CHAPTER 4

Information Development in India
For most developing countries, the internet has been of relatively little significance for the large majority of businesses, except possibly for some larger countries. The reasons are not hard to find. For most countries, the primitive state of communications infrastructure is a difficult barrier to internet development. In most, business operations involve mostly small firms, often the last to benefit from improved means of communications even in richer countries. And, not least, poor countries generally lack the pool of technically trained people necessary to fuel change.

With the possible exception of China, India has been affected more by changes in IT than any other developing country, yet the country remains very poor by any standard. The country's businesses have until early in the 1990s been heavily influenced in their growth by the government's licensing regime, several companies having become very large firms operating nationally mainly through their ability to garner licenses.

The structure of many of these firms, therefore, has been dictated not by market demands, but rather by the availability of government licenses. In addition, many companies have benefited from the government's past policy of protection from international competition, a program that together with licensing has yielded gross inefficiencies and bloated enterprises. All of this is changing. The licensing regime is largely gone, and protection is beginning to be pared away. Foreign direct investment, while still not exactly encouraged in some sectors, is far more welcome than it was. The results have been dramatic. Large conglomerates have had to give attention to their competitive viability in a much tougher economic environment. Reorganization and restructuring to achieve more competitive focus is becoming the rule.

In IT more specifically, India has in some ways become a world leader, yet the degree of penetration of such new phenomena as the internet is still quite modest. Even so, at least the larger manufacturing companies and, perhaps more importantly, financial institutions have begun to use new technologies to improve efficiency and better serve customers. There seems little question that the gradual opening of the Indian market has been forcing businesses to pay more attention to competitiveness.

In some ways India is not representative of the larger developing world. Although illiteracy is still widespread, India has a long history of support for technical education and, as a consequence, has produced large numbers of technically qualified personnel. The country is, in fact, a not inconsequential exporter of engineers and scientists; Silicon Valley alone boasts around 150 Indian millionaires, for example, and American immigration rules allowing thousands of visas for technical people have benefited disproportionately Indians. At home, the large group of technically-qualified persons in India, to some degree utilizing their Indian-American contacts, has formed the backbone of a rapid growth in IT investment in India, a growth that is continuing today.

India possesses a substantial middle class, variously estimated at between 150 and 200 million people, depending on criteria. This group is concentrated in perhaps 150 towns and cities scattered around this very large country, and it forms the major source of customers for a variety of businesses, either directly or indirectly. In an increasingly competitive environment, this group appears to have provided strong economic incentives for businesses to find ways to improve efficiency.
IT provides an important vehicle to accomplish this goal and IT providers are being pushed incessantly to improve access and broaden services. Finally, the IT industry has expanded relatively free of the kind of government regulation that has affected other industries. As a result, the industry has been the source of considerable entrepreneurialism and has fostered development of the growing venture capital industry described above.

Moreover, as in the United States, the IT industry itself has been the source of productivity gains for the economy as a whole as manufacturers emulate production techniques in the West and output increases rapidly. The importance of the IT sector in India also is a feature not replicated in most other developing countries.

Because the internet provides the greatest possibility for overall economic gain among IT sectors, we begin with a description of the internet and how it is currently being utilized. Not surprisingly, India has lagged far behind many other Asian countries in the adoption of the internet. In a population of one billion people, there are fewer than two million internet subscribers, a figure that contrasts with India’s closest comparator in size, China, which has more than three times as many telephone lines and four times as many internet users.

In fact, by the year 2000 India had only around 26 million fixed-line telephone connections and fewer than five million personal computers in place. Clearly, if the internet is to become a major vehicle in transforming the Indian economy, there is little question that rapid further development of India’s communications and data transmission network is essential. Just as obviously, there is still a long way to go in this development.

Of major importance is the state of economic development in the country; India on average is still a very poor country, with a monthly per capita GNP of only 180 US dollars on a purchasing power parity basis. Despite the existence of a sizable "middle class," most people in India worry about obtaining the essentials of life, not in gaining access to telephones, much less internet service. Even so, given the availability of an adequate telecommunications network, India’s internet audience could increase substantially.

But, that network, too, historically has been a major constraint. As noted, there exist relatively few telephone connections, and it is well known that the value of the internet increases geometrically with added connections. More importantly, however, the reliability of the system nationally has certainly not been adequate to support internet use, even if more connections were to become available.

The country has lacked a high-speed data communications backbone to speed transmission and interconnectivity. In some ways, these constraints are a "chicken and egg" proposition: without a better national telecommunications network, there is little incentive to connect; without more connections, the incentive to build a more adequate high-speed network diminishes. Breaking this deadlock promises to be an important determinant to internet growth and, more broadly, to the attractiveness of the country as a destination for high-technology foreign investment.
Another constraint to Indian internet development has been the structure of telephone tariff schedules. As in many other countries, tariffs have been based on time charges which can make internet usage a very expensive proposition. These tariffs have been changing and are now based on larger units of time. But, even now, the cost of internet service from the telephone monopoly is not cheap. Five hundred hours annually of dial-up service can cost $200 for a slow-speed connection, a figure that compares with a U.S. standard of perhaps $180 for unlimited time. Beyond the 500 hour yearly base, time is billed at about 35 cents an hour, also not an insignificant charge for users.

Internet expansion suffers from the generally poor condition of other parts of India's infrastructure. Internet use for commercial purposes is based importantly on increasing the speed of transactions, eliminating steps in the distribution chain and delivering products faster and more reliably. It is the last step of this process that is at risk in an India-like environment, because the physical infrastructure to deliver products from supplier to customer speedily is largely absent.

Even if high-speed telecommunications were in place, which as yet it is not, much of the transactional advantages of the internet in commercial practice would be lost owing to poor roads and inefficient rail facilities. To be sure, internet use provides opportunities for both consumers and businesses to compare easily large numbers of products and prices. But, without the ability to deliver products expeditiously, this advantage can be largely negated.

Widespread internet use within India is not necessarily a barrier to increasing and potentially benefitting from use of the internet by Indian companies. For example, with the much improved access to international gateways now becoming available businesses can easily expand their potential customer base globally through the internet, even if their local clientele is not yet connected.

In fact, buyers and, particularly, industrial purchasers in many industrial countries today are routinely posting detailed product and component specifications on specialized websites open to all with access to the internet. The purpose of such sites is to widen the net of possible suppliers, thus reducing costs. For Indian companies, therefore, opportunities to expand business relationships with foreign firms could be enormously enhanced through the internet, even though internet use in India remained relatively constrained.

Company utilization of the internet in India thus far is limited, but corporate interest in future use is intense. Firms are establishing special groups internally to investigate how the internet might be used both for internal control and for developing more efficient means for dealing with customers and suppliers. Generally, little will actually be done until the current efforts to upgrade India's telecommunications infrastructure are further advanced.

One exception, a company that has gone further than most, is Reliance Industries, a firm mostly engaged in chemical production and distribution, and a company actively involved in building a fiberoptic network linking Indian major cities. This company, in addition, expects that the internet will become a primary mechanism to improve
operations, and it already has in place an internet-ready communications and control system. But, much of the system today uses leased telephone lines, not yet the internet.

For example, of the company's 20,000-odd customers around India, 3-4 thousand are major buyers, accounting for perhaps 75 percent or more of total sales. These major customers for chemicals are now linked electronically to an internet-based market exchange introduced by Reliance, one of several now existing in the country. In addition, through leased-line facilities, customers can process orders, and Reliance can deliver dispatching details, better manage inventory, carry out invoicing, and provide technical service, all done electronically. This customer network will be transferred to the internet at the earliest possible moment, since the internet should provide substantially lower operational costs.

To provide some measure of the benefits already apparent from this system, Reliance has been able to reduce receivables from 310 days to 90 days, only one area of savings. Cost improvements come primarily from a general tightening and acceleration of processing within the company and between the firm and its customers. Savings do not occur as a result of reducing manpower. In addition, the speed of order delivery has been improved greatly and inventories reduced in a system that is now integrated into the firm's overall management control function that links not only important customers but also over 50 of the company's own operations. These results for Reliance are similar in nature to cost reductions experienced by companies in industrial parts of the world, even though thus far the internet has not been much utilized.

One might anticipate even greater savings in India, as compared with more industrialized countries, since operational efficiency prior to the introduction of electronic controls is likely to have been far lower than comparable figures for companies in the developed world.

Although the introduction of Reliance-like systems lags in India among larger manufacturers, there are other areas of the economy where considerable progress has been made, despite the as yet primitive nature of the country's telecommunications network.

A few Indian private banks and financial institutions represent a sector that has become a leader in using electronics to offer new customer services. Though still early in the process, banks see the internet as a vehicle not only to improve current services but, in addition, to bring into the banks new types of businesses. For example, some banks look forward to the time when client companies will choose to delegate most "back office" functions directly to their banks. Moreover, banks are attempting to link with Indian commercial web-sites to offer clearing services to clients of these sites.

One interesting example of bank activity is HDFC Bank, started as an off-shoot of India's Housing Development Finance Corporation six years ago. The bank now has 125 branches and is adding new ones rapidly, including 60 last year.

