JALA International, Inc.

Electronic Commerce and New Ways of Working

Penetration, Practice and Future Development in the USA and Around the World

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30 August 1999

Contents

Executive Summary

This report covers the current status and likely future developments of electronic commerce (e-commerce) and telework trends in the United States. Associated with the report is a set of five case studies of firms involved in e-commerce and another five organizations that have telework programs.

A supplementary report, appended to the end of the main report, discusses the same topics in 10 additional countries: Argentina, Australia, Brazil, China, India, Indonesia, Malaysia, the Philippines, Singapore and Thailand.

Electronic commerce

The United States is currently the world's largest developer of both e-commerce and telework programs, both of which depend increasingly on the Internet as a primary communications link. There are two main forms of e-commerce: business-to-business and business-to-consumer. The business-to-business variety was the original form, and remains the dominant one. E-commerce began in the US as a means for reducing the costs and improving the effectiveness of transactions between large manufacturing companies and their suppliers. The primary objectives of e-commerce are to:

- Lower purchasing costs;
- Rationalize inventories;
- Reduce cycle times;
- Make customer service more effective;
- Decrease sales and marketing costs;
- Expand markets; and
- Rationalize distribution channels.

Each of these objectives is treated in the report, with emphasis on the ways in which information technology can enhance traditional business operations and support entirely new forms of commerce; forms that would be impossible without the technologies. The report summarizes the current status of e-commerce within the United States and includes some excerpts from specific case studies.

Also covered are the ways in which e-commerce is likely to develop in the United States, including discussions on the new Internet-only startup companies, the development of complex networks of manufacturers, suppliers and consumers, the competition between the new companies and established firms in their industries, and the new types of businesses that may be invented. That discussion is followed by an analysis of the barriers and constraints to further growth and the issues affecting future developments.

New ways to work

The section on new ways to work begins with some definitions of telework and telecommuting and a description of the new organizational forms, some familiar, others not, that may result from the extensive use of telework. This is followed by a summary history of the development of telework in the United States, beginning with the first demonstration project in 1973.

Like e-commerce, the rise of telework is the natural consequence of a number of other general trends in the world. In the case of telework, these trends are the growth of the information economy; the rapid pace of development of telecommunications and information technology, the pressures of increasing urban traffic congestion, and intensifying economic competition at all levels of the economy. Each of these factors is discussed, together with a summary of who is using telework in the US: almost every large company and government agency and many smaller ones, with more than 21 million teleworkers in all. The primary cultural, technology, legal and regulatory barriers are explored, followed by a forecast of the developments over the next few years—almost 30 million US teleworkers by the end of 2003.

Diffusion enhancement measures and prospects

The report concludes with a section on the policy issues related to these two topics, beginning with a description of the relevant policy background at national, state, regional, and local levels. Our conclusions from the study are listed, together with policy steps that should or, in some cases, should not be taken if e-commerce and telework are to expand.

Electronic Commerce

"*In five years time, says Andy Grove, the chairman of Intel, all companies will be Internet companies, or they won't be companies at all. Just another example of the arrogance and exaggeration the information-technology industry is notorious for? Yes, in the sense that Mr. Grove is as keen as the next chip maker to scare customers into buying his products. No, in the sense that, allowing for a little artistic license, he is probably right.*"[1]

Forms of e-commerce

Electronic commerce, also known as e-commerce, is constantly and rapidly evolving in the United States, both in the varieties of forms of commerce and in the numbers and types of participants in the process. Basically, electronic commerce is simply the conversion of commercial processes to electronic forms that otherwise would be accomplished by means of paper-based or face-to-face transactions. As is the case with most technological innovation, electronic commerce first appeared as a means for supplanting traditional forms of transactions such as consumer banking and business-to-business goods ordering. Now, however, electronic commerce is evolving into the new forms of transactions that were not easily practicable in earlier years.

For the purposes of this study, there are two basic forms of electronic commerce: business to business; and business to consumer commerce. As the titles imply, business to business electronic commerce involves the transactions that occurred between businesses, such as parts ordering, catalog display, inventory checking, invoicing, and shipment tracking. Business to consumer electronic commerce is concerned with the retail process: direct sales of almost any product or service from businesses to the individual consumers. In the following sections we consider the current status, the environment, and prospects for electronic commerce in the USA.

Please note that, because electronic commerce is a new phenomenon and is growing rapidly, it is very difficult to find reliable nation-wide statistics on either status or growth rates. Furthermore, no direct surveys were made for this project, so we have relied on a variety of secondary sources for the information presented here.

History and the current situation in the USA

Business to business

Although the first commercial computers were built in United States in the 1950s, commercial applications of those and other computers did not begin until the 1960s. One of the first of these was a system called the ERMA (Electronic Recording Machine— Accounting) which was

[1] *The Economist*, Vol. 351, No. 8125, 26 June 1999, p. 5 of the special section: Business and the Internet.

first used by the Bank of America to process checks. From that beginning, the commercial uses of computers quickly spread to a variety of companies and a number of industries. The initial applications typically were to keep accounting ledgers, process payrolls, create management reports, and schedule production operations.

As commercial experience with computers increased, and as the computers became more powerful and more interconnected by telecommunications networks, businesses began to use inter-computer communications to send and receive purchase orders, invoices, and shipping instructions and notifications electronically. A primary barrier to this form of electronic interchange was the fact that most businesses and their suppliers had incompatible forms for these processes. To address this problem a new method for standardizing these operations was developed, known as EDI (Electronic Data Interchange). EDI is a standard for compiling and transmitting information between companies. In the 1970s and 1980s, EDI was used primarily over private telecommunications networks. Often these networks, known as value added networks, used either private facilities or leased facilities from large common carriers.

However, the cost of installing and maintaining EDI and value added networks generally is too high to be affordable by small and mid-sized enterprises (SMEs). Furthermore, EDI as used in the US has a set of standard formats that differ enough from European EDI standards to require additional translator software—and additional costs for firms using EDI for international trade. Therefore, although large businesses could use EDI to communicate among themselves, they often had trouble communicating with their smaller suppliers. The SMEs tended to confine their communications to fax, mail, and telephone because of the cost factors. Hence, the promise of EDI tended to be unrealized.

With the appearance of the Internet, and particularly with the development of the World Wide Web in 1993, an entirely new means of inter-organizational communication became commercially practicable. By the mid 1990s low-cost Internet access became available to companies of all sizes within the United States, typically at a monthly rate of USD20 or less per Internet account. Still, many companies were reluctant to use the Internet for other than generalized marketing and advertising because of concerns about security. In particular, the Internet's reputation for openness — which was one of its primary features for rapid expansion — caused great uneasiness on the part of those with responsibility for guarding company secrets, or even on the part of individuals concerned about sending credit card information over the Internet.

Table 1: US Companies with electronic commerce (Source: University of Texas' Center for Research in Electronic Commerce, JALA International, Inc. estimates)

	1995	1996	1997	1998
Number of companies	200	760	2900	11000

As a consequence, the development of improved security measures has been a primary focus of Internet software companies since the early 1990s. Very sophisticated measures for protecting the security of all the participants in commercial transactions have been developed. In fact, the excellence of the security measures has become a concern for the US federal agencies whose mission is to protect government security and to apprehend criminals. This has caused continuing strife between the Internet industry and the US government, especially because the government prohibits export of high-quality encryption software (even though it is readily available outside the US). A new standard, the AES , (Advanced Encryption Standard) may help resolve this issue when it becomes effective in 2001.

Nevertheless, electronic commerce is the most rapidly growing segment of the US industry. As Table 1 shows, the number of firms using some form of electronic commerce has grown from about 200 in 1995 to roughly 11,000 by 1999.

There are a number of reasons why companies become involved with electronic commerce. The following is a brief overview of each of these reasons.

Lower purchasing costs

The process of buying materials or services for a corporation can often be long and complex. The company must find suppliers who can provide the necessary services, parts, components, or subsystems and can also deliver the products within the necessary schedule and at the proper cost. Often it is also necessary to provide detailed specifications to the suppliers, together with the desired acceptance and quality control procedures. Once the initial product has been approved, the buyer transmits a purchase order to the supplier for a specific quantity and delivery date of the product. The supplier then confirms receipt of the purchase order and verifies that the delivery can be met. When the product is ultimately shipped, the supplier sends shipping information and an invoice to the buyer. The buyer's accounting department matches the invoice with a purchase order and notifications of receipt and acceptance and pays the invoice.

The above description is for a standard, uncomplicated purchasing process. If changes are made by either party between initial order and final receipt of goods or services, this scenario can become much more complicated. Even in the simplest case, the purchasing process involves a significant amount of paperwork. In some industries, this can amount to as much as 10 to 20 percent of the purchasing costs.

Because the purchasing cost can be such a substantial fraction of overall costs, companies have tended in the past to restrict their purchases to a small number of suppliers and to aggregate purchased items so as to minimize the number of purchase orders. This can result in inefficiencies when there may be other suppliers that can provide equivalent products or services at lower cost, although they may have a smaller array of products available. Large companies have been using EDI and private networks to reduce these administrative costs in the purchasing process. Although estimates vary, more than 10,000 businesses in the US used EDI in 1998 for transactions totaling between USD150 million and USD500 million annually, depending on how one measures the extent of EDI use.[2] Average procurement cost savings for companies using EDI range from 5 percent to 10 percent.[3] Increased use of the Internet has reduced the telecommunications costs for e-commerce participants, but the software and maintenance costs of EDI may still be prohibitive for many small companies.

<digression>A possible solution to that problem may be inherent in the adoption of eXtensible Markup Language (XML) as a medium of exchange on the Internet. Unlike HyperText Markup Language (HTML), which only governs the style and formatting of text and graphics on Web pages, XML governs the content of the pages. For example, HTML can only control the manner in which the phrase “10mm diameter by 2 meter length steel bars for 10 euros” appears on the page. A firm searching the Internet for the price of steel bars would have to know that exact phrase in order to have a chance of finding just the few suppliers who offer the product at that

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[2] Input, an e-commerce market research firm, estimates that USD162 million in transaction were carried out in 1997, entirely facilitated by EDI. Other estimates, including transactions that were partially EDI-facilitated, go as high as USD700 million.

[3] Lundstrom, Scott. “Internet Enabled Indirect Procurement: A Low Risk/High return Project?” *The Report on Supply Chain Management*. Advanced Manufacturing Research, Inc. July 1997.

price. A more general search, using combinations of the words could produce thousands of hits, materially increasing the cost of locating the desired supplier.

With XML, however, the phrase is encoded not by typeface and paragraph format but by specific indicators showing product type, size, and cost. Thus, the prospective purchaser need only search for items such as steel bars that are two meters long and 10 mm in diameter. An XML-enabled search engine would quickly locate all suppliers of 2 meter long, 10 mm diameter steel bars and note the prices for each supplier; a much more efficient process. Still, like EDI, XML needs to have a specific set of instructions that attach meaning to each of these descriptors. While EDI has several years of history in development of industry-specific descriptors, XML style sheet equivalents (Document Type Definitions) are still in their infancy.</digression>

Many major US corporations, such as Ford, General Electric, and others have reported significant gains in their purchasing responsiveness, improved service, and reduced labor and material costs as a result of their using e-commerce for their purchasing operations. An important adjunct to the purchasing process is the development of computer databases that can handle graphic as well as text material. This allows a company, for example, to include the blueprints and drawings automatically as standard items in the electronic transmission or receipt of purchase orders. Before the advent of e-commerce most of these components in the purchasing process had to be handled manually, generally involving the transmission of several pieces of paper from or to several different locations before the purchase order was complete. Not only has the complexity of the process been reduced, but the elapsed time between initiation of an order and award of contract has been significantly shortened.

In an example quoted in a federal document on electronic commerce, eight divisions of General Electric use an online procurement system for some or all of their procurement. In 1997 the company bought more than one billion USD worth of goods and supplies via the Internet. By the year 2000 General Electric plans to have all of its business units purchasing its non-production and maintenance, repair, and operations materials via the Internet, for a total amount of USD5 billion. The company estimated that annual savings could approach USD250 million.

Inventory rationalization

In addition to simplifying and streamlining the procurement process, electronic commerce facilitates the development of just-in-time inventory maintenance. At the input end of inventory management, the use of electronic commerce allows much finer prediction of the arrival times of orders, goods, and supplies. When inventory control is automated it also allows the maintenance of just enough stock in inventory to meet the demands of the production, given the known delays in stock replenishment. Without these controls, companies tend to have higher inventories than are absolutely necessary. This can be quite expensive. Typically in the early 1990s inventory turnover rates of four to six times annually were fairly common. As a counter example, showing the impact of efficient electronic commerce operations, Dell Computer Company turns over its inventory 60 times annually. Since this inventory must be housed in a building and generally must be paid for within a fairly short time after delivery, each day that an item stays in inventory imposes both rental and interest costs on the company. Ideally then, inventory items should arrive at the loading dock just instants before they are snatched up for use on the production line. Although that is impossible in practice, companies such as Dell are closely approaching that ideal.

Lower cycle times

The cycle time is the time it takes to build a product. Since some of the costs of production of anything relate to fixed cost items, such as rent and equipment depreciation, the fraction of those costs associated with a particular product depends on how long it takes to produce the product. The more quickly the item is produced, the lower the portion of the fixed costs that are reflected in its price. The result can be either a lower price to the consumer, higher profit to the producer, or some combination of the two.

Because electronic commerce enables greater efficiency in coordination of the entire production process, it also acts to reduce cycle time. To cite the case of Dell Computer Company once more, an average cycle time for production of a personal computer in mid-1999 was about four days; for many computer companies the equivalent cycle time is a week or more.

