

CHAPTER 2

The IT Revolution and East Asian Economic Growth

DR. F. GERARD ADAMS, PH.D.

*McDonald Professor, College of Business Administration, at Northeastern University, and
Professor of Economics and Finance Emeritus at the University of Pennsylvania.*

DR. YUZO KUMASAKA

President and CEO of ITeconomy Advisors, LLC, U.S.A.

1. IT and East Asian Development

IT has clearly made a substantial contribution to economic growth, globally, and in East Asia. The challenge faced by the researcher is to disentangle the various mechanisms that relate the use of IT capital to technology and economic development.

Over the past decade, East Asian countries have made considerable progress in advancing their information and communication technology (ICT) capabilities. Yet, they differ considerably among themselves and some still have a long way before they can make full use of the new technologies.

Table 1: Computer/ Internet Statistics

	Computers per 1000 people			Internet Subscribers per 1000 people	
	2001	2006		2003	2009
China	19	56		8	77
Hong Kong	186	698		186	295
Indonesia	11	20 (2007)		0.3	7
Malaysia	126	231		5	61
Philippines	22	72		0.7	19
Singapore	506	743 (2007)		100	237
South Korea	256	575 (2007)		24	338
Taiwan	n.a	694		134	216
Thailand	28	67		0.7	15
Vietnam	12	96		0.1	30
Japan	349	407 (2003)		117	249

Source: World Telecommunication/ICT Indicators Database, 14th edition 2010

As the statistics in Table 1 indicate, some of the East and Southeast Asian countries are at the forefront in the use of computer equipment. All have made progress from 2001 to 2006 but some still lag far behind on the negative side of the “digital divide”. In terms of computers per capita, the smaller countries, Hong Kong, Singapore, Taiwan,

and South Korea have reached levels comparable (and in many cases ahead of) advanced countries like Japan. On the other hand, Indonesia, Thailand, Vietnam, and the Philippines, still lag far behind in computer ownership, as does China. Similar differences, that reflect differences in real per capita income and urbanization, are also apparent in the statistics for Internet subscribers. This suggests that availability of computation facilities and interconnections at the consumer level is significantly different among East Asian countries, high in some but very low in others. The availability of computers for manufacturing and commercial use may not be as different as these figures suggest, as these are often determined by international enterprises. Spending on ICT equipment (Table 2) follows somewhat similar patterns, reflecting differences in economic wellbeing. In terms of shares of GDP, expenditures on ICT products increased from 2001 to 2008 in most of the countries except Vietnam and Japan, and have reached the range from 5 to 9 percent of the GNP in 2008 (Table 2). In terms of dollar per capita, however, the differentials remain very large reflecting the large differentials in per capita income that remain in East and Southeast Asia.

Table 2: ICT Spending Statistics

	ICT Spending as Percent of GDP			ICT Spending \$ per capita	
	2001	2008		2001	2008
China	5.7	9		53	195
Hong Kong	8.7	9.2		2110	2839
Indonesia	2.2	3.3		17	74
Malaysia	6.6	9.7		262	797
Philippines	4.2	6.1		41	113
Singapore	9.9	7.1		2110	2663
South Korea	7.4	9.1		676	1734
Taiwan	n.a.	n.a.		n.a.	n.a.
Thailand	3.7	6.2		76	251
Vietnam	6.7	4.9		26	51
Japan	9.6	6.7		2250	2571

Source: World Telecommunication/ICT Indicators Database, 14th edition 2010

Another approach to evaluating the roles, actual and potential, of ICT in East Asian economies is by way of the WEF (World Economic Forum) Network Readiness Indexes. These computations involve some hard data based measures, like the ones shown above, as well as some judgmental survey estimates by business people knowledgeable about the different countries. The data are shown as values and rankings for overall network readiness, and for subsidiary categories: Environment, Readiness, and Usage. (We show only the rankings here). From the perspective of the total index, a few of the East and Southeast Asian countries rank high—Singapore, 2; Hong Kong, 8; Taiwan, 11 in October 2009. But most of them remain in the middle range. It is interesting that total rankings in 2009 for the countries except Indonesia are better than their own rankings in network environment. This implies that East Asian countries can utilize IT infrastructure better than other countries. The relative positions of most of the countries have improved during the past six or seven years.