Branches have been connected to the home office from the outset through a private data network operated for the bank by Wipro Infotech Software and Services Company, a large Indian software developer. HDFC Bank targets high-worth individuals and larger corporate clients but is also developing a sizable retail banking business.
Telephone transactions of the type familiar in more developed countries (automatic payments, transfers, deposits, account balances, etc.) were introduced two years ago, but these functions are now also available through the internet.

Although precise cost estimates for serving customers via the internet are not available, banks have studied savings that are possible through telephone transactions, as compared with other means. For example, if a teller-based transaction costs, say, 150 rupees, the same transaction done via an automatic teller machine runs only about 15 rupees and via electronic connection 10 rupees, less than 7 percent of the teller cost. One other interviewed bank offering similar electronic services confirms these cost figures.

Internet-based services are a more recent introduction, but already demands for the services are expanding quickly. Today, HDFC Bank claims over 100,000 retail internet customers, almost half of whom utilize the service more than once monthly. Another aggressive bank, ICICI Bank, also is active both in telephone and internet service for its customers. Its internet customer base grew from 6,000 to 250,000 in a single year. As more customers are added in these banks, unit costs of transactions promise to fall rapidly, because the expense of adding more server capacity is minimal. In other words, the marginal cost of serving an internet customer is still falling.

In another aspect of its business, HDFC Bank is working closely with the Bombay Stock Exchange, which itself is in the process of automating transactions. Before automation was introduced, weekly reporting to the exchange was accomplished by brokers submitting floppy disks two days before each week's end.

Today, through clearing accounts maintained at HDFC Bank and elsewhere, clearing is instantaneous, and 400 brokers maintain accounts at the bank for this purpose. While such developments in the financial sector are encouraging, they should be kept in perspective. Private banks in India account for barely one-fifth of total deposits.

Although this proportion has been increasing, the vast preponderance of Indian banking is still done in state-owned facilities, which, thus far, have shown only modest interest in increasing efficiency. There has been talk of increasing the proportion of private ownership in state banks in order to increase productivity, but resistance to such moves by still powerful unions and others has stalled much action. Website Development Despite the lack yet of extensive broadband facilities in India, growth in the number of new websites has been explosive.

There are today hundreds of Indian commercial websites. Although financial figures are unavailable, it is likely that most of these sites are not yet profitable and are based on the joint expectation of much improved internet infrastructure and perceived first mover advantages. As in the United States, some of these sites will succeed, but most in all likelihood will never reach financial viability for a variety of reasons. Some will fail because they were formed too early to take advantage of newer infrastructure advancements to reach potential users. Advancements, in general, are not yet in place. Some will fail owing to their inability to change long-established commercial customs of their hoped-for clients quickly enough. And, still others will fall by the wayside because
their creative motivations were not matched by realistic means to gain revenues from their clients, another cause familiar from the American experience.

Still, as in more developed parts of the world, enough of the new websites could survive to at least begin to change how business is being conducted in India. In the process, these websites may be a harbinger of widespread efficiency gains in an economy plagued by slow transactions, sluggish order processing and unnecessarily high inventory levels. A brief review of some of these websites follows.

Business-to-consumer websites (B2C) Although there has been extensive development of websites intended to attract household consumers, their future viability can be seriously questioned. Part of the reason lies in the extremely limited penetration of personal computers among Indian households.

Although the numbers are rising rapidly, there are fewer than 4 million personal computers in all of India and, of these, perhaps only 20 percent are used by households, including those used for home offices. Telephone access, the only means, has been expensive and unreliable, and methods of product delivery to customers are as yet underdeveloped. Even though a substantial middle class may exist among India's impoverished millions, a group who might eventually be attracted to electronic transactions, these handicaps present a formidable barrier to rapid development of B2C growth.

All of these problems, of course, are in the process of easing, but the transition will require substantial time. Meanwhile, B2C websites hope to make sufficient inroads among urban dwellers to at least survive until better times are possible. It will decidedly be an uphill fight. Some observers note that while the population of personal computers is relatively small and the technological means to connect them is still rather primitive, there are 37 million cable television subscribers.

As the fiberoptic network now being laid out is completed, it is thought, these subscribers might furnish the foundation for successful B2C expansion. But, even if cable viewers could be connected to the fiber-optic grid, the paucity of personal computers would still provide a difficult environment for B2C transactions to expand.

One can conclude, therefore, that extensive development of B2C websites probably is premature at this stage of India's development. This conclusion is supported by results from a recent study by the Gartner Group, as reported in India News. Of the few internet subscribers in India, only 2.2 percent had engaged in B2C commerce or paid for services online. Only 3.6 percent had ever placed orders over the net, usually for such services as movie booking or for products like books, audio cassettes and CDs, and software. Customers were largely well-to-do families Business-to-business websites (B2B) Use of the internet between businesses, on the other hand, offers greater promise, and a profusion of Indian websites is one result.

As in the case of B2C sites, many of the B2B sites are likely to end up as casualties for many of the same reasons. But already there are indications that acceptance of the internet as a way of revising business practices to gain efficiencies is quite widespread. Many businesses are fully aware of the trade-related commitments the Indian
government has made as a condition of joining the World Trade Organization and of the falling trade protection that will be one consequence.

The internet is seen by many of these firms as one possible vehicle among many others for gaining increased competitiveness. Even so, present use of the internet, either for direct inter-company communications or through business websites, is still early in its development.

A few examples of websites now in existence provide background. Typical of cross-sector sites, ones involving a number of quite different sectors, is Indiamarkets.com, started by IMO Communications. Development of Indiamarkets began in March, 1999, with venture funding from the Warburg Pincus Fund among other sources.

As the company's own literature puts it, Indiamarkets is "India's first comprehensive business-to-business infomediary, an aggregation of vertical supplier communities representing over a hundred diverse product categories. The site, launched only in January, 2000, offers a gateway to promote business between potential trading partners and provides transaction-enabling content that facilitates judicious business decisions." To accomplish its objectives, the site offers a variety of on-line services: sector-specific news, reviews of state policies affecting the sector, a buyer posting facility, a supplier posting allowing one to compare offerings from across India, and an auction facility to sell machinery or excess inventories.

By late 2000, the site claimed to have 30,000 subscribers, $600 million in inventory up for sale, over 2,000 "hits" and 150 transactions arranged daily. IMO also is opening 70 business centers around the country to provide services to businesses without access to computer networking. Indiamarkets.com faces a number of problems common to such sites.

Of primary importance are the site's planned sources of revenue, mainly to come from a combination of advertising on the site, an "enhanced" listing for companies who pay an annual fee and, most importantly, planned fees for transactions completed using the website. Transactions fees had not been put in place by October, 2000, but arrangements had been made with Citibank for a payment gateway on the site for easy clearing. This will be facilitated by credit checks through Dun and Bradstreet.

Whether or not users of the site will be willing to pay fees remains to be seen. However, IMO studies show that, aside from user savings from lower prices, transactions costs are reduced by 6 to 7 percent through use of the site, a not insignificant figure. Such sites also are likely to lower prices by bringing added competition to markets from better and more complete information.

The website, of course, also will be subject to its own competitive environment, as more B2B sites offering services to the same clients open up. Thus, while the availability of various savings might make customers more receptive to fees, the size of those fees could be constrained by competitive considerations. Much depends on the degree to which the more generalized website, exemplified by Indiamarkets.com, succeeds in competition with sites that are more focused on particular sectors.
One such portal is Kagaz.com, constructed by Ecomedia Infosystems to service only the pulp and paper industry. Kagaz.com is a subscriber site, with a subscriber base now numbering about 10,000 (half of whom are foreigners), each of whom pays a small monthly fee for access. The site offers news, data, and bulletin board-type notices on paper availability.

India has relatively few paper manufacturers, but there are about 80,000 paper traders who act as middlemen between manufacturers and converters, cutters and printers. Traders exist because of their local knowledge of customers, taxes and regulations.

The ultimate objective of sites like Kagaz.com, of which there are now an abundance in India, is to offer a full e-commerce portal where transactions can be facilitated for a fee. For example, when new deals are arranged between sellers and buyers, Kagaz guarantees the deal and accepts payment, which is released when delivery has occurred. The problems faced by Kagaz.com are typical of many other such sites.

The very low overall penetration of personal computers and internet connections in India is matched by the spotty existence of PCs among potential customers of the site. Most traders, for example, have no access presently to a PC. Yet, these traders ultimately are the foundation of the site's hoped-for business, because they, not manufacturers, are the ones who maintain inventories in the system and understand intimately their customers needs and peculiarities. The intention for now is to work through these traders, not to work around them. Therefore, one major marketing task of Kagaz.com and like sites obviously will be to broaden the base of internet-connected and conversant traders and dealers.

Such a task will not be a simple one, even if the expansion of high-speed data links across India in the next two years proceeds as anticipated. The trader community is likely to be tradition-bound, accustomed to carrying out business successfully in time-honored fashion.