The cycle time problem is possibly more dramatically shown in the automobile industry. Japanese companies developed substantially shorter cycle times in the 1980s than did American automobile manufacturers. This represented a serious competitive challenge to the US auto industry. A major reason for the relative slowness of the Americans was that the organizational structures of the companies were fairly rigid and communication between company and divisions, as well as the companies and their external partners, was slow and often difficult.

As electronic links were established between company divisions and their partners a large number of delays were significantly reduced or eliminated. Because the divisions could more easily coordinate drawings and specifications, and the companies could exchange purchase orders, invoices, and shipping instructions more easily, not only production but design times were shortened. As computer-aided design and computer-aided manufacturing processes were integrated into the overall system, the time it took to develop and produce a new vehicle in the US decreased from four to six years in the early 1980s to about 30 months in the mid-1990s.

More effective customer service

One of the most important qualities provided by electronic commerce is the potential for greater speed and higher efficiency of customer service. When product descriptions, technical support, and order status information are all available online, customers can easily track their product orders and more rapidly gain access to routine technical support information. This not only saves money for the supplier by freeing up its customer support staff, thereby allowing them to address more complicated technical support issues, but it also creates more satisfied (and more likely to return) customers.

Furthermore, by tracking customer inquiries, suppliers can build databases about the frequency and severity of technical problems. This allows the development of more sophisticated technical support data for automated access by customers. This positive feedback acts to continually improve the quality of the automated support provided. In addition, the feedback increases with the likelihood that technical problems with products will be recognized and fixed at an early date.

Since one of the main advantages of electronic commerce between businesses is the increased ability to plan parts and component arrival times for manufacturing, for example, the ability to track shipments via the Internet also is becoming very important. As an example, Federal Express has gone from dial-up access to its own database to an Internet based tracking system so that its customers can constantly track shipments worldwide.

Although it is difficult to track the cost savings in great detail, the overall effect can certainly be measured in terms of cost savings from order tracking, software downloads and online technical

support. Dell Computer Company estimates that its saves many million dollars a year as a result of having basic customer service and technical support available 24 hours a day, seven days a week on the Internet.

Lower sales and marketing costs

In the traditional model sales are made by sales representatives visiting customers or contacting them by telephone. Thus, every customer contact requires some amount of time to be spent on the part of the salesperson. Where face-to-face visits to the customers site are required, the time required can be significant, thereby generally limiting site visits to occasions where fairly large orders are in prospect. As the number of customers increases and the diversity of products offered grows, the sales force must necessarily increase in size. This is the case even for organizations that use direct marketing; the telephone sales force still needs to grow to match the customer base.

In the electronic commerce situation, particularly where the commerce occurs over the Internet, this traditional model changes substantially. Much of the sales information is housed in a computer server rather than in a local store, distribution center, or salesperson. Access to the information is available at any time of the day, any day of the week, and from any country in the world. The only limitations to the reach of this new marketing model are the capacity of the servers to handle the inquiry traffic and the visibility/accessibility of the site on the Internet.

If the Internet server also includes an automated order entry capability (such as standardized forms or "electronic shopping carts") then another link in the order processing chain is eliminated. That is, the order entry task is performed by the customer rather than by the supplier's clerical staff or sales representatives. In those cases where even order entry is automated, such as in inventory control systems, even the customer end of the process can be eliminated, at least in terms of human intervention. This gives customer representatives more time to spend building customer relationships rather than wasting time in menial administrative tasks. Furthermore, online catalogs can provide considerably more information and be more current than their paper-based counterparts. Even in cases where sales representatives travel to visit clients at their facilities, they can have absolutely current information about products, inventories, and order status through the use of such technologies as laptop computers combined with cellular modems.

As an example, although Dell Computer Company has a number of "standard" designs, each computer assembled may be customized by the customer. Recently, Dell has developed sets of standard packages for each of its large customers through its "Premier Pages™" program. This program provides paperless purchase orders, approved product configurations, global pricing, real-time order tracking, purchasing history, and information on Dell's account team for each major customer. Dell also provides an online "virtual account executive" for its SME customers.

As is the case with improved customer service, the use of a centralized database connecting both the marketing and service operations, provides the company with detailed information about potential market development trends. This information can be relayed to design teams, helping them to better anticipate applications for their own developing technologies or that being developed by their suppliers.

Market expansion

The Internet is essentially always available everywhere. A company with a website similarly can be open for business 24 hours a day, seven days a week, even though there may be large periods of time in which the humans in the company are asleep or otherwise not attending to business. This produces two major changes in the traditional business model even for small firms. First, the firm is no longer restricted to customers who are physically reachable by its sales staff; even one-or two-person firms can have a global presence. Second, time of day is also no longer a consideration. Customers can obtain information about the firm's products, get technical support, and place and track orders to the extent that the company website is automated.

This can give significant advantages to small firms and firms with specialized products. The firm with specialized products, or one operating in a fragmented market, can have a much better chance of reaching its dispersed customers — or even finding potential customers it may not have known it had — than it could in the more traditional market model. Quite often, market plans are developed on the basis of some preconceived idea of who the customers are. Also quite often, these plans may omit potential customers for reasons of assumed inaccessibility or simply because the planners did not realize that a certain class of customers would be interested in their product.

For example, in the early days of its Internet development, half of the small businesses who purchased computers and related products from Dell's website had never purchased from Dell before. One out of four of these customers said that they would not have made the purchase were it not for the website. Furthermore, the value of these new customers' purchases tended to be higher than those of Dell's typical customers.

Channel rationalization: the infomediaries

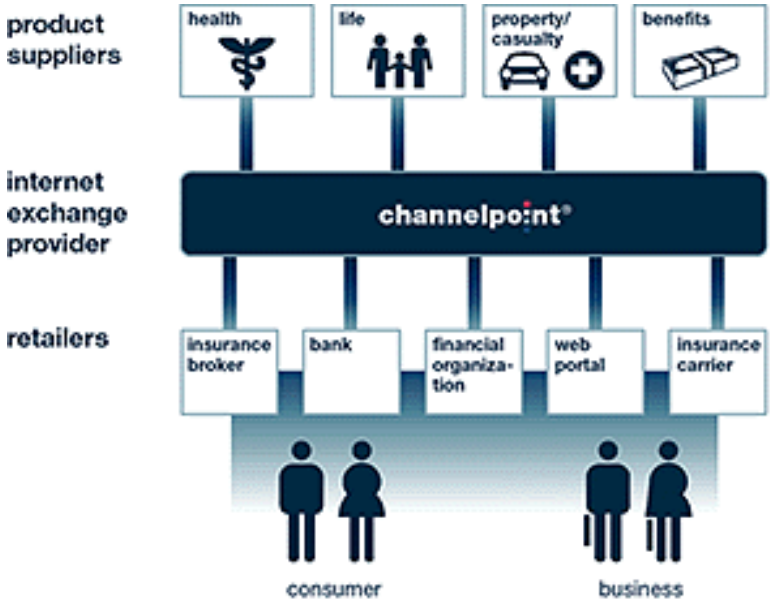
Another key feature of electronic commerce is its potential to reduce the number of players in the path between producer and consumer. Traditionally, distributors and wholesalers have played an important role in business-to-business commerce by providing a central source of information and certain economies of scale for both producers and retailers of goods and services. Small manufacturers often do not have sizable enough sales forces to deal directly with the ultimate purchasers of their products; hence distributors, with their broader contacts with retailers—and thence to the final consumers, can satisfy that need. Similarly, large organizations that use components and services from a variety of small manufacturers and service providers generally prefer to deal through distributors in order to simplify their accounting processes.

The Internet can serve as a form of meta-distributor on the one hand by providing a marketplace for the small producer in the form of electronic commerce enabled website and, on the other hand by making it easier for large manufacturers to purchase their supplies directly from providers. The elimination of the intermediary (a process now called *disintermediation*) is now a central feature in the rapid growth of companies such as Dell. Dell claims it has a competitive advantage of several percent over more traditional companies by virtue of the fact that all of its sales are direct to its customers. Companies in several industries are adopting this practice, some coming from the mail-order business, such as Lands End and L. L. Bean in the mail-order clothing and sporting goods field.

These disintermediation pressures, once claimed as the pending doom of their industry segment, are causing traditional wholesalers and distributors to restructure their businesses in order to survive in the world of electronic commerce. By using many of the same advantages

obtained by other firms in electronic commerce, organizations such as Ingram Micro have been able to provide a variety of new services that have not traditionally been the function of distributors or wholesalers. Ingram Micro grew from a regional wholesaler in 1979 to a global corporation with products ranging from desktop and notebook personal computers, servers and workstations, mass storage devices, CD ROM drives, monitors, printers, scanners, modems, networking hubs, routers and switches, network interface cards, business applications software, entertainment software, and computer supplies. In addition, Ingram Micro provides a wide range of outsourcing and value-added programs, including order fulfillment, tailored financing programs, channel assembly, systems configuration, the assembly of private-label systems[4], and marketing programs. Finally, Ingram Micro also provides virtual warehouses and distribution services for a number of resellers. In mid 1999 the company took over CompUSA Inc.'s sales operations that involve large corporate, government and education customers. Perhaps this should be called *reintermediation*.

Figure 1: ChannelPoint as an infomediary



ChannelPoint Corp. provides a similar example of what John Hagel of McKinsey, a large consultancy, calls *infomediaries* (see Figure 1). ChannelPoint serves as an Internet exchange, providing the connection between large insurance companies and individual insurance brokers. Its success derives from its focus on distribution costs in the US industry, which were expected to exceed USD120 billion in 1999. The basic premise of ChannelPoint's service is to convert much of the paper-based processing to electronic form and to integrate the marketing, selling, and buying of insurance products via the Internet. The ChannelPoint commerce Internet exchange supports all lines of insurance and benefits products including health, life, and disability, dental, and vision insurance. ChannelPoint will add support for property and casualty insurance by the end of 1999. ChannelPoint works with national and regional insurance carriers to collect the most up-to-date plan/policy descriptions, pricing models and business rules — collectively called "smart content" that can be dynamically tailored to the targeted audiences. This content is delivered through sophisticated Web-based applications that establish broker, work site marketing and direct-to-consumer electronic markets. Retailers including

[4] Private labeling is the process by which a company manufacturers a product which is then sold by its customer for resale under the customer's own brand name.

brokerages, banks, financial institutions and Web-direct companies participate in these e-markets via innovative pre-built or branded Web-based storefronts.

Business to consumer

Business to consumer electronic commerce obeys essentially the same ground rules as does business to business electronic commerce. The differences tend to be matters of scale rather than nature. In particular, business to consumer electronic commerce is more concerned with large numbers of small sales rather than smaller numbers of large sales. Dell and Amazon.com provide contrasting examples of this phenomenon. Most of the customers of Amazon.com are individuals while a substantial fraction of Dell's customers, at least 15,000 of them, are firms of size ranging from SMEs to major multinational corporations. Yet, the fundamental business models and information infrastructures of the two companies are similar.

Amazon.com began its business as an Internet bookstore. Its principal advantage over traditional bookstores was that it had no investment in a large inventory of books yet could offer an essentially unlimited inventory to its online customers. This feature allowed Amazon.com rapidly to become competitive with major American book seller chains such as Barnes & Noble and Borders. Key to the Amazon.com strategy is its centralized database system. This not only contains listings for most books in print but also allows the company to readily track customer orders, recommend other books in which they might be interested, simplify the ordering process for prior customers, and otherwise customize the company-customer interface.

Because of Amazon.com's success, the other major book seller chain stores were also forced to go online. Their entry, in turn, was a spur to Amazon.com to expand its operations into other retail areas. By midsummer of 1999, Amazon.com was offering more than 4.7 million books, music CDs, videotapes, DVDs, computer games, greeting cards, groceries, gifts, toys, consumer electronics, and even online auctions. The evolution of Amazon.com's services is reminiscent of the development of department stores from small retail shops in the 19th-century, with Bon Marché in Paris leading the way. Yet, while department stores evolved over periods of decades or more, Amazon.com is performing equivalent changes in months. Like much of current business development activities, Amazon.com achieves its increasing breadth of services largely by buying smaller companies in each respective specialty area.

Still, even though Amazon.com operates primarily on the Internet, it is increasingly forced to develop physical facilities — distribution and fulfillment centers — in order to continue to offer rapid service to its customers. The company's original plans were to rely on a small warehouse in its Seattle, Washington headquarters for book and distribution. As its business grew, it began spreading its distribution channels to publishers as well. When the company went into the record business it started shipping from distributors. However, as Amazon.com expands into toys and electronics, where the market is more fragmented, the distribution problems become more complex and more physical facilities may be required. Thus an increasing fraction of its capitalization is in property and buildings rather than software and rapidly moving inventory.

One crucial test of Amazon.com's ability to continue its expansion is yet to come. Wal-Mart, the world's largest general retail chain is about to come online in a major way towards the end of 1999. Its extensive network of walk-in stores and distribution centers are already in place, as is its sophisticated automated inventory control and ordering system. In fact, in October 1998, Wal-Mart Stores filed a lawsuit against Amazon.com charging violation of trade secrets because Amazon.com recruited and hired at least 10 Wal-Mart employees who had intimate knowledge of the retailer's proprietary data warehousing, distribution, and merchandising operation.

Amazon.com subsequently sued Wal-Mart for slander, defamation and libel. Whatever the outcome, these two lawsuits demonstrate the level of attention which electronic commerce has reached in the United States. Will Amazon.com expand and diversify fast enough to compete successfully with Wal-Mart?

