, John Leslie King, Sheryl Jarman, Jason Dedrick, K.S. Raman and C.S. Yap, 1991. Government as the driving force toward the information society: National computer policy in Singapore. *Information Society*, 7: 155-185.
- IDC (International Data Corporation), 1993. *Computer Industry Report.*, March: 4.
- King, John Leslie, Kenneth L. Kraemer, Jason Dedrick, K.S. Raman and C.S. Yap, 1992. Government policy and information technology in Asia-Pacific countries: a conceptual overview. *Informatization and the Public Sector* 2: 97-110.

- King, John Leslie and Benn Konsynski, 1990. *Singapore TradeNet*. Boston, MA: Harvard Business School, Harvard University.
- King, John Leslie and Linda Applegate, 1992. *The TradeNet Saga Continues*. Boston, MA: Harvard Business School, Harvard University.
- Kraemer, Kenneth L. and Jason Dedrick, 1993. Turning loose the invisible hand: information technology policy in New Zealand. *The Information Society*. 9(4): 365-390.
- Kraemer, Kenneth L. and Jason Dedrick, 1993b. The global computer market: where is potential for growth the greatest? Irvine, CA: CRITO, University of California.
- Kraemer, Kenneth L., 1994. National information infrastructure and competitiveness: the U.S. experience. Irvine, CA: CRITO, University of California.
- Kraemer, Kenneth L. and Jason Dedrick, 1994a. Payoffs from investment in information technology: lessons from Asia-Pacific countries, *World Development* (forthcoming).
- Kraemer, Kenneth L. and Jason Dedrick, 1994b. National technology policies and the development of information industries: lessons from the Asia-Pacific region. Irvine, CA: CRITO, University of California.
- Kraemer, Kenneth L. and Jason Dedrick, 1994c. Entrepreneurship, innovation and flexibility: information technology policy in Taiwan. Irvine, CA: CRITO, University of California.
- Kraemer, Kenneth L. and Jason Dedrick, 1994e. From nationalism to pragmatism: IT policy in China. Irvine, CA: CRITO, University of California.
- Kraemer, Kenneth L. and Jason Dedrick, 1994f. Industry coordination as a problem in national information technology policy: the case of the Philippines. Irvine, CA: CRITO, University of California.
- Lichtenberg, Frank R., 1993. The output contributions of computer equipment and personnel: a firm-level analysis. Working paper No. 4540. Cambridge, MA: National Bureau of Economic Research.
- McKinsey and Company, 1993. *The 1993 Report on the Computer Industry*. New York: McKinsey and Company.
- Mody, Ashoka and Carl Dahlman, 1992. Performance and potential of information technology: an international perspective, *World Development*, 20(2): 1703-1719.
- Schware, Robert, 1992. Software industry entry strategies for developing countries: a 'walking on two legs' proposition, *World Development*, 20(2): 143-164.

USITC, 1993. *Global Competitiveness of U.S. Advanced-Technology Industries: Computers*. Washington, DC: U.S. International Trade Commission, December.