Table 3: WEC Network Readiness Estimates

	Rankings of 104 countries	Rankings of 130 countries		Environment	Readiness	Usage
	2003	October-09		October-09		
China	41	37		57	19	36
Hong Kong	18	8		15	9	6
Indonesia	73	67		66	43	89
Malaysia	25	27		37	11	28
Philippines	60	85		95	79	72
Singapore	2	2		9	1	4
South Korea	20	15		27	21	1
Taiwan	17	11		21	10	5
Thailand	38	47		50	46	50
Vietnam	68	54		69	37	67
Japan	12	21		22	36	14

Source: World economic Forum Network Readiness Indexes

2. Economy-Specific and Sector-Specific Views of IT

Another perspective, that is important in explaining East Asian growth, is the role of IT in the variety of East Asian economies and to recognize the likely differences in the impact of IT in the different sectors.

The requirements for IT vary considerably in the different East Asian economies and in their various sectors. Thus, in the most advanced countries like South Korea and Taiwan, producers of sophisticated products like chips and computers require a high level of mechanization and IT capital equipment. Countries that are at much earlier stages of development like the Philippines and Indonesia, where wages are relatively low and where IT products are assembled or packaged, may operate with much less advanced equipment and methods. Other countries, like Malaysia and China may have some industries at the technological frontier while other sectors are still at a pre-IT stage of development. Consequently, we anticipate that our empirical work on East Asia will show important differences in the role of IT among the East Asian countries, differences related to their relative stage of development, industrial structure, and labor costs.

IT activities to be considered include not only the information technology and communications industries but also IT's effect on productivity in the evolving East Asian development process. These activities have played decisive roles in the development processes, which, moreover, vary greatly depending on the country considered and its stage of development.

3. The Product Cycle and the East Asian Development Ladder

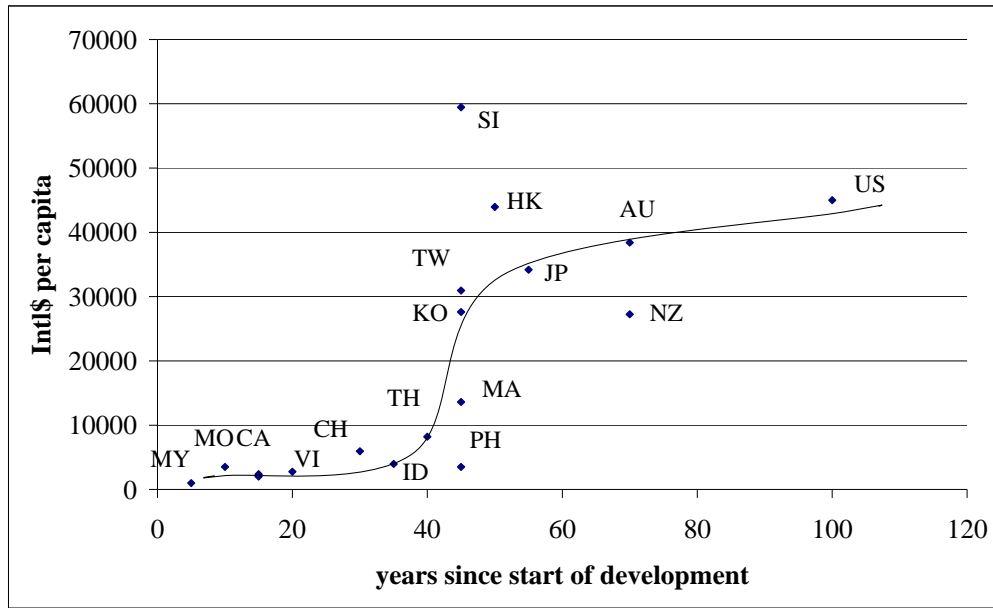
The product cycle (Vernon, 1966) helps to explain the gradual movement of production facilities from advanced countries to less developed areas and provides a framework for visualizing the development of the East Asian region. Vernon considered the production and exports of a product beginning in an advanced country,

the United States. At first, a new industry builds up in an advanced country and uses its home production facilities as a base for supplying the domestic market and for exporting. Over time, as the product becomes standardized and as producers become aware that it can be produced more cheaply elsewhere, typically because of lower labor cost, manufacturing is shifted to less developed countries, and the advanced country becomes an importer. Foreign direct investors and managers sent abroad play an important role in this pattern of trade.