Another area of rapidly growing interest in the Internet economy in the United States is that of stock brokerage. The Charles Schwab corporation provides an excellent example of the transition process from a successful traditional financial services firm to one whose feet are planted in both the traditional world and the new information economy. Schwab began its life as a conventional stock brokerage but soon diverged from the traditional pattern, beginning to provide discount services in 1975 through its walk-in branch offices. In 1985, Schwab introduced software that allowed PC-equipped investors to interact with Schwab's computers and make trades. By the end of 1985, investors were making 8000 trades per day. In 1993 Schwab introduced its Windows online trading and information service and, in May 1996, began its Internet online services and established its Web site. Schwab customers are able to obtain financial information and execute trades on an automated basis either through the company's automated telephone or online channels. In 1998 the company integrated its online and traditional brokerage services and reduced the price of online trades for most of its customers. This resulted in an increase in the proportion of trades placed through the company's online channels and a decline in its average commission per revenue trade. However, the increase in trading activity more than offset the effects of the lower average commission per revenue trade.

Although Schwab already had an active site-based brokerage operation, its move to the Internet materially improved its earnings growth and market share. The entrance of E*Trade™, Ameritrade™ and other online brokerages also increased competition. That, in turn, helped bring the cost of stock trading for individuals down from a percentage of the purchase value to a flat fee per trade. This growing competition has increased to the point where, as of late 1998, there were over 80 online brokerages to choose from, each offering a slightly different set of services and options, with the average trade costing about USD16.

One consequence of this new ease of investing has been a major surge of investment activities by individuals, including the appearance of numerous Internet day traders, individuals who basically sit glued to their computers, making quick trades several times daily in hopes of "beating the market". Whether this latter phenomenon is a benefit or not, remains to be seen. It certainly helps to increase market volatility.

E-commerce evolutionary patterns

Although the examples mentioned above are taken from a number of different segments of commerce, some consistent patterns of the evolution of electronic commerce are beginning to emerge. They follow the classic pattern of the diffusion of any new technology — or spread of disease, for that matter — going from the first innovations to the ultimate widespread adoption or application of the new technologies and methods. As this report is written, we are just a short way along this evolutionary path. The next sections summarize current experience and some future possibilities.

Start-ups: new approaches for old situations

Although electronic commerce had its beginnings in the form of the use of EDI by large organizations, the real momentum change of electronic commerce came with the appearance

of the World Wide Web in 1993. The fundamental advantage of the Web is ease of access. Among businesses a large pent-up demand for lower costs of operation had developed, to a large extent because of increased levels of competition. One of the foremost operational costs of any business is that of administration; paperwork. The primary purpose of EDI was to reduce or eliminate paperwork by using industry standard electronic forms for communication between business purchasers and suppliers. Unfortunately, because of EDI's cost and complexity, its use has been restricted to fairly large organizations.

By developing Web-based forms linked to its database, a company could produce the functional equivalent of EDI at significantly less expense. Hence, a substantial portion of a company's paperwork expenses could be reduced or eliminated almost at a single stroke. This is a central characteristic of all of the electronic commerce initiatives described in this report. Still, it is simply a new way of addressing an old problem.

The Web also provided the opportunity for communicating directly with the customer. Dell, Amazon.com, Charles Schwab, and many other innovators built their electronic commerce operations either by augmenting brick-and-mortar with electronic storefronts or by skipping the brick-and-mortar phase entirely. Although Charles Schwab already had hundreds of walk-in locations, the addition of its e-commerce capability added substantially to its revenues. Similarly, Dell's computer sales, although beginning as largely telephone-based operations, are quickly moving to the Internet. Even Amazon.com, the prototypical e-commerce retailer, is fundamentally a department store.

Thus, a large fraction — if not the great majority — of current e-commerce initiatives are primarily network versions of familiar commercial situations. Nevertheless, most of the major players in the contemporary e-commerce scene are start-up companies. Their explosive appearance on the stock markets of the world, such that the market valuations of many of them far exceed those of their traditional predecessors, clearly demonstrates the popularity of novel approaches to familiar situations.

Similarly, the typical pattern of entry of a company into Internet based activities is to convert its paper-based forms to an HTML format. Thus, the company catalog or standard public relations materials appeared on its Web site basically unaltered from the printed versions. Most companies soon learn that many of its customers – “Internetizens” — demand short, pithy statements that fit on a single screen. They become impatient with Web pages that take too long to load (where “long” means 10 seconds or more). If the company is an Internet retailer, it also learns that complicated graphics are also counterproductive because, with the long load times required for narrow bandwidth modems (the majority in the US) their customers skip to other pages or leave their websites entirely. So the company's website evolves from a set of linear, interlinked pages with complicated graphics to a much more complex set of inter-page and inter-site links and graphics optimized to minimize download time.

From chains to webs

These alterations in the nature of the Web sites on the micro-scale are reflected in the evolution of organizational linkages on the macro scale. In the case of Dell Computer Company, for example, the traditional chain from components supplier, to manufacturer, to distributor, to retailer, to ultimate customer becomes replaced by a network of links, with Dell at the center. The distributor disappears from the chain, Dell becomes both manufacturer and retailer, and the links between Dell, its customers and its component suppliers become more dynamic and frequent. Whereas in the traditional business model the manufacturer is the dominant entity, the emphasis in the e-commerce model is on service to the customer.

This model of direct from manufacturer to customer, so successful for Dell, is not applicable to every electronic commerce situation. Personal computers, though fairly complex in themselves, are fairly well-defined as a product. The potential buyers are typically reasonably well informed about the options available to them. However, in more complex market situations, such as insurance and broader scale electronics manufacture, intermediaries may still be necessary to make the market more efficient. Ingram Micro-and ChannelPoint act as concentrators; providing a single point of information and coordination for a diverse array of both suppliers and customers. Here too, however, emphasis is on delivering the most appropriate and effective information or product to the customer.

Still, the traditional business model is by no means entirely obsolete. Charles Schwab still conforms to the conventional picture of a stock brokerage. The primary difference is that it offers its advice and brokerage services directly to clients over the Web rather than via a broker in a walk-in facility. Yet even here one part of the traditional chain — the broker — disappears or diminishes in importance.

Today's version of electronic commerce is then a mix of traditional and new or altered business models, with emphasis on more complexity at the edges (the inputs and outputs) and greater simplicity in the center: a Web.

Davids and Goliaths

Many of the dominant figures in electronic commerce in the United States in 1999 did not exist in 1990. Yet their market capitalization amounts to several tens of billions of dollars. In some cases, such as Amazon.com, the total market capitalization is greater than that of several of their traditional competitors combined. The new Davids often are competing successfully against major national or multinational corporations: the Goliaths. They are rapidly gaining market share and becoming formidable opponents despite their youth. In fact, the new so-called Internet economy appears to flaunt traditional economics, ignoring the traditional concern for the "bottom line" in favor of maximizing market share whatever the cost (or current losses).

For the most part, though, the Goliaths such as Wal-Mart and the automobile industry are still sleeping giants. They will soon awake, probably, and begin using their tremendous financial muscle to alter the situation. A central question is whether the Davids will, because of their demonstrated flexibility, be able to outmaneuver and outflank their larger competitors.

Inventing new businesses

Most of the electronic commerce examples discussed above are various extensions or variants of existing business forms. This is typically the situation during the initial stages of an innovation. Soon, however, new types of businesses and new organizational forms may develop as a consequence of using the new technologies. For example, there are several electronic commerce businesses that act as traditional auctioneers, including eBay and one branch of Amazon.com. These companies operate by offering items or services for sale, with bids being made over the Internet within a period possibly covering several days and the winner being the highest bidder.

Now "reverse auction" companies, such as Accompany.com are appearing on the Web. In a reverse auction, the bidders specify a certain product they wish to buy and sellers bid on supplying it; the lowest bid from the seller wins. In this system, as more potential buyers sign up, the supplier tends to lower the asking price. Thus, while a traditional auction acts to maximize the price received by the seller, a reverse auction tends to minimize the price paid by the buyer.

New forms of organizations are also beginning to appear. For example, ad hoc organizations can easily form and dissolve through the effective use of Internet communications [see the section in this report on new ways to work]. One instance of such an organization is the team of partners that produced this report; each partner in a different country, collaborating almost entirely via the Internet. As more organizations begin to understand and explore the business possibilities offered by the Internet a wide variety of new businesses will be invented.

Barriers and constraints

Technology problems

Electronic commerce has three primary technology problems: system reliability, software extensibility, and telecommunications bandwidth. The system reliability issue was made all too evident in 1999 by system crashes of eBay, E*Trade, Charles Schwab and others. In the case of E*Trade a combination of heavy trading and a change in some of the system software caused a series of crashes over a three-day period. Although this infuriated thousands of customers, the company was able to continue its growth after a few weeks of setback. The online auction site, eBay and the Charles Schwab brokerage have had similar, if less extensive, experiences.

The software extensibility issue reflects the point that there is as yet no *lingua franca* for electronic commerce. As mentioned elsewhere, EDI was developed to provide a standardized set of formats for electronic commerce within companies of specific industries, such as automobile manufacturing and pharmaceuticals. Each industry has its own set of specifications and EDI formats, some of which are being converted to Internet use. The latest hope on the horizon is the XML language that is object specific rather than format specific like HTML. In principle, a relatively small number of XML document type definitions (DTDs) could be used to perform the same functions as EDI but over a much broader set of applications and industries, and at much lower cost.

A related issue is the problem of finding anything over the Internet. Even within a large organization with multiple sites around the world, it is important to have an easily searchable directory. Here, too, a directory standard based on XML may serve to accelerate the adoption of directory search techniques that are relatively universal. Known as Directory Service Markup Language (DSML), this new specification is projected to provide a mechanism for consistently formatting data.

One new company, RosettaNet, is developing an electronic technical dictionary to provide a common business language that will link entire industry supply chain business processes. Under a continuing mandate from a consortium of major information technology enterprises, RosettaNet spearheaded the development of the dictionary, which was designed by and for the information technology industry to standardize data required for supply chain business processes. This dictionary will link manufacturers, software publishers, resellers, wholesale distributors, and users, financiers, carriers and electronic business technologists.

A fundamental constraint over the rate of growth of the Internet is its throughput; that is, the speed with which an individual message goes from sender to receiver. For business to consumer electronic commerce, a significant constraint is the ability of the consumer's modem to receive information, with the average modem in the US operating at 28.8Kbps. This constraint also affects the design of Web sites, as mentioned earlier, in that it limits the complexity allowable in Web pages designed to be attractive to individual customers. As and when cable modems and XDSL capabilities become more readily available to individual

households this constraint will moderate. The availability of higher bandwidth communications to the ultimate consumer, while substantially helping the bandwidth problem, may not entirely cure it. Quite often, Internet service providers (ISPs) do not have the capacity in their servers to keep up with the traffic loads they receive. In long distance Internet communications, where a message may pass through several servers on its way from sender to receiver, the ISP delays may be the dominant factor in slow transmission.

A closely related problem is the mundane issue of data storage. All the information available on the Internet has to be stored somewhere in electronic form. Electronic commerce facilities that track customer purchase patterns and individual priorities need to store that information as well. The increased use of graphics files—a picture can occupy much more data space than a thousand words—multiplies the problem. This has produced a nearly insatiable demand for advanced, high-speed data storage facilities. The potential world market for such capacity is in the tens of billions of euros annually.

Financial issues

Electronic commerce is at the heart of what is becoming known as the new Internet economy. The traditional emphasis in the growth of a new company is on achieving profitability in as short a time as possible; that is, the primary focus is on achieving a positive "bottom line". The major new stars among the US electronic commerce companies, like Amazon.com, Yahoo! and eBay are famous for having multi-billion dollar market capitalization without ever making a profit — so far. Their primary focus is on achieving the maximum market share, under the assumption that eventually their dominance of their markets will lead to long-term profitability.

The so-called dot-com stocks are alternately the darlings or the Devils of the stock market. They have continued to lead the drive toward ever higher prices and price to earnings ratios through mid 1999. The fundamental question remains whether these valuations can continue indefinitely. At some point, presumably, these companies must begin to show profits or their high valuations will evaporate—as might some of the companies.

Similarly, at least 68% of large to medium-sized US companies have developed their own Web sites and most of the rest are in the process of developing them in anticipation of entering the electronic commerce marketplace. According to the Association of National Advertisers, the average investment in a corporate Web site in 1999 is USD252,500 (244,200 euros), with an additional USD182,000 (176,000 euros) annually for site maintenance. E-commerce site development is more expensive, at USD307,100 (297,000 euros). The Internet advertising bill was USD649,000 (628,000 euros), down from USD714,000 (690,000 euros) in 1998.

Yet many of these sites, like the Internet high fliers, have yet to show a positive return on their investment. 68 percent of companies surveyed by the Association of National Advertisers answered that lack of proof of return on investment was a key barrier to online advertising; 58 percent of the respondents mentioned lack of a reliable and accurate measurement technique as a barrier. Hence, the continuing growth of electronic commerce depends to some extent on the optimism of the companies involved that their investments will be amply repaid in the reasonably near future. If the economic climate worsens, the reaction for Internet related commerce could be as disproportionate as the current enthusiasm.

Legal and regulatory issues

One of the key regulatory issues of concern to US companies is that of encryption. Although to some extent encryption is a technological issue, the chief controversy in the US derives from the US federal government's position that high-level encryption technology (that is, technology

that uses keys longer than 56 bits) cannot be exported. Some exceptions have been allowed by the government, such as the use of 128 bit encryption for transactions between banks internationally but, for the bulk of potential electronic commerce transactions, lower and less secure levels of encryption are required. Ironically, current US law prohibits export of high-level encryption software but not of the source code that would allow someone outside the United States to produce software of equivalent capability. Since one of the primary concerns in both business to business and business to consumer electronic commerce is that of security of personal and financial data, federally imposed limits on the quality of encryption software can act as a substantial deterrent to growth. The US National Institute of Standards and Technology (NIST) is in the process of developing a new standard, the Advanced Encryption Standard, that will allow key sizes of 128, 192 and 256 bits.[5] The standard is scheduled to be in place by the summer of 2001.