Breaking old habits doubtlessly will prove much more difficult than has been the case in more industrialized societies, where PC use was common long before the advent of internet possibilities. Even so, if portals can demonstrate significant cost savings through internet use, a substantial marketing effort, competition should force change over time.

Business-to-government websites (B2G) The Indian government and some state governments have made a commitment to increased transparency and simplified procedures through their adoption of internet-based access to government functions.

Today, for example, governments account for over 28 percent of IT spending in India. In much of this effort, regional units have been in the forefront, computerizing operations to streamline services and, hopefully, reduce bureaucracy. Among the functions being made available through the internet are government procurement bidding and various application procedures, both familiar from more economically advanced countries. Whether or not such efforts do, in fact, reduce bureaucracy and lower government costs remains to be seen.
With burgeoning fiscal deficits at both national and regional levels, saving are obviously needed badly. In India, however, government service has often been seen as a sinecure, where employment is a continuing obligation. Transferring internal operations and some public functions to electronic forms may not have much in the way of employment effects, at least not in the short run.

Still, to the extent that the internet makes dealings with government at all levels easier and more transparent for non-governmental entities, and particularly for businesses, gains in efficiency could be substantial as internet use expands throughout the country. Moreover, to the extent that increased transparency and efficiency are accompanied by lower government employment and fewer opportunities for corruption, one might also anticipate that such advances will be fiercely opposed.

One rapidly expanding business for Indian companies is the provision of back-office services to international clients. The basic business has a long history globally; Ireland, the Caribbean and the Philippines, for example, have provided such services to companies in the United States for many years.

The typical task involves the transcription of raw data into electronic databases, where paper records are shipped in by air, local residents transform the data into electronic form, which is then transferred back to the developer country company via the internet. The business today involves a wide number of industries including, to name just a few, airlines, banks, insurance companies and medical establishments.

Currently, India employs between 50,000 and 100,000 people in what are termed "internet-enabled services," producing $500 million in export earnings. Growth has been so rapid that some observers anticipate employment of well over one million within ten years generating income of $10 billion.

Although such expectations may be overly optimistic, India does have some competitive advantages: like the Philippines, India has an abundance of English-speaking people, many with university educations, who are willing to work for a fraction of the cost similar workers earn in the client's home country.

Internet-enabled services have changed in recent years to involve other areas. For example, the transcribing of voice dictation by medical practitioners and others in the United States has become a big business.

A more sophisticated trend recently has been the transfer to India of some research and development operations, made possible by the instantaneous transfer of data and information through the internet. All of these services also rely not only on English language capability but also the availability of a reservoir of well-educated, yet under-employed, people. For example, typical employees in the Indian industry include graduates of university programs in science, liberal arts and even such professions as medicine or law.

Because the internet is only now just beginning to make its impacts felt across India, any discussion of development impacts is, at best, premature. Unlike in software development, now well established as an internationally competitive industry, use of the internet either by individuals or most businesses is still at a primitive stage. This picture
almost certainly will change rapidly, however, as high-speed data networks are completed linking at least the larger cities. How rapidly, of course, will depend on the speed of finishing not only the underlying network but also "last mile" connections to individual homes and businesses. For larger businesses, this process is likely to proceed quickly, as the gains are clearest there. For others, one can anticipate that existing cable networks will provide the most likely vehicle, but the process will take longer.

The extent of gains from wider internet penetration is, at this stage, a matter of conjecture. Even in the United States, estimates of productivity gains as a consequence of information technology generally and the internet more specifically vary widely.

The range of opinion runs from Nobelist Robert Solow's well-known remark 13 years ago, "We see the computer age everywhere except in the productivity statistics," to much more optimistic statements from a variety of other economists more recently. Clearly, productivity has jumped in the United States in the past five years from some set of causes, but the sources continue to be elusive. It suffices here to note that the U.S.

Congressional Budget Office and the Office of Management and Budget both project productivity gains in the next ten years to be about 0.5 percentage point higher than the average for the years 1973 to 1995. In the developing world, estimates are even more perilous, but it does seem clear that one cannot simply extrapolate the industrial country experience to developing countries. Some observers believe that efficiency gains are likely to be smaller in poorer countries. They point out that developing countries depend more on production in small and medium-sized enterprises, and these are less likely to experience substantial gains from internet use, at least not in uses internal to the organization, as compared with larger organizations.

Moreover, poorer countries typically rely more on commodity production and exports, which, in comparison with the manufactured goods produced and marketed by industrial countries, are less likely to find material productivity improvements from use of the internet.

Finally, the point has been made that introducing technologies from industrialized countries, possibly including the internet, can result in smaller productivity gains in developing regions, as compared with gains in the technology- innovating area. These technologies tend to be biased toward skill- intensiveness, which produce fewer gains in productivity when transferred to a developing country.

These observations are, of course, entirely speculative at this stage, since the internet is in its infancy in most poor regions. But, there seems little doubt that gains from the internet could be substantial and, despite more skeptical conclusions, could affect developing economies in even more profound ways than is the case for industrialized regions.

The case of intracorporate use of the internet is illustrative. In industrial countries, use of the internet for coordination between geographically widespread units represents only an incremental change from the way in which business had been done. For larger companies, management control typically had been exercised through dedicated networks long before the internet came into existence. Companies like Texas Instruments have operated sophisticated global networks linking their subsidiaries for
decades. For such firms to move from these networks to the internet was really only a small, if less costly, step. In fact, many of these firms thus far have continued to use older networks in preference to the internet.

For a developing country like India, on the other hand, even dedicated networks are a relatively new phenomenon and are far less pervasive than in more industrialized parts of the world. Delivery of reliable telephony, the backbone of any dedicated system, has occurred only recently.

As a consequence, use of the telephone system as a vehicle for internal management controls has not been widespread, as the earlier Reliance Industries example illustrates. Assuming the internet, utilizing still-to-be-provided broadband facilities operated privately, becomes widely available in coming years, reliable opportunities for better management controls should become more popular.

Even smaller companies may be well placed to take advantage of it. The result might well be a much more productive industrial system made possible through better managerial controls. Again, however, at this stage much is conjectural.

The gains from improving transaction capabilities between firms should be even more striking in a developing country environment, particularly in a large country like India. Part of these gains will come through the B2B portals noted above and are similar to gains found already in industrial countries. Part will be the result of company-specific uses of the internet to increase awareness of procurement needs among a larger audience of potential suppliers. Again, tightening relationships between buyers and suppliers has been under way for many years in developed countries, starting with Japan and later being transferred to firms in other industrialized countries.

It antedates internet development in these parts of the world. In India, on the other hand, the distribution system at all levels remains antiquated and inefficient. The gains to be made from tightening this system, even apart from fixing the abundant remaining problems in physical distribution, are likely to be substantial.

In addition, although services in India are far less important as a proportion of GDP compared, say, with the United States, the internet still promises to yield efficiencies in the service sector. The examples of banks given above provide concrete evidence.

Clearly, financial clearings, among other financial services, can be enormously accelerated through the introduction of electronic banking, with commensurate savings in working capital requirements throughout the economy. To be sure, the larger benefits are not likely to be in consumer banking for some time to come, since internet penetration is so limited, even among the well-off, and overall income levels so low.

For businesses, on the other hand, the much greater ease of accomplishing financial transactions through the internet promises important gains. Similar benefits could be available in other services, including insurance processing, government licensing and permits, health care and transportation, among others.
Adding more competition to existing markets promises to be another development contribution, especially in the Indian context. Aside from a few large firms, markets in India tend to be regional and even local, isolated from one another by poor communications and inadequate roads.

The internet can at least partially alleviate these problems, in the process widening sources of information and, in all likelihood, lowering prices. The active interest in several B2B portals, as evidenced by the number of "hits" and associates transactions, provides some evidence that these benefits already are being found.

To be sure, much remains to be achieved in physical infrastructure improvement to assure that gains are truly widespread, but even in the short-run the evidence seems to be that through better information markets are broadened and prices reduced.

Finally, India's efforts vastly to improve connectivity internationally by allowing private parties to offer their own gateway facilities can be seen as belated recognition that the future of global commerce will more and more be intimately dependent on high-speed access to the internet.

The need for improved international connectivity goes well beyond the requirements of internet-enabled services, although for India these are likely to be rapidly expanding areas of business.

The wider reality is that if Indian manufacturing companies are to become more internationally competitive, as they hope to be, ready access to wideband internet services will be of paramount importance. Buyers in the industrialized countries that Indian companies hope to service expect to be in instantaneous and continuous contact with suppliers through the internet, and firms that have inadequate electronic connections already find their possibilities compromised.

The Indian government has recognized this requirement and is moving quickly to improve both international gateways and the country's fiber optic infrastructure, both largely through incentives directed to private sector providers.

As in most countries, computers and IT have been around for a long time in India. But, considered as an industry gaining global recognition and as having an internationally competitive future, IT's much-publicized growth in India has been a much more recent phenomenon.

Software exports, the earliest harbinger of a more widespread IT expansion, began only in 1985, when Texas Instruments established its subsidiary in Bangalore. This move was followed not only by other foreign software companies setting up operations in that city and elsewhere but also by a number of domestically-established software companies.