East Asian development is an interesting illustration of how the product cycle process has helped the East Asian countries integrate into the modern world economy. One after another, the East Asian countries have gone from being poor producers of agricultural products to world scale suppliers of advanced manufacturers. Some of the smaller East Asian countries, like South Korea, have gone all the way from subsistence agriculture to modern industry. China has leap-frogged its way into the world economy by hinging much of its development on world export markets, as other East Asian countries have done before. (One should not, however, ignore the high rates of investment and total factor productivity of industries directed at the Chinese internal market).

Figure 1 illustrates the S-curve of East Asian development. The growth path of most of these economies has followed an S-shaped curve, with initial slow growth, then rapid development, and finally a slower growth path as they have achieved a degree of economic maturity. In the chart, the horizontal axis shows for each country the number of years since the start of rapid economic growth. For Japan, that means some 60 plus years since the end of World War II. Other East Asian countries began a growth spurt somewhat later, for example, South Korea after its war, Singapore after separation from Malaysia in the early 1960s and China at the end of the 1970s when it turned toward a market economy. On the vertical axis, we show for each country the per capita GDP on a purchasing power equivalent basis. The points lie broadly along an S-curve. Initially, growth seems to be slow, then accelerates rapidly as countries develop foreign markets and the internal market grows, with the countries acquiring the more advanced technologies of their neighbors already ahead on the development path. Finally, when countries mature, growth comes more slowly as costs are high and advanced techniques must be developed at home.

Figure 1 :The S-Curve of east Asian Growth



China (CH)	HongKong (HK)	Korea (KO)	Mongolia (MO)	Taipei (TW)	Cambodia (CA)
Indonesia (ID)	Laos (LA)	Malaysia (MA)	Myanmar (MY)	Philippines (PH)	Singapore (SI)
Thailand (TH)	Vietnam (VI)	Japan (JP)	Australia (AU)	New Zealand (NZ)	United States (US)

The growth ladder process lies behind this development path on which China is now by far the leading participant. The explanation for the sequential pattern of East Asian development lies in the changing patterns of comparative advantage and technological competence as countries advance. At the beginning, the East Asian countries were very poor, with low wages, and little capital and technology. They had little finished product to export, only simple consumer goods with a reputation for shoddiness. As these countries developed and gained the benefits of direct foreign investment, they began to send low cost but quality product to market. Eventually, wages and costs rose, and labor-intensive production like assembly work became less competitive. The production of labor-intensive products was shifted abroad to neighboring countries, on the next step down on the development ladder, where costs were lower. The advancing country turned to more sophisticated products, to more capital- and technologically-intensive goods. This sequence of events, as described in table 2.4, represent the Stages of Development Ladder. The beginning stage (Stage 1) represents primary production taking advantage of cheap abundant land and labor. The

next stage (Stage 2) represents labor-intensive manufacturing. This ranges from labor-intensive assembly production of simple products like clothing and toys to more mechanical products like consumer electronics. Stage 3 focuses on more advanced products, including high-tech manufacturing like computers, digital cameras, and machine tools that require capital-intensive technically sophisticated inputs. And, finally, there is the sophisticated service stage (Stage 4) calling for financial, programming, and management services that require a highly educated labor force.

This sequential development process described here represents an international application of Vernon's product cycle (Vernon 1966). Rising production costs and maturity of the production process made it more economical to produce goods in less advanced lower wage countries. As countries advance economically, they "hand off" industries to less advanced neighbors. Fujita *et al.* (2001) describe the process as follows:

"...the process of industrialization is not uniform across countries. Instead, it proceeds in a series of waves with countries successively undergoing rapid industrialization as each establishes a critical mass of industry. Successful industrialization, however, raises wages—given our continuing growth of demand for manufacturers—and thus eventually prepares the way for the spread of industry to yet another country". (p. 273)

Note the role of wage differentials and of increasing returns to scale—critical mass—in this discussion that reflects the thinking of the "new economic geography."