A related issue is that of authentication of the partners to electronic commerce transactions. Currently, businesses use passwords, electronic signatures and IP addresses to identify the participants in a transaction. Several initiatives are underway to develop more effective systems of digital certification and authentication. The US government is promoting the development of an international convention to legally recognize digital authentication. The government is also supporting the development of both domestic and global uniform commercial legal frameworks that will recognize, facilitate, and enforce electronic transactions worldwide.

So far, both federal and state governments in the US have taken the position that Internet transactions will not be taxed simply because they occur over the Internet. The position of the US government is that no new discriminatory taxes should be imposed on Internet commerce. It also believes that no Customs duties should be imposed on electronic transmissions. According to the government, the application of existing taxation on commerce conducted over the Internet should be consistent with the established principles of international taxation, should be neutral with respect to other forms of commerce, should avoid inconsistent national tax jurisdictions and double taxation, and should be simple to administer and easy to understand. Current actions in the US Congress are to have a moratorium on Internet taxes until 2001.

Related to the issue of taxation within the United States is a broader issue of coping with customs duties and related regulations in international commerce. At least for companies whose products are primarily goods, the thought of coping with an array of different requirements, standards, and red tape from potential customers in other countries has been enough to dissuade them from international trade. This issue may be particularly severe for small and medium-sized businesses. Recently, however, a new online service called GLS.com has been announced by a New York company, Syntra Ltd. This application automates the process of allowing transactions to meet all international requirements.

The Internet is posing a large series of new legal questions, including such issues as privacy, trademark and the copyright protection, defamation, censorship and various computer crimes. One of the more problematic issues is what is known as long-arm jurisdiction. In the US, any federal or state court can imposed its authority upon the people or corporations in any other state if it can demonstrate jurisdiction. Since the issue of establishing jurisdiction can often be vague and nebulous, concerns about long-arm jurisdiction may act to diminish the enthusiasm

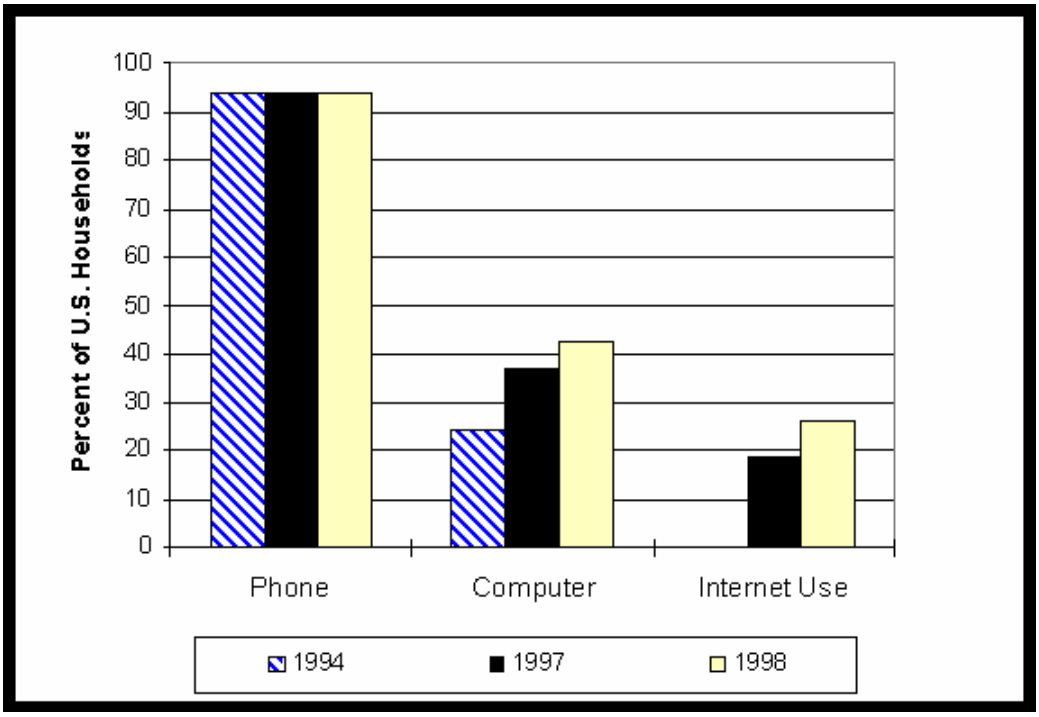
[5] The difficulty in "cracking" an encrypted message is proportional to the number of bits in the key, doubling in difficulty with each additional bit. Thus, a 128-bit key makes a message 72 quadrillion times (72,000,000,000,000,000) harder to decrypt than one with a 56-bit key.

of companies for electronic commerce. As awareness of this type of the issue begins to include similar international considerations the reluctance to become involved in electronic commerce may grow proportionately.

Transaction completion time has become another important factor in the growth of electronic commerce in the financial services industry. Completion time is the interval between the initiation of a transaction, such as placement of a buy or sell order to a stockbroker, and the time the entire transaction, including payment for the order, is completed. Current rules require that such trades must be completely settled within three days. A few years ago the allowable settlement period was five days. Market regulators are now working toward a rule in which the trade must be settled within one day after the transaction is initiated. The traditional, paper based process is incapable of handling transaction limits that are that short; electronic commerce is the only feasible way to meet the rules. Hence this and similar roles act to force most financial service businesses to adopt some form of electronic commerce.

Market access issues

Figure 2: Percent of US Households with a Telephone, Computer, and Internet Use
Source: *Defining the Digital Divide*. US Department of Commerce, July 1999



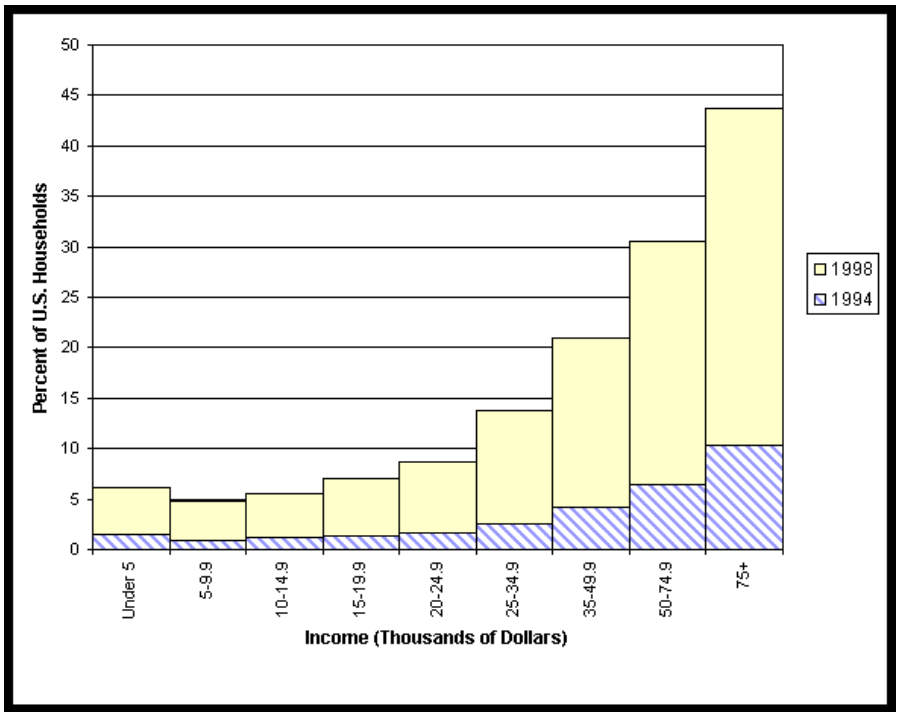
Most large businesses in the US have ready access to the Internet, usually with high bandwidth telecommunications lines. These provide rapid downloads for most Web pages and high-speed data transfer between company facilities, suppliers and customers. Approximately 40 percent of all businesses and 32 percent of small businesses have Internet access in 1999. According to the Association of National Advertisers, 68 percent of companies with Internet access also have Web sites. Although only 10 percent of small businesses had Web sites early in 1998, a mid-1999 survey concluded that 20 percent of very small businesses (with 10 or fewer employees) had Web sites.

Figure 2 shows changes in consumer access to e-commerce-relevant technology from 1994 to 1998. By the second half of 1997 according to Odyssey Ventures, Inc., more than 7 million US households were making purchases online. Forrester Research, Inc., estimated that online retail

purchases in 1997 amounted to almost USD2 billion, with the average person spending USD24 annually on the Web, according to BancAmerica Corp., Robertson, Stevens and Co.

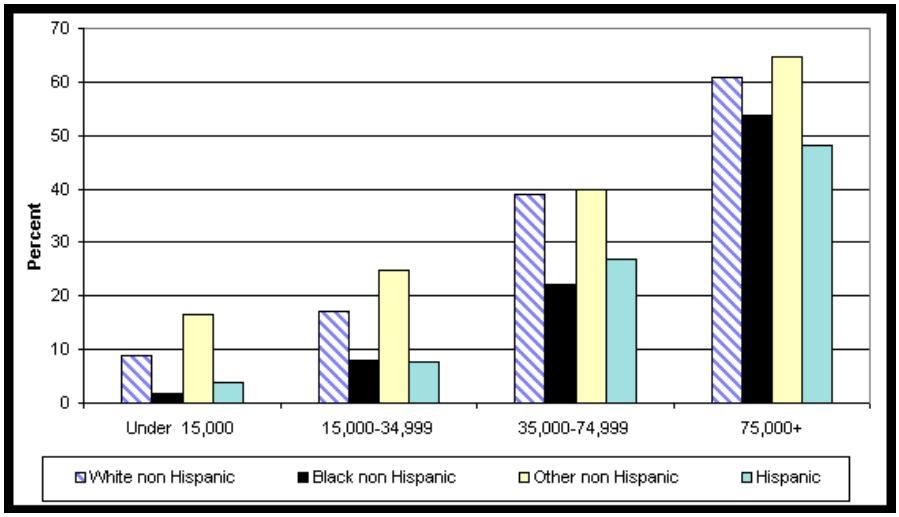
Through the mid to late 1990s the primary technological impediments to consumer access were limited bandwidth of available modems for PCs and the complexity of the access process. The continuing development of user-friendlier Internet access software by service providers such as AOL helps to increase consumer interest in the Internet.

Figure 3: US households with email, by household income
Source: *Defining the Digital Divide*. US Department of Commerce, July 1999



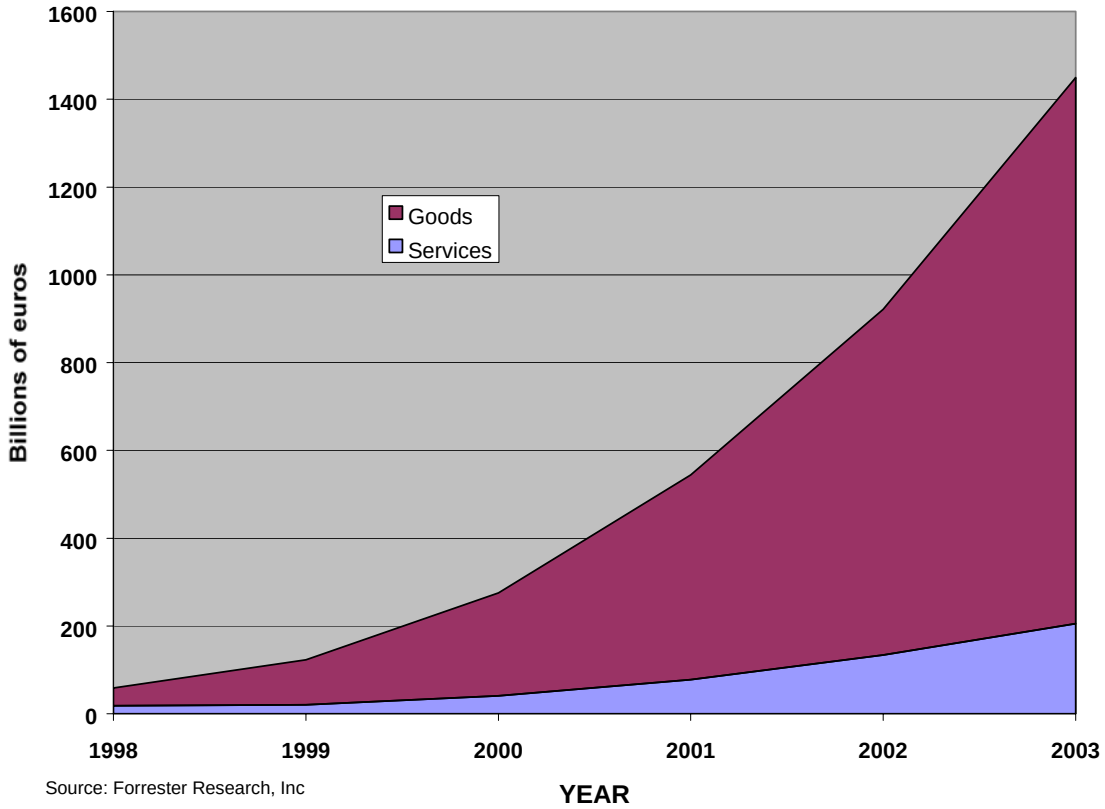
As Figure 2 indicates, the number of US households with Internet access is rapidly growing, by almost 50% between 1997 and 1998. However, that access is not uniformly distributed among all US households; high income households are more likely to have access to email and the Internet, as is shown in Figures 3 and 4. In 1998 almost half of high-income households had email access, as contrasted to less than 10% for those households at or below the median income level, although the annual growth rates are comparable.