In more recent years, as the internet has expanded globally, these earlier investments have been followed by an explosion of start-up internet companies and by early efforts of a few well-established manufacturing companies at using the internet and other forms of communication to improve efficiency in their operations.

IT manufacturing also has occurred in India for many years and has included investment by multinational companies, as IBM's early involvement in India suggests.
Today, many foreign producers of computers and peripherals (HP, IBM, Compaq, Canon, etc.) have manufacturing operations in the country, often in joint ventures with Indian companies.

There are in addition a number of wholly Indian companies, exemplified by HCL, a company that formerly had a joint venture with HP but has now taken over the enterprise. A variety of other manufacturers exist, including producers of peripherals, electronic supplies and fiberoptic equipment, among others, including Modi Xerox, Tata Liebert and Wipro as examples.

Manufacturing growth in computers and peripherals has been less than spectacular in India. This is a reflection partly of the thus far limited growth in the domestic end user market and partly of the inability of the volume-limited manufacturers to be competitive. In addition, in recent years unit sales of equipment have grown faster than the dollar figures would indicate, as unit prices have fallen in response to more competitive moves by both domestic manufacturers and multinationals.

Historically, IT manufacturing has been a protected industry in India but, as in other technically-based industries, this policy has been changing. By and large, manufacturing in India has not been internationally competitive. As one consequence, India has been unsuccessful in following the lead of other Asian nations in developing robust export markets for IT equipment or components.

However, as a signatory to the IT Agreement of the World Trade Organization, the government has committed to a zero duty regime by 2003. This, together with a simplification of procedures for transacting business in the sector, could have positive competitive outcomes for the Indian industry, but it remains to be seen who will be the major beneficiaries: local businesses, foreign investors, or some combination of the two.

One possible vehicle for bringing IT manufacturing to the fore, through direct foreign investment as in Singapore or Taiwan (China), has not been successful for a variety of reasons. Foreign investors might have taken the lead in introducing leading edge technologies and manufacturing methods. But, when such investors did attempt to break into the Indian market, their hopes often were dashed.

Disagreements over intellectual property protection was one cause of difficulty, as IBM's early departure illustrates. This development, a result of India's sensitivity to foreign influence, alone discouraged other investors for many years afterwards.

More recently, attempts at joint ventures between Indian firms and outside technology investors, such as that between HP and HCL, often have failed, owing in part to inconsistent objectives among the participants. Foreign investors were interested mostly in producing for local markets, whereas Indian companies wanted eventually to develop export markets as well.

Unlike software development, which can begin small and technically simple, efficient hardware output in IT depends on a minimal scale of operation and continuous access to technological innovations largely derived in industrialized countries. Protection doubtlessly was conceived as a way eventually to develop adequate scale but,
as in most other cases, has resulted only in inefficient producers without easy access to technology.

Moreover, manufacturing is more susceptible to India's familiar inadequacies in high-ways and port facilities which, particularly if exports are a goal, can add materially to delivery costs for goods shipped by methods other than air transportation. The reality in any case is that IT hardware production is as yet an insignificant industry in India. This situation, of course, could change rapidly if the internet and associated computer technology use expands as some anticipate will occur in India.

After all, the same technological talent that produced international competitiveness in some software areas, could be brought to bear on hardware design and production. But, success in hardware will come with considerably more difficulty than in software, where government influence has been minimal and where production has relied almost entirely on highly skilled engineers and technicians working in relatively small groups.

Software Development For now, India's major comparative advantages in the IT sector is software development. Software had its modest beginnings, at least as an internationally competitive sector, with the Texas Instruments investment in Bangalore noted earlier (See also the accompanying box). Today, the business is both large and expanding rapidly, directed almost entirely to overseas clients, and involves both domestic and foreign firms.

Most companies, multinationals and domestic firms alike, today use dedicated satellite links in their contacts with either their home offices or customers. Eventually, however, the speed and cheapness of internet connections may substitute for dedicated means, as international internet connections become better established and security issues are overcome.

Texas Instruments (TI), the first of several multinationals to establish operations in India, began as a wholly-owned operation intended to enable the company to continue software development 24 hours a day and to do so with decreased costs. At the time, engineering salaries in India were only 10 percent of those prevailing in the United States, which translated into software development costs of fifty percent less than in the US.

Today, owing to its early positive experiences, TI assigns not only much more sophisticated applications of software but also has expanded to include the design of integrated circuits. Although still dedicated entirely to TI's internal needs, the much-expanded facility in Bangalore now employs 350 people in a world-class computing and communications environment equal to any in the company's global operations.

Infosys Technologies, Limited, began in 1981 as essentially a two-man applications software shop for large companies. By 1985, sales had already reached $18.1 million. In the 1990s the company added satellite transmission capabilities to ensure reliable and fast connections with clients in the industrialized world. Rapid growth has continued, with fiscal year 2000 sales at $203.4 million, over 90 percent North America and Europe.

Today the company employs around 5,000 software professionals in seventeen development centers located throughout the world, up from just 585 professionals in
1985. In fosys is not the largest of India's dedicated software firms, as both Tata Consultancy and Wipro have greater sales, but in terms of its growth rate, employment expansion and customer base, it is a prototypical Indian applied software company.

The sector's growth has exceeded 50 percent annually in the period shown. Today, software shipments count for over 10 percent of India's total exports and two-thirds of sales for the entire IT sector, including equipment, training and maintenance.

The software market in the United States and Europe is simply orders of magnitude larger than in India. Moreover, potential customers in developed countries have dealt with software consultants for a long time. They tend to have a clear picture of software development costs and are, commensurately, receptive to the cost-saving opportunities Indian companies potentially make available. Professionals in India earn perhaps $12,000 annually, high by Indian standards but one-quarter or less of western salaries for like work. And, according to sources in the United States, the quality level of major Indian software producers can exceed typical standards in the U.S. for the types of programming undertaken.

Fast growth has been paralleled by a rapid expansion in the need for technically trained personnel in the sector. Professional employment for software production, according NASSCOM, reached 280,000 in 1999, up from only 6,800 when Texas Instruments formed its subsidiary. Companies have projected a need for another 140,000 professionals in the next year, far more than the 85,000 becoming available from various Indian educational institutions under the most optimistic projections. McKinsey consultants, who have done a major industry study for NASSCOM, estimate that India could absorb 2 million software engineers in various capacities by 2008. Clearly, the rapid expansion of both private and public institutions for technical education now going on in India is badly needed.

Development Contributions of Software Operations Taken in a narrow context, the software sector cannot be said to have had a major development impact on a country as large and as poor as India. Direct employment in the industry is minuscule in relation to the country's population and is concentrated in only a few metropolitan centers. Most of the sector's output is directed abroad, applications software presumably intended to improve operational efficiencies in US and European, not Indian, companies.

Few ordinary Indians can be said to have been affected one way or another by the software sector's astronomical growth and increasing international prominence. And yet, a case can be made for taking a somewhat broader view of the sector in terms of its potential effects on the larger economy. Some of these impacts are apparent already; others may take somewhat longer to come to fruition.

Aside from India's very large informal sector, software development is probably the only sector to have grown up largely free of inhibiting governmental regulation or interference. In fact, central and state governments have provided such incentives as tax exemptions, investment concessions and setting aside areas for technology parks, among other steps, to encourage the sector's growth.

Nurtured by these incentives, the sector has provided the primary example in India of the growth potentialities that can occur by allowing relatively unfettered
entrepreneurialism to flourish. One consequence has been a commensurate growth in venture capital availability, as investors see the chance of multiplying their investments by a hopefully propitious selection of opportunities. The example set by the software sector has not been lost in government circles, where a similar growth pattern in a number of other high technology areas is a fervent hope, if not quite yet an expectation.

Plans that are afoot include the creation through private companies of a fiberoptic "backbone" linking the nation's cities and towns, a rapid expansion in the availability of fast internet connections, the building of a system of "info-kiosks" to bring internet availability even to rural areas, and an overall improvement in telephone service nationwide.

The hope is for India to become an international leader not only in software development, by now an accomplished fact, but to leapfrog many other developing countries by establishing a world-class telecommunications infrastructure and associated technology capabilities.

Matching these plans to reality, however, will require enormous efforts, including close coordination among and between central and state government units, and very large amounts of private investment capital. To attract the capital, private investors will need to be assured that they can move ahead without inordinate interference from various governmental units. It is not entirely clear, even in high technology sectors, that this freedom will be forthcoming, despite a new telecommunications policy. This is particularly true in areas where, in the past, government has maintained a monopoly, as in local telephone provision. Still, the point to be made here is that the success of the software sector has provided a useful role model for developing further high technology sectors and the message has not been lost even among the entrenched bureaucracies in the various capitals. Long distance voice and data communications, for example, have been opened up to private competitors, following the earlier lead of wireless communications.

The software sector also has been a source of additional export earnings for India, and one not dependent on the country's grossly inadequate rail, road and port network. Software now contributes ten percent of total export earnings, and it is a percentage that is growing rapidly as the industry expands at rates exceeding 50 or 60 percent annually, far higher than other, more traditional export industries.