Often managers and technicians from one country will help develop the industry in neighboring countries; skilled technicians from South Korea setting up manufacturing operations in Malaysia and Indonesia, for example. FDI plays an important role in this process.

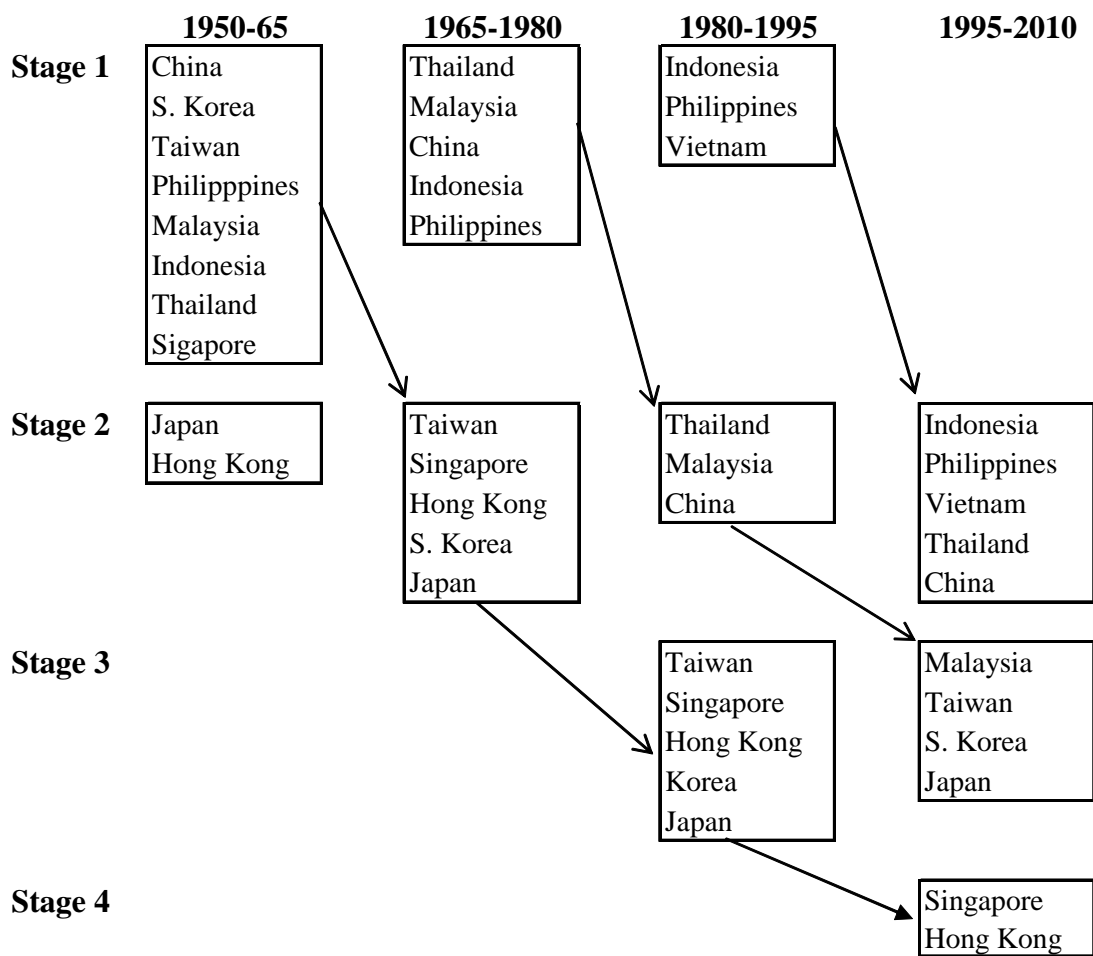
Table 4: The Stages of the Development Ladder