Figure 4: *US households using the Internet, by race and household income*
Source: *Defining the Digital Divide*. US Department of Commerce, July 1999



Further, as Figure 4 shows, the Hispanic population in the US is falling behind the other racial components in gaining Internet access. This gives rise to concerns that the gap between the haves and the have-nots may be widening.

Figure 5: Current and forecast growth of business-to-business e-commerce in the US. Source: Forrester Research, Inc.



Future developments

Growth patterns

Electronic commerce is already in a high state of ferment. The future promises more of the same, and at an accelerating rate. Many of the regulatory and technological barriers to the development of electronic commerce either will be eliminated or drastically reduced within the next two or three years. Eliminating the psychological barriers to further development will take longer. Although estimates of the total amount of growth vary widely, projected electronic commerce revenues are likely to exceed USD200 billion in the year 2000.

Both because electronic commerce in the US is widely spread and is rapidly growing, it is very difficult to obtain timely, comprehensive, and accurate data as to its current status or rate of growth. Estimates from various experts in Internet markets vary widely, sometimes by orders of magnitude. Figure 5 summarizes the current and future estimates of business to business e-commerce as formulated by a well known American market research firm.

Table 2 provides a comparison of some of the estimates for e-commerce by various expert sources. Business-to-consumer e-commerce estimates range from 30% of business-to-business volume in 1998 to less than 10% in 2002. The wide variation in estimates is partly a matter of varying definitions as to what constitutes e-commerce, but it is also due to differences in survey techniques. In any case, substantial growth, particularly in busines-to-bussiness elecronic commerce, is expected in the coming few years.

Table 2: Estmates of business-to-business e-commerce

Source	Year forecasted	Forecast (Billions of euros)
eStats	1998	17.0
Forrester Research	1998	58.8
Univ. of Texas	1998	95.2
IDC Research	2002	189.7
eStats	2002	286.8
Forrester Research	2002	921.5

Technological keys

Micropayments

One of the high potential, but low reality, areas of electronic commerce has been the conduct of small transactions: those that are impractical for credit cards. Several schemes for conducting micro-payments over the Internet have been advanced in recent years. These include CyberCash, eCash and others. Generally, response to these ventures has been tepid because of the difficulty of using the systems. Now, however, interest is accelerating in the development of new micropayment services. The new Internet start-up companies in this field included Cha Technologies, QPass Inc., eCharge, iPin, and Reciprocal Inc. Cha's Click Charge service is an example. Users sign up for the service using their regular credit card numbers. Once the card is registered, the user can conduct micro-payment transactions on any Cha-enabled Web site. The company gets its income by charging a percentage of each transaction, similar to the practice of

credit card companies but probably at somewhat higher service charge rates. The objective of micro-payment services is to allow consumers to purchase either small items or small information packages, such as reports, notes, or even book chapters. The other services are similar, but differ in how the transactions are billed; iPin charges the ISP, eCharge bills through the local telephone company.

Security

An absolutely critical factor in the widespread acceptance of electronic commerce is security. Any form of substantial monetary transactions requires a significant guarantee to both parties involved that the agreed-upon funds have been transferred and that the parties involved in the transfer were the ones intended. This requires both secure transmission of the transaction data and authentication of the identity of the participants in the transaction. While sufficiently secure encryption methods are in widespread use within the US, with few exceptions the country's export laws prohibit the use of 128 bit and other forms of "the break proof" encryption between the US and other countries. Some limited exceptions to this rule have been made, primarily between banks and similar financial service organizations such as CyberCash. Although these regulations do not materially affect electronic commerce internal to the US they presumably do decrease the competitiveness of the US in international trade. Negotiations continue between the federal government and the purveyors of encryption software but the outcome is still uncertain. Some software companies, such as RSA, the industry leader, have started "clean room" developments of their software in other countries in order to avoid these restrictions. In any case, very effective security software is expected to be widely available within the next few years, substantially enhancing the prospects for continuing growth in electronic commerce.

XML standards

As mentioned elsewhere, one of the impediments to easier electronic commerce is a lack of a relatively inexpensive but comprehensive system for facilitating online transactions. XML is currently touted as the potential solution to this issue. Unfortunately, there is as yet no single standard for XML extensions to be used in business to business transactions over the Web.

In fact there are at least three different approaches to the Document Type Definitions (DTDs) needed for quality transaction processing. These are cXML (for commerce extensible markup language); BizTalk; and ICE (Information & Content Exchange). cXML, as proposed by Arriba Technologies Inc., comprises a set of DTDs for 12 common transactions, including purchase orders, invoices and change orders. The primary developer of BizTalk is Microsoft with input from a number of electronic commerce providers. Like cXML, BizTalk is aimed at facilitating common commercial transactions. ICE, on the other hand, is not a set of DTDs but a transport protocol that helps establish the business rules for exchange of information between partner sites. It is therefore complementary to the two sets of DTD standards.

Convergence of these competing standards, together with one for DSML (Directory Service Markup Language), is expected within the next year or two, at least on a de facto basis. At that point, individual electronic commerce transactions will become easier to conduct and more reliable in their outcome. The result should be a further reduction in the barriers to electronic commerce and acceleration of its growth.

Effects on the business processes

Table 3: Some contrasts between traditional and e-business
[Adapted from a table by Christine Willard in *ComputerWorld*, 12 July 1999. P. 50]

Factor	e-Business	Traditional Business
Basis of Competition	Innovation in products, services and processes	Incremental improvement
Entry Barriers	Intellectual skills, time and space limitations, paradigm resistance, financial constraints	Construction funds, location
Focus of Control	Customer	Producer
Marketing, sales & service modes	Mass personalization	Mass marketing
Time to Market	Time-insensitive once product is developed; market is always open	Depends on materials availability, suppliers, transportation time
Pricing	Near-zero transaction cost; no inventory needed for intellectual products, on-site production	Based on costs of raw materials, transport and labor, inventory levels
Operations	Using knowledge to optimize the transaction	The actual process of creating the product
Organization	Multifunctional, Web-connected teams	Hierarchical departments

Although most of the immediate effects of electronic commerce result from different ways of performing traditional processes, changes in the way companies do business are already becoming apparent. One of the most important of these changes is the shift in focus from emphasis on production details to customer or consumer issues. In many traditional business operations, the business produced the products it best knew how to make, under the assumption that the business knew best what the customer wanted. Mass production techniques produced large numbers of identical products under the assumption that customers wanted, or could be persuaded to want them. In the new, electronic commerce paradigm, customization to exact customer needs has become the central theme of such organizations as Amazon.com, Dell, ChannelPoint, Charles Schwab, and Ingram Micro, as well as many others engaged in either business to business or business to consumer electronic commerce.

Distribution versus Fulfillment

In the traditional business model the flow of goods is from manufacturer to distributor to retailer to customer. The e-commerce model is more likely to substitute the fulfillment center for the middle two components of the traditional model. For example, Amazon.com is developing a series of fulfillment centers strategically located around United States. Orders received on one of Amazon's Web sites are directed to the fulfillment center nearest to the customer's home. In some cases, the completed products are shipped directly from the publisher.

While fulfillment centers are similar in function to distributors, there are important differences. Distributors tend to have inventories that are particular to a single industry and they have a relatively limited number of established customers: the retailers of the products of that industry.

The fulfillment centers, on the other hand, may handle a variety of goods that even exceeds what might be available from a well stocked department store. Their customers are individuals rather than other companies.

One of the central factors influencing the rates of growth (or shrinkage) of distributors and fulfillment centers is the intensity of desire by consumers to "feel the goods" before purchasing. As consumer confidence increases in the ability of fulfillment centers to quickly deliver the desired goods, the use of fulfillment centers will increase.

New Ways to Work

New work forms

There can be considerable overlap among the following work modes. For example, an employee might commute daily from home to a traditional office but perform intra-organizational telework much of the time as a member of a dispersed team. Or she might telecommute as well, performing some of the teamwork from home. Some team members might be independent contractors engaged in inter-organizational telework. If they are widely distributed geographically, they may also be engaged in flex-work on the occasions when they have synchronous (live) conferences. The following are terms as originally defined in 1973 by Jack Nilles[6] and in wide use in the US

> Telework. *ANY form of substitution of ICT for "normal"[7] work-related travel. This comprises four options, no two of which are mutually exclusive:*

- *Telecommuting*. Periodic work away from the principal office, one or more days per week either at home, a client's site, or in a telework center. The emphasis here is on substitution of information and computer technology (ICT) for routine daily morning and evening trips between the workers' homes and their principal offices. Hence, there are upper limits on the distance between the home and office (simply the affordable local commute distance). Most contemporary US telecommuters are employees, not subcontractors, of the organizations for which they work.
- *Intra-organizational telework*. Work using ICT to substitute for "normal" travel for face-to-face interactions between members of work teams and/or for other intra-organizational communication. Examples are various modes of teleconferencing (audio, video and computer-mediated) and work team e-meetings within an organization. No distance limitations.
- *Inter-organizational telework*. Work using ICT to substitute for "normal" travel for face-to-face interactions between workers and their clients and/or suppliers in other organizations. Examples are e-mail, EDI and other forms of e-commerce, various modes of teleconferencing and e-meetings between organizations. Usually, routine inter-organizational communications using email are not counted as telework in surveys on the topic. No distance limitations.

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[6] The terms *telework* and *telecommuting* were originally defined in1973, the rest in later years.

[7]

- *Teleservices*. Work using ICT to substitute for "normal" travel for face-to-face interactions between workers and their individual clients. This category includes such operations as telemarketing, telebanking, tele-consulting and telemedicine (or at least the non-automated portions thereof).

Organization Forms

Most telework being done in the United States today is carried out within traditional types of organizations: insurance companies, banks, government agencies, manufacturing companies, software developers, etc. Most of these organizations adopt a traditional hierarchical structure, with the president or Chief Executive Officer reporting to the Board of Directors, various vice presidents reporting to the CEO, the department heads reporting to the vice president's, and so on. Since most organizations have adopted this structure over the past centuries, telework has naturally begun within such organizations. Although all of the new ways of working can be performed within these traditional organizations, the underlying technologies also allow new types of organizations to develop in response to changing business conditions. The most common descriptions follow.

Network Organizations

These are also known as distributed organizations. The term can refer to distributed branches or divisions of a single firm or a well-defined consortium of cooperating firms. All of them use ICT as an important means of efficient communication among the distributed parts. "A major characteristic of a network organization is that the separate nodes in the network operate relatively autonomously, although governed by the overall policies, business rules, and procedures of the network as a whole."[8]

Evanescent Organizations

These are like network organizations except that the interacting components typically combine on an ad hoc basis. The team producing this project report constitutes an evanescent organization, with participants from eleven countries.

Virtual Organizations

Like network organizations, this term had about as many definitions as there are definers. The most common version focuses on the concept that the virtual organization is location –free. That is, it may have no fixed place where there is a corporate headquarters. Although it may have a postal address, URL, and central phone number, the postal address may be a drop box somewhere, the web site is monitored by the Webmaster, and the phone number may just automatically forward calls to whomever is in charge of the service desired. Virtual organizations are generally small since size tends to force accumulation of property.

The situation in the USA

Although telework and other forms of network-enabled or augmented work occur in almost every country, the United States has been the world leader since the early 1970s. According to

[8] Jack M. Nilles. *Managing Telework.* New York: John Wiley & Sons, 1998, page 230.

at least one survey, more than 25% of all US households conduct work from home in 1999.[9] The following sections provide a partial history of the growth of telework in the USA plus a discussion of the key factors impelling the growth.

Some telework history

Here is a summary of some of the events and personalities involved in telecommuting in the US over the past three decades. Most of the development of telecommuting during this period was by private firms, although there were several key telework demonstration projects that were publicly funded and served as models for the private efforts.

1970 Jack Nilles, rocket scientist and spacecraft designer, meets urban planner who asks: "If you people can put man on the moon, then why can't you do something about traffic?" Nilles starts analyzing traffic problem from fundamentals: what causes traffic congestion, and why. Concludes that it is caused by an excess of cars, half of which are carrying individual workers to and from their office jobs, where much of their time is spent using telecommunications to communicate with others. Why not persuade them to work at home, thereby reducing the traffic problem?

1971 Nilles tries to convince his employer, an aerospace systems engineering company, to support research on the telecommunications-transportation tradeoff; that is, substituting phone lines for freeways. Request is rejected because the research would involve many "fuzzy" non-technological issues.

1972 Frustrated, Nilles leaves the company, moves to University of Southern California (USC) to become its first Director of Interdisciplinary Programs; applies to National Science Foundation (NSF) for grant to study the *Policy Implications of the Telecommunications-Transportation Tradeoff.*

1973 USC team wins NSF grant, sets up test project with local insurance company, begins successful satellite office telecommuting test. Nilles coins words *telecommuting* and *teleworking* to make the concepts easier to grasp. Richard Harkness writes theoretical Ph.D. dissertation in Civil Engineering at U. of Washington: *Telecommunications Substitutes for Travel: A Preliminary Assessment.* Peter Goldmark (inventor of the LP record) starts the New Rural Society project in Connecticut, emphasizing teleworking-induced dispersion of population (ironically, Goldmark is killed in traffic accident, project is abandoned).

1974 Final report of USC NSF grant (*Telecommunications-Transportation Tradeoffs*, NSF-RA-5-74-020) is published. AFL/CIO rejects telecommuting as probably exploitative.