Yet, although export growth by India's companies has been rapid, the Indian share of software production in global markets is still minuscule. In the year 2000, for example, Indian exports of software to developed country markets represented less than 2 percent of total production in those countries. Clearly, there remains ample opportunity for rapid growth to continue for some time to come.

Although direct employment in the software sector is both small in relative terms and specialized, there are a number of indirect employment effects that can be mentioned. Most obvious are the opportunities in other areas that have opened up as the sector has expanded, including jobs in construction, infrastructure improvements and suppliers. No estimates of such "trickle down" effects exist, but the impacts cannot be
trivial if one judges by the large construction projects supporting the sector's expansion that can be seen around such cities as Bangalore, Mumbai, Hyderabad or New Delhi.

The fact that India is demonstrably competitive internationally in the production of sophisticated software brings other advantages to the country. Indian technological sophistication, though still narrowly defined, has begun to alter international perceptions of the country. Instead of viewing India as a country burdened by decades of heavy-handed government regulation of the economy, foreigners now view the country somewhat more favourably, though not yet as a country where future growth will approximate that of China and several of the Southeast Asian countries.

Whether or not much enhanced foreign direct investment and technological transfer will follow such changes in perception is, of course, decidedly problematical in today's political and economic environment in India. A weak set of national and state governments is plagued by high fiscal deficits and seems unwilling or politically unable to rein in the subsidies that are largely the cause. This weakness, together with a long-standing suspicion that foreign investment represents a continuation of imperialism under a different guise, continues to make life difficult for those investors who have shown recent interest in establishing a greater Indian presence.

Even domestic investors have had difficulty with the crowding out effects of Indian deficits. Add to all of these concerns the paucity of Indian public investment to improve physical infrastructure or general educational standards, and it should come as no surprise that investors still see India as one of the world's more difficult economic environments. The positive example of software obviously has much to overcome. Even so, the software sector's success has at least given greater voice to demands for educational improvements to support not only this sector but also other related sectors.

The immediate impact has been in the expansion of technical colleges and universities as well as more attention to lower-level training institutes. While not helping directly with the more basic problems of illiteracy and inadequate primary and secondary education, such moves certainly do support not only software producers but also other technology-based sectors that have been receiving attention as sources of more general economic growth in India.

Internet use has been relatively slow to evolve in India. This slowness has been characteristic not only of personal use of the internet but includes business use as well. Although there are abundant internet sites devoted to business-to-business (B2B) and business-to-consumer (B2C) transactions (reviewed earlier), few are yet successful in a financial sense.

Moreover, employing the internet for internal corporate transactions is still in its infancy in India, mostly because the underlying communications facilities are as yet not fast enough or sufficiently reliable for most corporate uses. It is fair to say that most data links used within large companies in India are not internet-based, but rather are dedicated leased telephone facilities.

Awareness of internet potentialities as a valuable tool for future business communications is now widespread. In fact, planning for internet use by corporations is advancing rapidly. On a more general scale, the internet is being seen as a necessary
vehicle for improving the country's global prospects and, therefore, essential for contributing to further economic development, a view involving not only business interests but, as importantly, government ministries. As a consequence, several initiatives have been advanced to accelerate India's development of required infrastructure to support wider internet use, particularly by business interests. Several of these initiatives are reviewed briefly below.

Fiberoptic backbone: As noted, one of the major impediments to more advanced uses of the internet, particularly for business use, is the primitive nature of the country's communications system. While telephone quality has been much improved, India has lacked the necessary infrastructure for high-speed data transmission. It has been clear for some time that if such a system is to be built, it will not be done by governmental interests, national or local. In the face of large fiscal deficits in both national and state budgets, public investment has remained low. Nor has there been any expectation that the national telephone monopoly would find the enormous amount of funds to support the creation of country-wide, high-speed data networks.

To break this obvious logjam, permission has been given for private companies to lay optical fiber cable along road and highway rights-of-way at no charge and to allow private right-of-way arrangements with such other entities as power distributors and Indian railways. Moreover, permission has been granted to private parties to enter the long-distance telephone business. One result of such changes has been a number of privately funded efforts to build an interconnected system of fiberoptic cables to link at least the major cities in the country in relatively short order. Problems still remain on so-called "last mile" connections, but the apparent hope is that, for larger businesses, these problems will not be insurmountable and, for residences and small-businesses, ways can be found to link through existing cable television lines or through information kiosks. One example of a company that has entered the fiberoptic cable business is Reliance Industries, a company cited earlier regarding its present and future use of the internet. This firm is committed to developing a national fiberoptic network linking 115 cities which, together, represent about 50 percent of India's GDP. This $3-4 billion set of projects in a short time will permit Reliance to offer long-distance and local telephone service, internet service and high-speed data transmission. Eventually, the company expects to enter the already competitive business of selling back-office services. Reliance is only one of several private companies in India determined to profit from the provision of internet infrastructure.

Wireless services: By 2005, it is estimated that 1.2 billion people worldwide will be able to access the internet using mobile communications. And, for many, mobile connections may well be cheaper and more convenient than fixed lines. For relative latecomers to the cellular telephone explosion, like India, who can initiate digital systems from the start, wireless services may be one method for avoiding some of the disadvantages stemming from inadequate and often expensive dependence on landlines.

Wireless services in India, which have been digital from the beginning, are furnished largely by several large, private providers. The state-owned operator, MSNL, is only now beginning its own services. Although growth in the market for mobile
communications has been disappointing, mostly owing to high costs of both equipment and service, this picture is changing. Costs have been coming down, and the response thus far has been encouraging for providers. Today, there are perhaps 2-3 million subscribers in India, a very low number compared even with other developing countries. Growth, however, has approximated 85 percent over the past year, a figure that obviously is based on the low user base noted above. To provide a comparison, China has 54 million subscribers. Whether or not mobile communication becomes as important as a vehicle to access the Internet remains to be seen in India. Thus far at least, mobile Internet service is yet to be offered.

Fixed telephone service: In a recent enumeration of internet readiness, the Economist Intelligence Unit ranked India fifth of the sixty countries ranked. A major reason for the low rating was India's connectivity ranking, a measure taking into account not only the state of the existing telephone network but also other factors affecting access, such as dial-up costs and literacy rates. In this ranking, India was rated 3 on a scale of 10 in connectivity, along with such other countries as Egypt, China and Pakistan, among others. There are about 2.0 main telephone lines in India per 1,000 inhabitants, a strikingly low number but one that has increased by 60 percent in the past four years. One corollary of low telephone density is that service has not yet reached thousands of villages. And, while major cities are largely serviced, the quality of many lines is poor, largely owing to low quality last-mile connections. While telephone access and quality of service have both been improving rapidly, the system is still often subject to dropped connections, obviously a bane for reliable Internet services.

Provision of telephone communications in India has until quite recently been a province exclusively of government as was the provision of Internet services. Although local land-line service remains in the public domain, both long distance and Internet services have been opened up to other providers. One consequence has been an explosion of Internet service providers (ISPs); in 1999 alone new ISPs established over fifty sites. Interestingly, the potential presence of this new competition apparently motivated Videsh Sanchar Nigam, Limited (VSNL) dramatically to expand its own presence by adding thirty cities to its ISP network and to lower fees. One can anticipate a similar reaction as private long-distance providers gear up to enter aggressively into that market.

As to local services, the market is still reserved to the Department of Telecommunications, except in Mumbai and New Delhi, where Mahangar Telephone Nigam, Limited (MTNL), is sole provider. MTNL also is a public sector company under the Ministry of Communications. Both the DOT and MTNL have been under great pressure from within the government to expand telephone access, and the result has been a quite rapid expansion of services. Still, insofar as the Internet is concerned, competition for the public companies to increase the quality of services and lower prices is likely to come not from within but rather from cable television providers linking with some of the private companies laying down fiberoptic cable across the country. Here a number of constraints unfortunately apply.
*International Linkages:* Until recently, all telecommunications gateways in India were the province only of the government through VSNL. Needless to say, with internet and other users seeking high-speed connections, the demand for international bandwidth already far exceeds the supply. And, demands are increasing rapidly, even with only limited use of the internet thus far. Most Indian websites, particularly those being designed to service non-resident Indians, have attempted to evade this bottleneck by establishing their sites in the United States. But, in the longer run, if the internet is to become the vital communications means hoped for, the gateway constraint must be breached. Recent changes in Indian telecommunications policy have opened up international gateways anywhere in the country to private internet service providers (ISPs).

These new carriers hope to team with foreign providers of undersea cable to rapidly expand international services. Although limited only to internet providers, not voice traffic, and burdened by somewhat excessive security requirements, the new licensing provisions promise to reduce the supply-demand gap in the near future.