		Product Category		Resource Requirements
Stage 1	Primary Products			
		Raw foodstuffs		Abundant cheap land and labor
		Processed foodstuffs		Mineral and energy resources
		Minerals + fuels		
Stage 2	Labor-intensive manufactures			
		Basic textiles		Low cost labor
		Garments		Transport
		Athletic shoes		
		Leather goods		
		Toys		
		Electronic assembly		
Stage 3	High-tech manufactures			
		Motor vehicles		Technically skilled labor
		Televisions		Capital management
		Cell phones		
		Computers		
		Pharmaceuticals		
		Machinery		
Stage 4	High-level services			
		Programming		Educated labor force, language
		Movies and entertainment		Communications network
		Finance		
		Management		

The progress of the product cycle and development ladder in East Asia is described in figure 2.2. The period from 1950 to 1965 was a period in which Asia was largely a producer of primary products, only Japan and Hong Kong were major producers for the world market and their exports were largely simple manufactured products like textiles. The time from 1965 to 1980 saw some upgrading as Singapore and South Korea joined Hong Kong and Japan into the Stage 2 category producing manufactured goods for the world market. More recently, from 1980 to 1995, we show a number of East Asian countries becoming leaders in the market for more sophisticated products: cameras, televisions, automobiles, and other advanced consumer goods. These call for a high level of manufacturing skill, capital intensity, and advanced technology. Taiwan,

Singapore, South Korea and Japan were the leaders in these products. In the period 1995 to 2010, still further shifts have occurred; Singapore and Hong Kong joined the advanced service economy, too costly and too small in size now to be competitive in manufacturing, they have become financial and managerial centers. Japan, however, remains a manufacturing economy specializing in high-level electronics and machinery and cars.

Figure 2: The Stages of the Product Cycle Process



4. The Role of IT in the East Asian Development Ladder

The IT revolution has played a substantial role in the product cycle process related to East Asian development. But this role varies greatly depending on the stage of development that each country has attained.

In Stage 1, there is little function for IT except as a mechanism for ordering, accounting, market clearance and finance. Primary industry production does not involve information technology or computers. Subsistence agriculture is not capital or IT intensive. Mining requires large scale capital but little involving modern IT.

Stage 2, mass production of simple products, similarly does not call for much direct use of information technology, though as countries advance the use of machinery to automate the assembly process increases. In this case, however, industry may rely heavily on an IT infrastructure for communications and financial management. Note, moreover, that assembly of electronic products falls into this category. Many of the sophisticated IT devices now available to consumers, like cellular telephones, are assembled, albeit by often by hand, in factories located in Stage 2 areas.

Stage 3 involves all the dimensions of IT. The production of sophisticated products, like computer chips, and the design and manufacturing of advanced mechanical products, such as cars, relies increasingly on electronic controls, information technology and communication. Industries in this group compete directly with the products of advanced countries in Europe, Japan, and North America, where industrial processes are largely controlled electronically. These industrial operations require a high level of technological competence that is available in some, but not all, countries of East and Southeast Asia.

Stage 4, the sophisticated service industries are greatly dependent on highly developed IT networks linked to a global network. IT activities relevant to high level services run the gamut from large computer and communications systems necessary for the development and transmission of computer code, to banking systems, computerized management tools, and equipment for movies and TV.

It is apparent that IT has played an increasingly important role as East Asian countries have gone from primary production to more sophisticated stages of the production process.

5. Implications for Industrial Structure and IT

As we have noted, the nature of the East Asian growth process has important implications for industrial structure and for the role of IT. At an early stage in the process, industrialization depends on the use of hand labor in industry, for assembly or manufacture of simple products. Industrialization proceeds as unskilled low wage workers are drawn into industrial centers. At this stage of development, the role of IT is limited, largely to control the channels of supply and delivery, since little, if any, sophisticated machinery is used in production.

At more advanced stages of development, the role of IT in industries increases, both in manufacturing industries for export markets and as IT utilization in the production process. The sophistication of products increases, so that countries like South Korea have become primary producers of sophisticated chips and of products like advanced TVs that include sophisticated IT equipment. At still more advanced stages, like the level of development we observe in Hong Kong and Singapore, the role of industry diminishes to be replaced by management, finance, and communication, all of which require high levels of communication and computer connections.

References

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