1975-1980 Nilles tries to interest other federal agencies (Transportation, Environment, Energy, Housing and Urban Development) in supporting more research and demonstration projects on telecommuting. Common negative response: *Our mission is to improve transportation, (or ameliorate its effects) not reduce demand for it.*

1976 Expanded, book length version of NSF final report is published.[10]

1977 Japanese and Portuguese (Brazilian) editions of *The Telecommunications-Transportation Tradeoff: Options for Tomorrow* are published

1978 Blue Cross/Blue Shield of South Carolina starts its "cottage keyer" project for insurance claims data clerks, showing 26% productivity edge over in-office workers.

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[9] However, some of this work is not telework, according to International Data Corporation.

[10] Jack M. Nilles, F. Roy Carlson, Paul Grey and Gerhard J. Hanneman. *The Telecommunications-Transportation Tradeoff: Options for Tomorrow*, New York: John Wiley & Sons, 1976

1980 Mountain Bell starts telecommuting project for managers. Nilles exhorts California Energy Commission to investigate low cost ways to reduce demand for automobile use, rather than (or in addition to) spending huge sums for mass transit that doesn't pay its way and small improvements in car efficiency. Nilles forms consultancy, JALA Associates. US Army (DARCOM) starts telecommuting pilot project, is stymied by federal regulations prohibiting the government from paying for a phone line into a private residence, lack of accounting standards for establishing productivity changes

1981 Aetna Life and Casualty company starts telecommuting project

1982 Control Data Corporation starts its Alternate Work Site (AWS) and Homework programs, the latter for training and employing the mobility handicapped in computer-based work. American Express begins Project Homebound, back office telecommuting for the mobility handicapped

1983 JALA completes study for the California Energy Commission: *Telecommunications and Energy: The Energy Conservation Implications for California of Telecommunications Substitutes for Transportation*. Includes forecast of telecommuting growth in California. Margrethe Olson, of New York University, organizes National Research Council symposium: *Office Workstations in the Home*.

1984 Gil Gordon, a telework consultant, starts his monthly telecommuting newsletter: *The Telecommuting Review*. At USC's Center for Futures Research, Nilles organizes multi-client telecommuting demonstration projects involving several Fortune 100 companies such as IBM, GTE, regional Bell Operating Companies. Electronic Services Unlimited publishes *Telecommuting: Its Potential Effects on Profits and Productivity.*

1985 JALA develops telecommuting implementation plan for state of California. David Fleming heads the project.

1986 Southern California Association of Governments starts internal telecommuting test project, headed by Patricia Mokhtarian. Mokhtarian starts informal discussion group, the Telecommuting Advisory Council (TAC) as part of the Los Angeles Central City Association. JALA estimates US telecommuter population at 517,000.

1987 California [state government] Telecommuting Project begins, under leadership of David Fleming, with 330 telecommuters, evaluation phase goes through mid-1990. JALA estimates US telecommuter population at 690,000.

1988 JALA organizes strategic planning project for City of Los Angeles to explore ways of reducing traffic, estimates US telecommuter population at 940,000.

1989 JALA develops implementation plan for City of Los Angeles telecommuting project, forecast of US telecommuters at year-end set at 1.3 million. California's Loma Prieta earthquake disrupts business in San Francisco but serves as demonstration of the utility of telecommuting for surviving disasters. Federal telecommuting/flexiplace program started by Office of Personnel Management (project organized by Wendell Joice), later moved to General Services Administration with Warren Master. State of Hawaii opens telework center outside Honolulu. Puget Sound Telecommuting Demonstration Project begins, organized by Washington State Energy Office, Dee Christensen and others. Project involves several state and municipal agencies, companies such as Hewlett-Packard, US West.

1990 City of Los Angeles begins its 3-year Telecommuting Demonstration Project involving more than 400 telecommuters. County of Los Angeles begins its telecommuting program. Governor of California requires that all state agencies consider telecommuting as part of their disaster preparedness programs. AT&T joins with state government of Arizona for joint telecommuting demonstration project in Phoenix area. AT&T component is headed by Susan Sears. JALA forecast of US telecommuters set at 1.8 million by year end. Survey by Tom Miller of LINK Resources suggests that there are 3.6 million US telecommuters.

1992 JALA forecasts 3.7 million US telecommuters at year end; LINK survey puts total at 5 million. Gil Gordon organizes Telecommute '92 conference.

1993 JALA forecasts 5.1 million US telecommuters at year end; LINK survey puts total at 5.8 million. The book, *Telework Explained* is published in the UK. Gil Gordon organizes Telecommute '93 conference.

1994 Major earthquake in Los Angeles causes instant telecommuting because of highway disruptions. The book *Making Telecommuting Happen*, by J. M. Nilles, is published. Telecommuting Advisory Council (TAC) has first national conference in Phoenix, AZ, followed by Telecommute '94 conference. JALA estimate rises to 7.1 million US telecommuters; FIND/SVP survey (still run by Tom Miller) concludes that there are 9.1 million, the majority of them in SMEs.

1995 Two Telecommute '95 conferences occur; one in Jacksonville, Florida, organized by the University of Southern Florida, the other in San Jose, California, organized by Gil Gordon. TAC has second annual conference in Long Beach, CA. JALA year-end forecast is for 9.4 million telecommuters; FIND/SVP survey of US households drops their estimate to 7.6 million.

1996 TAC has third annual conference in Las Vegas, NV; Telecommute '96 is in Scottsdale, AZ. JALA year-end forecast is for 12.6 million telecommuters; FIND/SVP survey of US households estimates to 10.4 million.

1997 TAC has fourth annual conference in Washington, DC; Telecommute '97 is in Orlando, FL. JALA year-end forecast is for 15.6 million telecommuters; FIND/SVP survey of US households estimates to 13.3 million.

1998 TAC has fifth annual conference in Washington, DC, changes its name to International Telework Association and Council (ITAC); Telecommute '98 is held in Baltimore, MD. The book *Managing Telework*, by J. M. Nilles, is published. JALA year-end forecast is for 18.6 million telecommuters; extrapolation to year-end of Cyber Dialogue survey (still run by Tom Miller) of US households yields estimate of 17 million. Symantec hosts multi-city tour to promote telecommuting, produces its *pcTelecommute* software package for home-based teleworkers.

1999 ITAC has sixth annual conference in Seattle, WA. JALA year-end forecast is for 21.4 million telecommuters; extrapolation to year-end of 1998 Cyber Dialogue survey of US households yields estimate of 21.7 million.

Forces for change

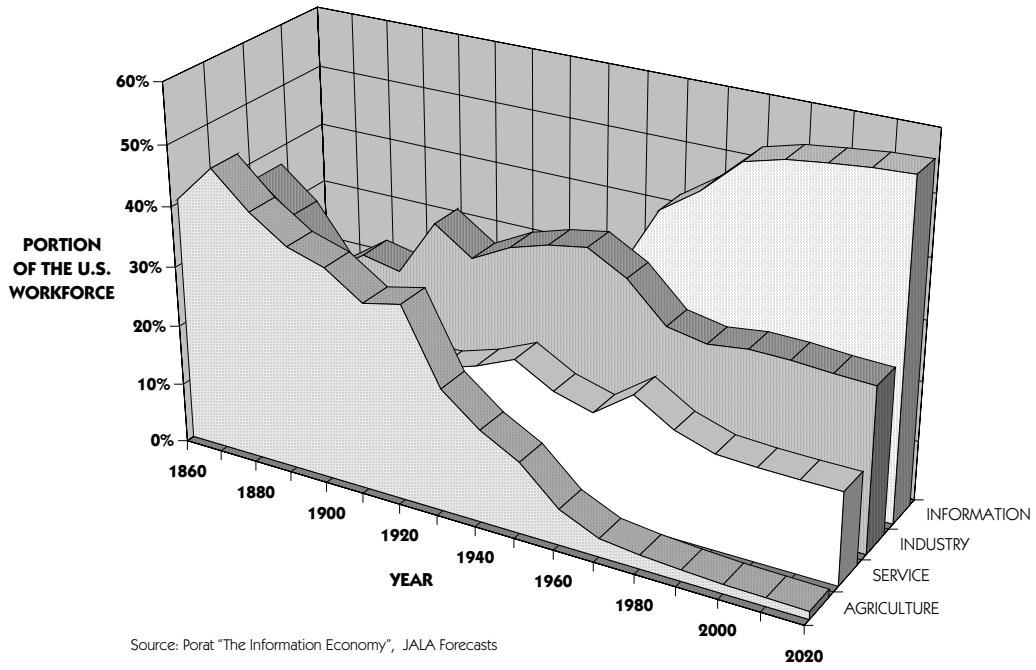
The information economy

The steady growth in the number of people involved in new ways to work, particularly telework, is a consequence of several forces for change. One of these is the transformation of the global economy from one that is dominated by the exchange of goods to one that is information-dominant. Historically, the world economies make the transition from agriculture, to industry, to information dominance. The evolution of the workforce in the United States serves as an example of this process, as shown in Figure 6.

Throughout most of historical times, until the 19th-century, the largest component of any country's workforce comprised farmers. As the industrial revolution spread through Europe and America in the 19th-century, the migration of farm workers to higher paying jobs in factories began. Because large factories needed to be located near the sources of workers and transportation networks that could bring in supplies and ship products out, villages grew into towns, towns into cities, and cities into megalopolises. The dominant theme of this

transformation was centralization; centralization of the means of production, of the workforce, and of the transportation networks.

Figure 6: US workforce components



But, as industry grew larger and more complex, and as the markets for the products of industry became more dispersed, a new type of work arose to dominance: information work. Information workers were needed to design new products, organize production processes, market the production products, and organize all the other aspects of human society as it, too, grew in complexity. In 1954 in the United States the information sector became the largest component of the workforce, finally exceeding industry in numbers. Today, the information sector accounts for between 55 and 60 percent of the *US* workforce, depending on one's definition.[11] The once dominant agricultural sector now constitutes less than three percent of the *US* workforce and industrial employment has decreased from its peak of 37 percent to about 27 percent. Thus, the majority of American workers have office jobs. That majority is likely to increase in the future.

Information and Communication Technology

Another major factor in this change process is the unparalleled rate of development of information and communication technology. Because of the continuing technical improvement in microchips, fiber optics, telecommunications systems, communications satellites, and other elements of these technologies, the ability of individual humans to process and communicate information also has been transformed.

In principle, an information worker can be located almost anywhere in the world where either sunlight or an electrical power supply is available and work with someone else in a distant location. The tools needed to perform the work, personal computers, and, the operating

[11] Unfortunately, neither the US Census Bureau — nor that of any other country — disaggregates the workforce into four sectors instead of three. The analysis of the US workforce included here is based on a detailed assessment of individual job categories.

systems and application software, are readily available to businesses of all sizes in the *US* The "transportation" cost of that distant-work arrangement — the cost of telecommunications — is on its way to becoming negligible. Therefore, the cost of allowing an information worker to telework is decreasing by roughly 30 percent annually.

Competition

Partly because of the rapid growth and acceptance of information and communication technology, the business environment has changed as well. Competition is intensifying at all levels. Fundamentally, there are two ways to meet the competition: produce the same products at a lower price; or produce better, or more attractive products at the same or even higher prices.

Over the past decade, many US firms have concentrated on both of these options by reducing operating costs and increasing their rates of innovation in order to fight competition. In many cases this motivation has resulted in downsizing and re-engineering; just two of several euphemisms for reducing that most costly resource: staff. In other cases, growing companies have searched desperately for ways to reduce demand for office space.

Unfortunately, many companies also discovered that some of the downsizing options most attractive to about-to-be-downsized employees were counterproductive in the long run. That is, early retirement packages and other inducements to older managers and professionals were exceptional incentives to those staff members to leave their firms and strike out on their own. In many of those cases, the newly separated former employees became consultants to their former employers (at higher rates of pay than when they were employees) or even competitors, many of them home-based teleworkers. The employees who were not downsized were often less skilled or had less experience than their former colleagues. Morale suffered, as did productivity, so that companies suffered losses in profitability commensurate with their losses in staff.

Although that downsizing scenario was by no means universal, there were enough such incidents to make companies search for other alternatives to increase their competitiveness. Further increasing the need to maintain a well qualified and content staff has been the historically low unemployment rates in United States in the '90s. Thus, a further need was added to the list of worries of most corporate presidents: attracting and retaining qualified staff. The spate of downsizing programs also increased the need for improving employee productivity without increasing employee stress.

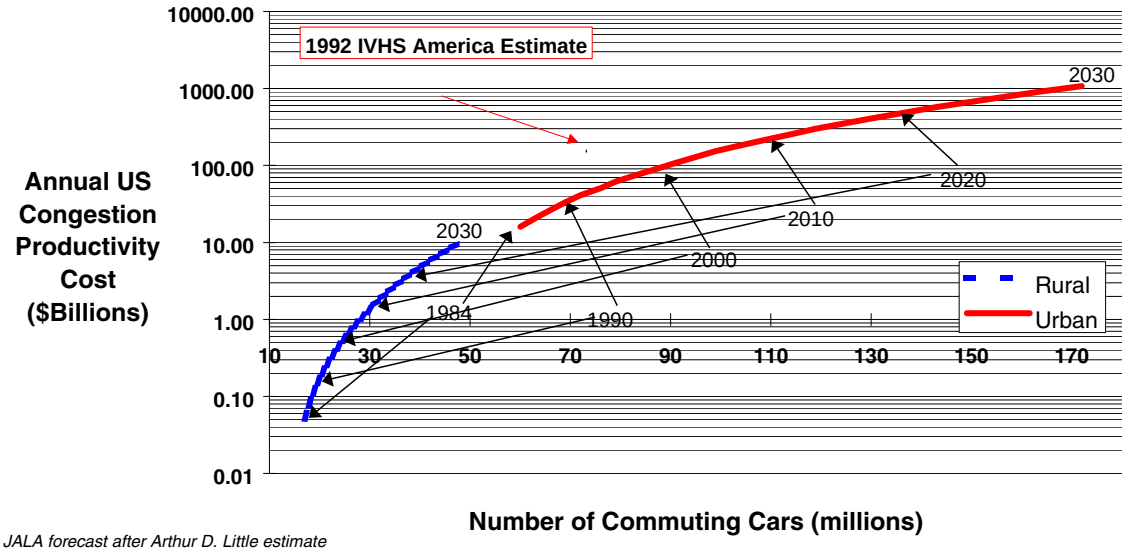
Finally, productivity improvements became viewed as necessary but not sufficient to meet competition and improve profitability. Employee innovativeness also became increasingly important, particularly in growth industries and regions such as information technology and the Silicon Valley.