There is, of course, much more to business success than access to the internet. Firms exist in an environment that is either supportive of their competitive efforts, not supportive, or something in between. Even with a completed high-speed fiberoptic network connecting most cities and with much improved international gateways, both expected within the next two years, India's economic environment could, at best, be ranked as "something in between." For purposes here, it is unnecessary to run through the litany of well-known difficulties businesses face (continued government interference at both national and state levels, remaining protection, even in the IT sector, inadequate public investment owing to high fiscal deficits, the associated 'crowding out' effects in capital markets, government subsidies, sectors reserved to very small firms, labor laws, etc.).

The fact is that today few firms in India outside the software, textile and chemical industries are truly competitive internationally, especially among locally controlled companies. Even within the IT sector, domestic manufacturers of personal computers, peripherals and other equipment are concerned that opening markets in response to India's joining the WTO could be devastating if and when lessened levels of effective protection are introduced. Adjusting to increased international competition, in other words, could present difficult problems for many Indian companies.

Two negative factors affecting the growth and success of the internet in affecting productivity improvement seem particularly important. The first has been mentioned earlier, poor physical infrastructure for moving products within the country and, for export and imports, through ports.

The inability to ship goods easily and cheaply is a major constraint in building a true national marketplace in India and a constraint that will not easily be overcome. Some efforts have been made to improve ports through private sector initiatives, but much remains to be done both here and, particularly, in highway construction. Given low public investment and the apparent discomfort in relying on private methods of financing infrastructure projects, this constraint is likely to persist for some time to come.
The other factor that ultimately promises to compromise success, certainly as compared with several other Asian nations, is educational achievement. Fewer than 60 percent of Indian children complete the fifth grade, and 45 percent are illiterate. These percentages compare poorly with such competitive countries as Thailand, Indonesia or, especially, the Philippines.

Although lack of literacy has not thus far been a major problem for those parts of the IT sector that have been successful, particularly the software industry, the much wider impacts from the internet that are anticipated across the economy will depend increasingly on availability of trained or trainable workers. In some ways, India appears bifurcated between an educated middle-class, from which the technical schools draw, and the vast majority of the population with little, if any, formal education.

Appendix

Strengths and weaknesses of Asia’s developing economics

Some of Asia’s strategies to rapidly modernize and industrialize its economics, with some of their successes and difficulties. Despite the variations in the development schemes of the individual nations, there are several common themes. In general, industrial development in Asia seems to have been most rapid and most successful when conceived as a long-term effort that requires active governmental involvement to define goals and optimize limited resources, attract industry, encourage continuous technological progress through its various stages, and develop global competitiveness. Despite the stunning economic and technological gains achieved in the past quarter-century by the Asian countries described above, the recent downturn in 1997-98 exposed serious weaknesses in infrastructures and financial systems, as well as overcapacity in industries such as electronics and petrochemicals. Table 1 lists some of the general obstacles to continued development. Table 11 summarizes specific strengths and weaknesses of the NIEs as they relate to continued growth potential.

<table>
<thead>
<tr>
<th>Table 1. Asia’s Obstacles to Continuing Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overcapacity                                   : The region is overbuilding in such manufacturing areas as autos, semiconductors, consumer electronics, and chemical processing.</td>
</tr>
<tr>
<td>Weak Capital Markets                          : Capital is channelled too often to state-owned companies or private conglomerates. Small businesses are starved for funds.</td>
</tr>
<tr>
<td>Rising Costs                                   : Tight labour markets are pushing up wages, while rising affluence is increasing demand for goods and housing.</td>
</tr>
<tr>
<td>Poor Infrastructure                            : Asia needs better highways, pollution control, port facilities, and power plants.</td>
</tr>
<tr>
<td>Widespread Corruption                         : It hampers small businesses and scares off some foreign investors.</td>
</tr>
<tr>
<td>Inadequate Training                            : Some countries have poor elementary schools, while others cannot teach workers to act innovatively.</td>
</tr>
</tbody>
</table>
Mature and Newly Industrializing Asian Economies

A number of uncertainties face the countries of Asia as their economies mature. Japan, the dominant player in Asia and the most advanced, is struggling to solve problems in its real estate markets, financial institutions, and social security and health care systems for its aging population. Japan’s ongoing economic woes despite its hard-won business and technical strengths caution Western and Asian observers to seek a balanced view of Asian economic growth policies.

The major strengths and weaknesses of Asia’s NIEs can be summarized as follows.

Korea

Korea’s chaebols are the strongest global players among Asia’s NIEs. They have benefited from 25 years of government support and protected markets and are now recognized as major global players. Samsung leads in computer memory products and will expand its semiconductor capabilities. Other chaebols also are performing well in international markets, despite the country’s fiscal woes. Korean industry is becoming increasingly autonomous as it moves abroad. Nurturing the growth of smaller companies has had some limited success. An outstanding educational infrastructure and hard-working citizens figure prominently among Korea’s competitive advantages.

On the other hand, Korea faced declining exports and increased labour problems during the downturn. At the same time, it is paying the political price for its heavily regulated, highly politicized, and, by Western standards, corrupt banking system. Korea’s currency and financial crisis resulted in loans worth $55 billion, including $21 billion from the International Monetary Fund (IMF), $10 billion from Japan, and $5 billion from the United States. Many financial companies closed operations. In addition, both security and economic threats from North Korea figure into the equation.

Korea’s chaebols need to restructure and become more focused to meet the growing strength of global competition. Korea’s 12th-ranked chaebol, the Halla group, filed for bankruptcy on December 6, 1997, with $5.3 billion in debt, 20 times the group’s equity. Hyundai had guaranteed as much as $1 billion of Halla’s debts. Daewoo faces financial problems in 1999. By law, the 30 largest chaebols are now required to lower their debt-payment guarantees to 100 percent of their equity.

Taiwan

Taiwan has successfully established a global position in electronics products and key components and has a significant number of firms capable of taking their operations into the global market. Taiwanese firms’ original development strategy has made them leaders in new product introductions. The country’s key component and product strategy ensures that adequate resources will be available for continued development of technological and product capabilities. Taiwan’s economic successes are tempered somewhat by its ambivalent political status vis-à-vis mainland China, both in terms of its relations with other countries (few countries want to alienate China) and in terms of the political and economic aspirations of its people. Solution of this political problem does
not appear to be imminent; meanwhile, however, Taiwan continues to engineer its rapid economic growth, based in no small measure on tapping business opportunities in China. In the long term, China hopes for Taiwan to provide a key technology base for its continued development.

Singapore

Singapore appears to have developed the most comprehensive approach to attracting MNCs and keeping them involved in its economy. The government provides incentives to establish management and operational headquarters in Singapore, actively aids companies in moving factory and marketing operations across the region, and provides incentives for firms to conduct their research activities in Singapore. Singapore is making major investments to establish the most advanced telecommunications system in Asia, while continuing to promote technology-based, value-added manufacturing. Singapore aspires to become the primary financial center for the Asia-Pacific region. Its goal is to become the "intelligent island" in the age of information technology. Some say its "economic miracle" has come from a totally managed society that critics argue is overregulated.

Malaysia

Malaysia achieved very high growth rates until the financial crisis that resulted from heavy foreign investment in high-tech manufacturing. Malaysia's vision still is to be totally developed by 2020. It plans to build the most advanced information technology infrastructure in the world. In spite of its recovering growth rate, the earlier rapid development has caused structural economic issues such as a huge current account deficit.

Malaysia is aggressively pushing to build an independent technological lead in multimedia. This follows a similar approach taken earlier in the automobile industry. By making a strong financial commitment, providing 10-year tax holidays to technological leaders, and developing next-generation infrastructure and products, Malaysia will continue to be an aggressive player in Southeast Asia.

China and Hong Kong

China's strong commitment to upgrading its technology base and infrastructure encourages foreign firms to locate operations close to its 1.2 billion-consumer market. In China today, fewer than 5 percent of the people own a dishwasher, clothes washer, vacuum cleaner, micro-wave oven, or car. There is one telephone for every 25 people, one fax for every 200 people, and one PC for every 400 people. High-tech industrial parks, such as the China-Singapore Suzhou Industrial Park near Shanghai, and special economic zones, such as Shenzhen, are central to China's strategy.

Hong Kong provides direct access to China. China fever abated somewhat in 1997, 1998, and 1999. For example, the total value of new pledged foreign investment contracts dropped 20 to 30 percent in 1996 and 1997. Few people can predict the long-term impact
of Hong Kong's return to China. There are many questions about Hong Kong's ability to continue to provide world-class service under Chinese rule. It has become increasingly expensive to operate in Hong Kong, and the education base there has its own shortcomings. However, Hong Kong is expected to aid China's ability to upgrade its business skills and provide a key channel for raising capital.

Contrasts Between the Asian NIEs

There are sharp contrasts among the United States, Japan, and some of Asia's newly developed economies. Singapore stands out as the country with the highest percentage of population in the workforce. While Japan has the second highest percentage of workers, its aging population is likely to cause a decline in workforce percentage. In education, Korea has the highest percentage of university graduates in the workforce, but still struggles to improve the indigenous innovative capability required to develop advanced technologies. This difficulty has a negative impact on GDP growth.

The countries in Asia are rivals in pursuit of Western business, which has resulted in overcapacity of operating facilities. This situation has provided an opportunity for Western firms to exploit low-cost sources of supplies in Asia, especially in electronics components. Continued development by the United States of close relations with Asian countries provides continuing economic opportunities. As Henry Kissinger has noted, "We are, or could be, closer to each of the contenders in Asia than they are to one another."

Less Developed Asian Economies

Less developed Asian countries such as the Philippines, Thailand, and Indonesia have benefited from the successes and rising wages of their more developed neighbours. They, too, are taking on the challenges of managing rapid industrialization. Those countries that are able to overcome political problems and develop effective strategies will also participate in Asia's future economic expansion. Growth in regional and global demand requires continued expansion of Asia's industrial base. Rising wages and full employment in the NIEs provide continued opportunities for the LDCs of Asia. For example:

- The Philippines has benefited from the regional expansion of firms from more developed countries. However, political unrest and official corruption continue to be problems. Corrective actions seem limited as long as the powerful landed gentry resist moves toward economic reform and discourage foreign investment. While the closing of the Subic Bay and Clark military bases chilled relations with the United States for a time, the infrastructure that remained has served the Philippines well in attracting industry and jump-starting its economic growth. However, the thriving industrial complexes now located at the bases are in serious need of expanded infrastructure.

- Thailand had its financial crisis because of a banking system burdened by a host of bad loans. Pressures on its currency affected the fiscal stability of such neighbouring countries as Malaysia, the Philippines, and Indonesia. At the present, rising wages
are making manufacturing in Thailand less competitive, and it is struggling in its effort to move up the ladder to higher-value products. It is further being constrained by an educational system in need of serious improvement.

- Indonesia still is in a state of political as well as economic crisis, although signs offer hope. As the people's economic and political aspirations continue to rise, Indonesia's leaders are addressing the difficult structural changes demanded by the IMF in return for a $43 billion rescue package to stabilize Indonesia's currency. The country also seriously needs an improved communication system because of its geographical structure. Its 13,500 islands stretch 3,200 miles east to west and 1,100 miles north to south.

- **Vietnam**: The addition of Vietnam to the Association of Southeast Asian Nations (ASEAN) appears to have been the most successful of the ASEAN expansion efforts to date. Vietnam is at the center of the most dynamic economic region in Asia. It is fast developing a market economy driven primarily by foreign investments exploiting its low wage rates. Vietnam is a country still debilitated by the ravages of war, with an almost nonexistent communications and transportation infrastructure. Its GDP per capita is about one-quarter that of Indonesia or the Philippines. The situation should, however, quickly improve because of major investments from Hong Kong, Taiwan, and Australia.

- **Cambodia, Laos, and Myanmar**: Although ASEAN has been a stabilizing and supportive force for areawide economic development, it has yet to have much impact on the least developed countries of the region. The concern for human rights in both Cambodia and Myanmar is politically distracting. At this time, prospects for development in these countries are limited. Myanmar may have some advantage because of its location and the completion of the China highway that will link South China to Thailand through the northeast corner of Myanmar. Indonesia and Thailand are expected to see shrinking economies in 1998 because of serious financial problems and the collapse of regional markets. However, 1999 forecasts put most Asian economies back on the road toward rapid growth. Even if the forecasts are too optimistic in the short term, many observers already see signs of recovery and restructuring in most countries that bode well for Asia's long-term economic recovery.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>8.8</td>
<td>7.8</td>
<td>6.6</td>
<td>7.0</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>5.3</td>
<td>-5.1</td>
<td>-1.3</td>
<td>3.1</td>
</tr>
<tr>
<td>Taiwan</td>
<td>6.8</td>
<td>4.9</td>
<td>3.9</td>
<td>4.8</td>
</tr>
<tr>
<td>Indonesia</td>
<td>4.6</td>
<td>-13.7</td>
<td>-4.0</td>
<td>2.5</td>
</tr>
<tr>
<td>Malaysia</td>
<td>7.7</td>
<td>-6.8</td>
<td>0.9</td>
<td>2.0</td>
</tr>
<tr>
<td>Philippines</td>
<td>5.2</td>
<td>-0.5</td>
<td>2.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Singapore</td>
<td>8.0</td>
<td>1.5</td>
<td>0.5</td>
<td>4.2</td>
</tr>
<tr>
<td>Thailand</td>
<td>-0.4</td>
<td>-8.0</td>
<td>1.0</td>
<td>3.0</td>
</tr>
<tr>
<td>Japan</td>
<td>1.4</td>
<td>-2.8</td>
<td>-1.4</td>
<td>0.3</td>
</tr>
<tr>
<td>Republic of Korea</td>
<td>5.5</td>
<td>-5.5</td>
<td>2.0</td>
<td>4.6</td>
</tr>
</tbody>
</table>
Asian Model for Development

The Asian experience shows that there is no perfect set of actions that guarantees economic development without risks and setbacks. Governments must be flexible in dealing with the ever-changing competitive terrain by adjusting development strategies as conditions change and the relative strengths of competing countries grow. The lessons that can be learned from the Asian experience are worth noting. These lessons revolve around the strategies and trends in low-cost labour, infrastructure investment, worker skills, support for technology, and the business climate. They also reflect the growing impact of globalization and regional cooperation.

Competitive Strategies and Trends

Low-cost labour

The search for low-cost labour continues to be the primary driver of economic development across Asia and other developing areas of the world. It dictates constant changes and updates in strategies to attract and retain investment and increase standards of living. As development occurs and labour costs increase, there is a corresponding growth in the purchasing power of consumers for products and services that in turn creates a significant market opportunity. The growth in the purchasing power of Asia's population of 3 billion, especially its growing middle class, during the early and mid-1990s created a significant market opportunity. Domestic and foreign corporations invested in Asia in hopes of capturing an early market position.

Asian countries with rising labour costs turned to technology-led economic growth strategies as a way to continue to increase their standards of living as some types of investment inevitably began to move to lower-cost producers. Singapore has developed its own strategy to build and manage "world-class" industrial parks in Vietnam, China, Indonesia, and India to benefit from the move by helping firms expand low-cost operations across Asia. The impact of the economic slowdown on this scenario is mixed. Labour costs in some Asian countries have fallen, increasing their attraction for some types of investment. On the other hand, the purchasing power of much of Asia's middle class is stagnant or in some cases declining, negatively affecting market opportunity.

Infrastructure investment

Demand for all forms of infrastructure investments drives corporate and country strategies and is an important part of the Asian development model. Basic industrial infrastructure is a competitive advantage in attracting business to a country. Before the economic slowdown, infrastructure investment began to allow Asian economic growth to expand from a limited number of urban areas to broader geographical areas.
As Andrew Tranzer noted in 1996, "East Asia is now capturing over 60 percent of the world's private capital flows to developing countries, an inflow worth $100 billion in fresh capital every year—not to mention managerial and technical expertise (East Asia central banks collectively hold more than $600 billion of foreign reserves)." Despite the setbacks of 1997-98, Asian countries still are investing in building the infrastructures needed by tomorrow's information societies. It is expected that the Asia-Pacific region (excluding Japan) will spend a trillion dollars on infrastructure in the next 10 years. Singapore's IT 2000 strategy calls for the creation of a national information network with all homes, schools, businesses and government agencies interconnected in an electronic grid. China plans to spend more than $40 billion installing the equivalent of a Bell Canada-size network each year until 2000. China's government also has established its "Golden" projects to boost its communications systems, record-keeping, commercial transactions, and so on into the information age. And the Philippines is taking advantage of military bases vacated by the United States.

Where extending advanced infrastructures across an entire economy is too costly and complex to accomplish in the short term, science and technology "parks" have allowed countries to rapidly build state-of-the-art mini-economies within a geographically restricted area. Reduced tax rates, advanced infrastructure, and policies such as one-stop regulatory permitting give Asia's high-tech industrial parks an advantage in attracting or keeping global competitors.

**Worker Skills**

Ability to compete globally is not a function of national size, as Malaysia, Korea, Singapore, Taiwan, and Hong Kong demonstrate. There are many reasons for the success of their companies, but it is becoming increasingly obvious as their labour costs have risen that their primary competitive advantage is their growing knowledge base and number of skilled workers.

Today every country can easily tap into global technology, acquire advanced manufacturing practices, adopt the best financial techniques, acquire investment money from international venture capitalists, and employ knowledgeable workers from around the world. In today's globally competitive environment, the best jobs go where the most qualified workers are available. Conversely, advanced education in science and technology results in the highest-paying jobs and the most benefit to the economy. Countries with inadequately trained workers tend to find themselves locked into low-paying, low-value-added assembly-type jobs and industries. Lester Thurow expressed it well when he said, "The skills of the workforce are going to be the key competitive weapon in the 21st century" in Head to Head: The Coming Economic Battle Among Japan, Europe, and America.