Traffic and the environment

A major unintended consequence of the centralization characteristic of the industrial revolution, with its emphasis on urban settings, is traffic congestion. Although in the early to middle years of the 20th century daily traffic flows tended to converge on urban centers, late 20th century flows shifted to the suburbs of major metropolitan areas. In any case, the number of cars on the road during commute hours persistently grew to exceed road capacity. The result has been a steady increase in the time the average American spends commuting to and from work.

Changes in housing patterns have tended to exacerbate this problem. As housing prices in established suburbs or city centers escalated, young families seeking their own homes were forced to move farther and farther from their places of work. Dual earner households became the rule. Often the workplaces of the two earners in the household were in entirely different locations, further increasing the need for multiple cars and stretching commute distances and times. Aside from the increased stress levels this situation produces for the workers, there are significant productivity loss implications for their employers, as is depicted in Figure7.

Figure 7: US traffic congestion patterns



JALA forecast after Arthur D. Little estimate

All of this traffic congestion has had a further major impact: intense and unhealthful urban air pollution. Although the Los Angeles area has long been the archetypal home of smog (the place where it was named), many other American cities — and many more outside the *US* — have equal or more severe smog problems, most of them induced or exacerbated by traffic congestion. About 40 percent of personal automobile use in the *US* is for commuting to and from work.

Although alarming to environmentalists and to government agencies involved in improving the environment, there generally has been no direct means of inducing private citizens to move to the use of mass transit or other alternatives to their cars as a method of traveling to work. Billions of dollars have been spent on improving mass transit and increasing the use of car and van pools; yet almost 90 percent of contemporary urban commuters in the *US* continue to drive their cars to work alone; one person per car. Therefore, private car commuting has remained as a major source of urban air pollution.

The Business Imperatives

A fundamental premise of the first research effort on telecommuting in 1973 was that, if telecommuting was to succeed, it had to have quite positive impacts for businesses. Ideally, telecommuting had to have positive impacts for both employers and employees. Consequently, the research component of that and several subsequent projects included a variety of measurements of both economic and socio-psychological impacts. Experience since that early project has reinforced the belief that a minimum requirement for acceptance of telework is a positive impact as perceived by employers.

The competitive pressures discussed above have provided an appropriate setting for persuading employers to test and adopt telework. One (or a combination) of 4 main business factors are typical of the primary reasons why many businesses choose to adopt telework:

1. **Office space savings**. Depending on the fraction of the company's workforce engaged in telecommuting, and the frequency with which they telecommute, companies have discovered that they can save as much as half of the office space they would require in a traditional work setting. For example, an advertising agency in the Los Angeles area built a new office building that was sized to accommodate no more than 60 percent of the company's staff. The new building had an open form layout primarily conducive to meetings between staff members or between staff and clients (it has since returned to a form with more privacy). At least 40 percent of the staff telecommutes on any given day.
2. **Productivity increases**. Although one of the primary fears of supervisors is that teleworkers will have significantly reduced productivity, as compared with their coworkers, a series of tests over the past 25 years have demonstrated consistently that teleworker productivity is higher than that of office-bound workers on average. In individual cases the productivity gains can be as high as 300 percent, although the average is in the 5 to 25 percent range, depending on the type of organization and the level of the worker. [The degree of productivity improvement is somewhat correlated with the salary of the worker; greater productivity increases for higher paid workers.] The productivity change can be measured not only as higher output, but as more creative output where creativity is a crucial aspect of the work. Both of these attributes help increase a company's profitability, adaptability, and flexibility; vital for coping with changing market conditions.
3. **Employee retention or recruitment**. Usually, employees who are allowed to telework feel a greater sense of obligation or loyalty to their employers (again, in contrast to the expectations of prospective telemanagers). Several impact studies have demonstrated that employees who are allowed to telecommute are less likely to leave their employer for another. Many organizations have also discovered that telecommuting can be a powerful inducement in recruiting new employees. For example, Autodesk, a world leader in design software and digital content creation, has chosen telecommuting as one of the primary components of its Future Work Now program for employee retention.
4. **Good citizenship**. Although rarely the primary motivator, adoption of telework often allows the company to demonstrate that it is a good corporate citizen, is forward looking, and is a desirable place to be employed. In some areas with strict environmental regulations, such as the Los Angeles, Atlanta, and Puget Sound regions, there are additional regulatory inducements to companies that reduce the fraction of their employees who use cars to commute to work. As traffic, and the air pollution accompanying it, continues to grow in most American cities this motivation increases in importance.

There are several other economic arguments for companies to adopt telework. Among them are: reduced use of sick leave; reduced demand for parking spaces; lowered demand for retraining; and the ability to establish facilities at lower rents away from urban or suburban centers. But, even without these additional benefits, companies have learned that they can enjoy a combination of reduced costs and improved performance annually of as much as 50 percent of each teleworkers salary, even after including the costs of supporting telework.

Who is doing it

The result is that most of the more than 20 million teleworkers expected to be active in the United States by the end of 1999 work for employers who have made their telework adoption decisions on the basis of one or more of the four criteria just discussed. Approximately 70 percent of those employers are small to medium-sized businesses (80 percent of the businesses in the *US* are very small—with 10 or fewer employees). Large organizations tend to adopt telework more slowly than do smaller concerns, primarily because of the higher levels of bureaucracy in larger organizations.

Some examples may serve to illustrate the differences. Although the first telecommuting tests were done with an insurance company in Los Angeles in 1973, using a group comprising underwriters and claims adjusters, most of the telecommuting adopted by other members of the insurance industry has been provided for routine workers. For example, CIGNA's telecommuting program includes many clerical production people, not just sales or professional/managerial staff employees. CIGNA's initial motivation for its project in 1991 was simply to improve the working environment for its employees. However, the company soon realized that there were significant business advantages to this policy. The company lists the following key benefits of the initiative.

- Enhanced ability to attract and retain employees;
- Productivity improvements;
- Reduced environmental pollution through reduced auto commuting;
- Reduced employee stress and more balanced work and personal life;
- Operating/capital cost reduction—the company can grow without proportionately adding to real estate expense; telecommuting currently saves the company at least USD24 per square foot in real estate expense. That saving translates into millions of dollars annually.
- A survival/continuity aid in emergency situations; for example, CIGNA employees telecommuted after the 1994 earthquake in Los Angeles rather than risk spending four hours daily fighting traffic or risking not getting to work at all;
- An aid in employing disabled people who can't readily commute;
- Faster return to work for employees with temporary disabilities.

Autodesk, a leading supplier of PC design software and digital content creation, had similar motives in creating its Future Work Now (FWN) program. Designed to reduce job stress and improve employee satisfaction in the high intensity Silicon Valley software industry, the program includes flexible work hours, telecommuting, and even sabbatical leave every four years.

Although the program first started as recently as 1996, by mid-1999 half of the company's more than 3000 employees were telecommuters, and 10 percent of the employees were telecommuting essentially full-time. Autodesk does not have quantitative estimates of the productivity changes brought about by the telecommuting. However, one example gives an indication: the Kinetix division, where the initiative began, continued to meet its rapidly expanding commerce goals and business volumes without increases either in the number of personnel or their stress levels.

The FWN program has also served as an effective recruiting tool in the frenetic Silicon Valley employment environment. Autodesk has a competitive advantage because of the attractiveness of telecommuting in a region with serious traffic congestion problems. Furthermore, the existence of the FWN program aids teamwork of Autodesk employees since they are less constrained by physical separation; team members can be at home or in any of the company's many facilities and still work together effectively.

The AT&T telecommuting initiative provides another scale entirely. With annual revenues of more than USD51 billion and some 126,000 employees, AT&T provides services to more than 280 countries and territories around the world. Initially, AT&T looked at telecommuting as one method to meet provisions of the federal Clean Air Act, one primary objective of which was to reduce air pollution produced by automobiles. The company's telecommuting implementation projects began with tests in Los Angeles, California, in 1989 and in Phoenix, Arizona, in 1990. Upon analyzing the test results, AT&T discovered that telecommuting provided a number of benefits to the company and to its employees.

AT&T then spent almost four years in developing an overall implementation plan and employee education procedures. By mid-1994 the educational material development was completed and the company announced a company-wide Employee Telecommute Day on 20 September 1994. When Telework Day finally arrived even the Chairman of AT&T, Robert Allen, telecommuted from home. After the official inaugural day, the company began setting up long term telecommuting arrangements with a growing number of employees. By late 1998, of AT&T's 126,000 employees, more than 30,000 (half of the 55,000 managerial and professional staff) telecommuted regularly from their homes.

The company has experienced clear productivity gains by its telecommuting employees, increased employee retention, about USD500 million in cash flow and about USD 3,000 to USD 5,000 per person in reduced demand for office space. In fact, AT&T managers surveyed in 1998 stated that telecommuting is an aid to recruiting , as well as a benefit to employees. Benefits to employees include greater flexibility in meeting work and family demands, decreased living expenses (smaller dry cleaning bills, lunch costs, etc.), and greater feelings of self-empowerment. Benefits to the community include decreased levels of traffic congestion and its accompanying air pollution (or at least reduced rates of *increase* of these), as well as greater participation by AT&T employees in community activities.

Growth in acceptance of telecommuting has not been confined to the private sector. In fact, one of the earliest large telecommuting development programs, for the state government of California, was initiated partially as a means of demonstrating to the private sector that telecommuting made economic sense. This project, the implementation phase of which began in 1987, was the culmination of planning efforts initiated in 1980. Another purpose of the project was to demonstrate that telecommuting was feasible and attractive for a wide variety of organizational settings and types of jobs. However, the need to reduce the demand for office space was the trigger motivation for the project. Ultimately, 15 different state agencies and more than 300 telecommuters participated in the project. Training of the telecommuters and their managers began in late 1987 with formal telecommuting beginning in early 1988. The evaluation of the impacts of telecommuting continued through 1988 and 1989.

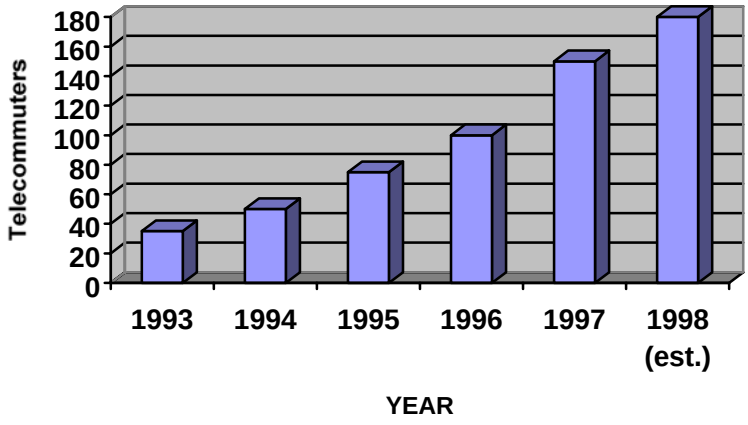
By 1990, when the project evaluation was completed, it was clear that the primary goals had been achieved. In particular, a number of the initial apprehensions and misconceptions about telecommuting had been resolved or disproved. Table 4 summarizes some of the results. As of mid-1999 there were more than 12 thousand state employees who were regular teleworkers, most of them teleworking from their homes.

Table 4: Some conclusions of the state of California telecommuting project

Assumption/Concern	Outcome
Productivity of the teleworkers will drop	It rose by an average of 9%
Technology costs will be excessive	They were negligible, compared with the productivity increases
Employee loyalty will plummet	It rose significantly, as evidenced by the major reduction in employee departure rates
There will be no impact on traffic	Teleworkers do not use their cars when teleworking, nor does anyone else in their households
There will be no impact on the environment	No car use, no exhaust emissions
There will be an increase in urban sprawl	No net effect was detected; some teleworkers moved farther from their main work site, as many moved nearer.
Teleworkers will feel left out of the social activities in the workplace	No detectable effect
The management burden will increase	Direct supervisors felt that their management efforts were made easier

Although telework is often thought of as confined to what are clearly termed information industry companies or government agencies, its applicability is much greater. Georgia Power, with more than 8000 employees, serves as a case in point. In the early 1990s, Atlanta Chamber of Commerce officials asked Georgia Power to develop a model commuter efficiency program. Such a program was needed because the city's declining air quality, specifically ozone, was becoming an issue. With that in mind, Georgia Power initiated several telecommuting test cases, all of which proved very successful. The motivation for expansion of the program soon turned to space saving.

Figure 8: Evolution of the telecommuting program at Georgia Power Company



But as air quality has become more and more of an issue, the company found that increasing numbers of employees wanted to telecommute, especially during the summer when so-called "smog alert days" are declared. Until recently, the existing computer infrastructure hadn't

allowed the company to expand the program. Now the company has upgraded its entire system to Windows NT and is beginning to expand the use of telecommuting. Figure 8 shows the growth pattern.

Barriers and constraints

A common question posed by someone who has recently investigated the nature of telework is: "if telework is so great, why isn't everyone doing it?" There are several important constraints and barriers affecting the rate of growth of telework in the United States and around the world. These are reviewed next.