**Support for Technology**

Asia's success in applying advanced technology resulted in part from substantial investment and commitment to specific emerging industries and critical supporting technologies. In the early stages of development, Korean government-funded research
institutes provided an important mechanism in building the research strength of its chaebols. ITRI in Taiwan has been responsible for supporting the electronics industry and entering the semiconductor industry. In Singapore, government research institutes target industries and subsidize R&D for foreign firms willing to conduct local research and build a local technology base. In addition, Singapore's EDB directly subsidizes high-tech development programs. Malaysia's "multimedia corridor" called "Cyberjaya" provides various types of support for companies locating in it, including a new multimedia university.

Development of multitechnology/multimedia products often also requires strategic alliances for more rapid and efficient development, since internal development may be too slow in getting to market in a timely fashion. Taiwan's entry into the semiconductor business has included every major player in the world. Asian NIEs have effectively targeted growth industries and related technologies for development. Many of the targeted areas are in electronics, multimedia, and information fields. Taiwan is only one example of the practice of targeting. Its Critical Components strategy targeted 48 critical components and 24 critical products to provide global leadership in 10 emerging industries. The Taiwanese government has provided R&D, prototyping, and ramp-up incentives and support to semiconductor and LCD technologies.

As a result of this kind of targeting, Taiwan, as well as the other NIEs addressed in this study, is achieving first-rate competitiveness in global electronics, multimedia, telecommunications, and information markets, successfully challenging traditional leaders. Hong Kong's Vtech has over 50 percent of the world's electronic learning aids market. Taiwan's Acer ranks among the top 10 PC companies in the world, competing directly with U.S. and Japanese leaders. In key computer components, Singapore's Aztech Technology controls nearly 90 percent of the world's sound card market. Korea's Samsung is the world leader in DRAM technology.

Business Climate

The growing ease of doing business in Asia has facilitated economic growth. Singapore's "one-stop shopping" strategy has been very attractive to MNCs. Hong Kong's high-quality services and management infrastructures provide a critical bridge for companies seeking to do business in China's industrial parks and special economic zones. Similar strategies are being used across Asia to allow efficient local administration of industrial development policies. Offering attractive investment incentives is an important component of Asian industrial development strategies. Investment incentives offered by Asian NIEs include tax holidays, exemptions, and reductions; another factor that draws investors is improved access to new markets. In terms of sheer size of investments, China, despite large declines in the past three years, has been the Asian country most successful recently at attracting foreign investment, about a third of all manufacturing-related investments in developing nations.
Environment

Sustained and sustainable economic growth is also linked to the ability to integrate environmental and productivity decisions. A clean environment, particularly as it affects production of high-technology products, is increasingly a competitive issue in Asia. In Beijing, NEC had to isolate and air condition its entire factory to keep pollution from affecting the quality of its IC production.

Globalization and Cooperation

The Asian experience suggests that to improve competitiveness, local high-technology companies can and must rapidly begin to expand operations beyond the national economy, since economies of size and scale demand their involvement in as many markets as possible. Localization of business activities must then focus on marketing and distribution. The Korean experience also indicates that as companies go global, they must intensify efforts to develop next-generation technologies. Research centers must be established not only at home but also in major technical centers abroad, as Japan and Korea have done in the United States and elsewhere.

Regional cooperation is an increasingly important element in competitive Asian development practices. With eight cooperative growth triangles, superior technologies and development practices are moving rapidly throughout the Asian region. For example, the Southern China Growth Triangle unites Taiwanese technology and management skills with Hong Kong’s distribution and service skills and Southern China’s low-cost production expertise.

Singapore and Malaysia provide capital and leadership in the development of the Southeast Asian region through ASEAN. ASEAN is now sponsoring the Association of Indian Ocean Rim Countries and the South Asia Association for Regional Cooperation, which involves India, Bangladesh, Nepal, Sri Lanka, and Pakistan.

Project-based cooperation also exists. For example, in February 1997, a submarine optical fiber network was completed that links nine Asian nations (Japan, Korea, Taiwan, Hong Kong, the Philippines, Thailand, Malaysia, Singapore, and Indonesia)—a length of over 12,000 kilometers. The $650 million project, built by a consortium of companies from the United States, Japan, France, and Great Britain, began in 1994 as part of an effort to build an Asia-Pacific Information Infrastructure. Another area in which cooperation is evident is the financial support extended by the healthier Asian economies to those experiencing fiscal difficulties at this time.

Obstacles to Continued Growth

Despite aggressive strategies to upgrade technologies and attain global competitiveness, Asian countries face various obstacles to sustaining their economic growth:

- Overcapacity and strong price competition have resulted from heavy investment in a small range of industries including automobiles, semiconductors, consumer electronics, and chemical processing. In addition, the Asian economic slowdown has
cut recent forecasts of automobile sales in 2000 by nearly half for Thailand, Indonesia, Malaysia and the Philippines.

- Many local firms are ill prepared as they restructure to meet World Trade Organization membership requirements for local market access by global competitors. The IMF also is committed to opening the Asian financial system to global competition, with Japanese deregulation that began in 1998.

- The scarcity of local capital makes it difficult for developing nations to build infrastructures or properly capitalize their own local firms. Short-term foreign loans placed countries like Thailand in serious financial jeopardy, since signs of economic slowdown cause foreign capital to exit rapidly and generate pressures for currency devaluation. Small entrepreneurial firms cannot grow without access to such funds.

- There is a shortage of talent needed for advanced stages of development. Weak school systems and a lack of creative thinking are exposed as labour costs rise and higher-level skills are needed. Simple lack of experience operating in an international milieu increases risks.

- As some of the experiences of Japan and Korea have demonstrated, heavy regulation and administrative guidance directed at protecting local markets can prove to be dysfunctional to industry restructuring in the face of increased global competition and rapid technological and market change. Protective government regulations are difficult to dismantle, but if not dismantled can ultimately impede growth by slowing market responsiveness. As product life cycles fall from years to months, bureaucratic interventions or management delays can rapidly cause local firms to lose competitive advantage.

- Many Asian business relationships and activities (1) are illegal under the 1977 U.S. Foreign Corrupt Practices Act, (2) inhibit competition, restructuring, and rationalization of growing Asian economies, or (3) impede working relationships with potentially helpful multinational corporations and organizations such as the IMF. While seeking to stabilize the Asian economies, the IMF has a longer-term objective to reduce the incidence of political corruption. On December 17, 1997, 34 OECD nations signed an antibribery treaty that will make payments to government officials a criminal act following the U.S. Foreign Corrupt Practices Act. Such pressures to change traditional or accepted business practices can greatly stress rapidly developing economies. Despite these obstacles, overall, Asian countries are rapidly adopting proven strategies for economic development. As more and more nations commit to developing high-tech industries, national and corporate competition is increasing in both emerging and established industries. The focus in India, China, and the Philippines on software, challenging U.S. domination of this industry, is an example of the constantly changing competitive landscape.

While the aftermath of the financial and monetary crisis is expected to continue to slow Asia's growth rate in the next two to three years, economic expansion is not expected to stop; in fact, most Asian countries are counting on technology development to help them grow out of their present difficulties.

88
Considerations for U.S. Policymakers

The recent stability in the U.S. economy has generated steady growth and provides full employment. The breadth and depth of the U.S. technology base continues to be second to none. Long-term competitiveness, however, relies on education, infrastructure, innovation, and initiatives that encourage both domestic operations and global leadership. As the U.S. market diminishes in relative global importance, it must sustain its innovative and technical capabilities in order to support continued economic stability and growth. Asian (and other) nations are challenging U.S. leadership in emerging high-technology industries: as Japan has successfully targeted steel, automobiles, and semiconductors, Taiwan has successfully targeted computer-related technologies, and Malaysia is targeting multimedia technologies. Such challenges cannot be overlooked. As nations compete for leadership in advanced technologies, the United States must ensure that its "crown jewels" are not lost to foreign competition. Therefore, it is essential for the United States as well as less developed countries aspiring to higher standards of living to be mindful of the lessons of the Asian model of development. Asian global strategies are addressing five fields that all countries should consider crucial to success in high-technology industries:

1. Educating and effectively utilizing knowledge workers, creating new knowledge, and protecting related intellectual property.

2. Increasing their access to global markets to ensure competitive economies of scale and recognition of evolving product and market standards.

3. Developing advanced infrastructures to attract and support global technology leaders and to facilitate development of local firms that can compete in the global marketplace.

4. Attracting and investing the capital needed to build essential infrastructures and to develop technologies and capacity for emerging growth industries.

5. Using legislative and fiscal incentives to induce high-technology companies to locate and participate in local R&D and value-added operations.

There also are market opportunities to consider. Since many countries lack the technology base needed to enter emerging businesses by themselves, strategic alliances offer U.S. firms opportunities to participate in the establishment of future industries in many locales. Careful management of international market alliances will be imperative to future U.S. economic success, as will open markets, rapid responses to market and technological change, and continued cost competitiveness. Like Japan, the Asian newly industrializing economies' growing technological base offers a source of a new and unique R&D. While the United States finds itself in a comfortable economic position today, it can expect growth in global competition supported by aggressive industrial development strategies from newly industrializing countries in Asia and elsewhere. The new competitive paradigm will demand continued infrastructure and technology development, global market access, and creative new responses to both competitive and cooperative challenges from the Asian countries of the Pacific Rim.