Cultural barriers

The cultural barrier that is by far the most powerful and important in regulating the rate of diffusion of telework is tradition. The overwhelming majority of companies, when queried about their attitude toward telework, answer with words to the effect of: "how do we know that they're working if we can't see them?" In short, there is an innate lack of trust between supervisor and employee or an automatic reaction based on long familiarity with the standards of the industrial revolution. Indeed, contemporary business culture in the developed world is based on the industrial model: centralization of resources and employees. This model is one of the implicit assumptions in most corporate and managerial thinking.

Although many organizations in the United States talk about the importance of training, the level of training provided by corporations to their employees is far lower than that provided to European employees. Typically, when a person in an American company is promoted, it is usually to a management position in order to achieve a higher salary level. Generally, the promotion is not accompanied by management training; again unlike in Europe, the employee is expected to get such training, if any, on his or her own. Most employees, therefore, do not receive management training. Prompted by their nervousness about their new responsibilities, these new managers tend to hope that they can retain control of their new organization unit only if all their subordinates are in the office most of the time; the "management by walking around" theory.

Consequently, such managers can be severely stressed upon learning of the possibility that one or more of their employees may soon be working remotely. Since good management skills are typically not inherited, but must be taught, these managers understandably become very resistant to such a change. They, like many organizational cultures, are risk averse.

Therefore, it is vital to the success of telework that prospective telemanagers be given training in the techniques of remote management. This includes developing one-on-one negotiation skills, responsive feedback habits, adaptive scheduling capabilities, and communications skills by other than face to face means.

These factors also apply to the organization as a whole. If the entire culture of an organization is very hierarchical and centralization-dependent, there is little chance that it will be successful in adopting telework. If, on the other hand, the organization has a network structure, or a small number of hierarchical levels, and promotes free interchange among its employees, then the chance of success of telework in the organization is relatively high.

The key to success of telework in an organization is the development of high levels of trust between managers and their employees. This admonition by no means implies a blind trust; the trust must be based on periodic verification that it is appropriate. The success of this approach

has an interesting side effect: the burden of responsibility in a telework organization shifts in some sense from manager to teleworker. It is no longer the responsibility of the manager to be a police officer keeping an eye on the worker to make sure the work is performed. Rather, the teleworker, having previously agreed with his or her supervisor to produce the required work, now assumes the primary responsibility for its performance. This shift in roles is part of the reason why the productivity of teleworkers is higher than that of their coworkers.[12]

Technology constraints

Information and communications technology available today throughout much of the world is entirely adequate for the support of much higher levels of telework than are now being practiced. Yet, technology limitations are often cited by prospective employers of teleworkers as being either inadequate, or too expensive, or both, to support effective teleworking.

One of the aspects of this issue has to do with accounting practices rather than technology limitations. In most companies the accounting system is quite effective in assessing costs. A telework program usually does involve some additional technology costs, such as the purchase of modems, telecommunications software, firewalls and routers, and the like. In fact, once a telework program has achieved operational status, the primary operational costs have to do with telecommunications charges and technology maintenance costs. However, accounting systems are much less adept at identifying the benefits of telework, such as improved productivity and office space demand reductions, and attributing them to telework.

Still, there can be substantial technology constraints for some types and levels of telework. In cases where high levels of data transfer must be maintained, such as in complex engineering design operations, or full-motion, high-definition videoconferencing, wideband telecommunications may be required. Until the Internet is geared to easily accommodate these sorts of transmissions, the costs of maintaining them over large distances could be uneconomical for a company. Furthermore, where a company is very concerned about protecting its private information, yet needs teleworkers to handle the information, security considerations may also makes the cost too high. Virtual private network technology is rapidly adapting to address these concerns but there is still no single standard for the technology. Companies are basically constrained to use the technology from a single vendor at this point, thereby limiting their options.

Bandwidth constraints are currently an important factor in the typical telework situation in United States. Unlike in many areas in Europe, ISDN lines are not standard household equipment in America. Most home-based teleworkers are restricted to the use of V.90 modems operating at 53 kbps or less. As more and more business transmissions are carried out over the Internet, and as Web pages grow to contain more complex graphics, these transmission rate limitations can become more problematic. Added to this problem is the, possibly more frequent, inadequate capacity of Website servers to handle the demands placed upon them. The increasing availability of DSL and cable modems will materially reduce these problems, at least in the locations where they are available. But universal access to these wideband transmission facilities is still years in the future. That is, both e-commerce and telework face similar technological challenges.

[12] These assertions are based on years of practical experience on the part of companies with large numbers of teleworkers and by consultancies such as JALA international that have developed quantitative measures of the impacts.

Legal and regulatory barriers

There are few legal and regulatory barriers to telework in the United States other than those relating to telecommunications regulation. Those that do exist tend to be local in nature. The most prevalent barrier is a local restriction on home-based work. These barriers are usually erected in order to maintain the residential nature of suburban neighborhoods; zoning laws are enacted requiring that all the buildings in certain areas be residences of one sort or another and that no commercial establishments can be erected there. The intent of these laws is to prevent neon signs or similar advertisements appearing in front of homes and to forbid excessive commercial traffic on residential streets. Strictly speaking, the laws also prohibit any form of working at home. For the most part, the letter of the law is ignored for teleworkers except for cases when a neighbor[13] wishes to make trouble for them.

Since telecommunications are a key element in — and constitute the primary operational cost of telework, telecommunications regulations can have an effect on telework adoption rates. This is further complicated by the fact that, in the United States, the Federal Communications Commission regulates long distance communications while communications inside each of the 50 states are regulated by state commissions. Therefore the prices of communications can vary greatly from state to state, depending on local decisions. Furthermore, while decisions related to telephone technology are usually made at the state level, cable TV is more often regulated by individual municipalities. So there can be at least three levels of regulation that affect the price of, or access to, communications available to a home-based teleworker. Early in 1999 the FCC made a decision that further muddies the water: it decided that ISP's, since they are concerned with the Internet, should be considered as long distance carriers even though their primary reason for existence is to provide local access to the Internet. The implications of this decision are still uncertain.

Future developments

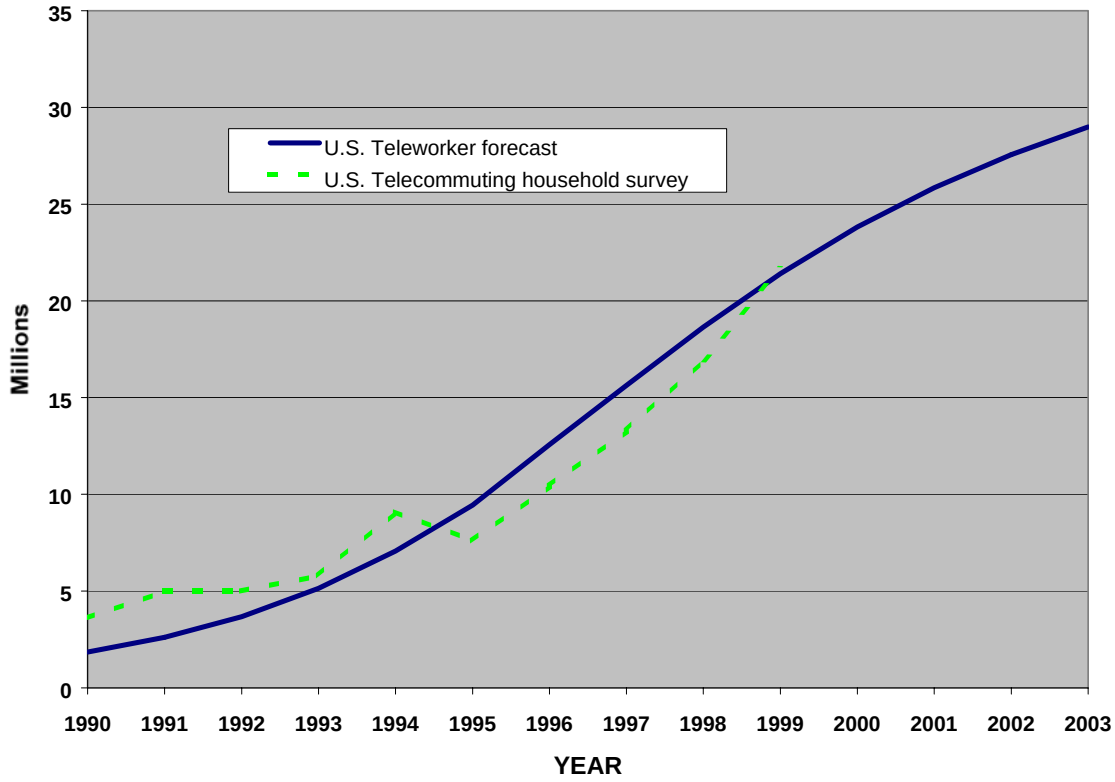
It is essentially impossible to predict the future, particularly in an area that is rapidly changing and subject to a wide variety of influences. Therefore, the following material should be treated as an exposition of the most likely future course of events; the actual future will inevitably unfold somewhat differently than what is described here.

Although surveys and forecasts differ slightly, the general consensus of experts in the field is that there will be at least 20 million teleworkers in the United States by the end of 1999, most of them telecommuters. The rate of growth of telework is beginning to slow, in percentage terms, but multiple millions of teleworkers are still expected to add to the total annually. By the end of 2003 there may be as many as 28 million teleworkers in the *US* Figure 9 shows the details.

The most likely future depicted in the figure is based on the assumption that a number of related trends will continue as they have in recent years. Foremost among these are the continued reductions in the cost of personal computers and telecommunications, and the associated growth in adoption rates of personal computers and Internet access by both businesses and households.

[13] In one case in Los Angeles, a home-based teleworker who also maintained a small recording studio was forced by the local commercial studios to abandon his practice even though there were no complaints from the neighbors and there was no significant increase in local traffic.

Figure 9: Current forecast of telecommuters in the United States.
[Sources: Teleworker forecast by JALA International, Inc. Telecommuting household curve is from (or, in 1999, extrapolated from) Cyber Dialogue surveys]



Most of the growth in telework has been among the managerial and professional staffs of companies and independent contractors. There are exceptions to this, primarily in the insurance industry (such as the CIGNA case) and in activities such as telemarketing. Because of the reduced entry costs of telework, as a result of the decrease in ICT costs, the fraction of teleworkers who hold nonprofessional jobs will steadily increase.

Most contemporary teleworkers in the *US* are home-based. Less than 100,000 routinely work at telework centers. At least three of every five teleworkers are employed by SMEs.

The proportion of teleworkers who are not telecommuters will also increase as a consequence of growth in teamwork among distributed organizations and in the expansion of multiregional and multinational telework-enabled trade. A substantial portion of this growth will be between the United States and EU member nations but growth will also expand between the *US* and several developing countries.

One of the technological imponderables is the rate of diffusion to households of wideband telecommunications technologies. In particular, the race in this area is between cable modems and DSL in most urban areas. Already, reports have appeared in the general press focusing on capacity problems with cable modems when a reasonable fraction of subscribers attempt to access the Internet simultaneously. In 1999 these problems have appeared primarily during evening hours and weekends; that is, when traffic growth is largely unrelated to business activities. However, as the number of home-based teleworkers grows, the likelihood increases that current cable technology will prove inadequate. This, of course, poses problems for those companies with large and growing investments in cable technology.

Access is another central issue in the Internet controversy. Large telecommunications companies that own significant cable infrastructure (and therefore must pay for its installation and maintenance) strongly resist demands by ISP's for access to their facilities. In mid-1999, the primary battle in this respect was between AT&T and AOL. The struggle occurs both at national and local levels.

DSL technology does not have the same "channel stuffing" problems as cable since each of the DSL connections is physically separate (its own pair of copper wires) from the others. But DSL has other physical limitations in that its message carrying capacity is an inverse function of the distance of the subscriber from the telephone switch. Furthermore, in the murky regulatory environment in the *US* the local telephone carriers have been slow to move to diffuse the technology among their subscribers.

An associated regulatory issue is the pressure toward distance independent pricing of voice and data transmissions. Since 20 percent or less of the actual cost of message transmission is distance dependent — the larger part being allocated to switching and translation costs — consumers and businesses are both pressing the regulatory bodies to institute flat rate pricing. Since some of the resistance to adoption of telecommuting or broader forms of telework is related to the cost of telecommunications — particularly for teleworkers who live outside the local, toll-free calling areas — such pricing changes should act to accelerate acceptance of telework.

Diffusion Enhancement Measures and Prospects

This chapter focuses on the public policy initiatives that relate to the continued development of electronic commerce and new ways to work in United States. Public policy at almost all levels of government can affect the adoption rates of both of these technology applications.

The Policy Background

National

The seminal innovation that resulted in development of the Internet was the decision by the Defense Applied Research Projects Agency (DARPA — an agency of the *US* Department of Defense) in the late 1960s to develop a communications network that would be essentially impervious to a nuclear attack. The central concept to that development was that of splitting messages into individual packets, each packet containing the address of the intended recipient and the sender, and sending them by whatever route was readily available at the moment. The ability of a message to go from point A to point B did not depend on the existence of a specific communications path; if one intervening communications node was inactive, the message could go forward via an alternative route. Although initially confined to communications among the defense agencies and universities, the ARPANET was transformed into the Internet within the past decade.

Probably the most important overall policy action at the national level in the 1990s is the National Information Infrastructure (NII) initiative promulgated in 1993 as a cooperative venture between the public and private sectors. Its primary purpose is to accelerate development of the hardware, software, networks, and systems needed to provide the world's best information access to ordinary Americans. The NII can be viewed as three layers of functions: applications, services, and bitways, as shown in Figure 10.

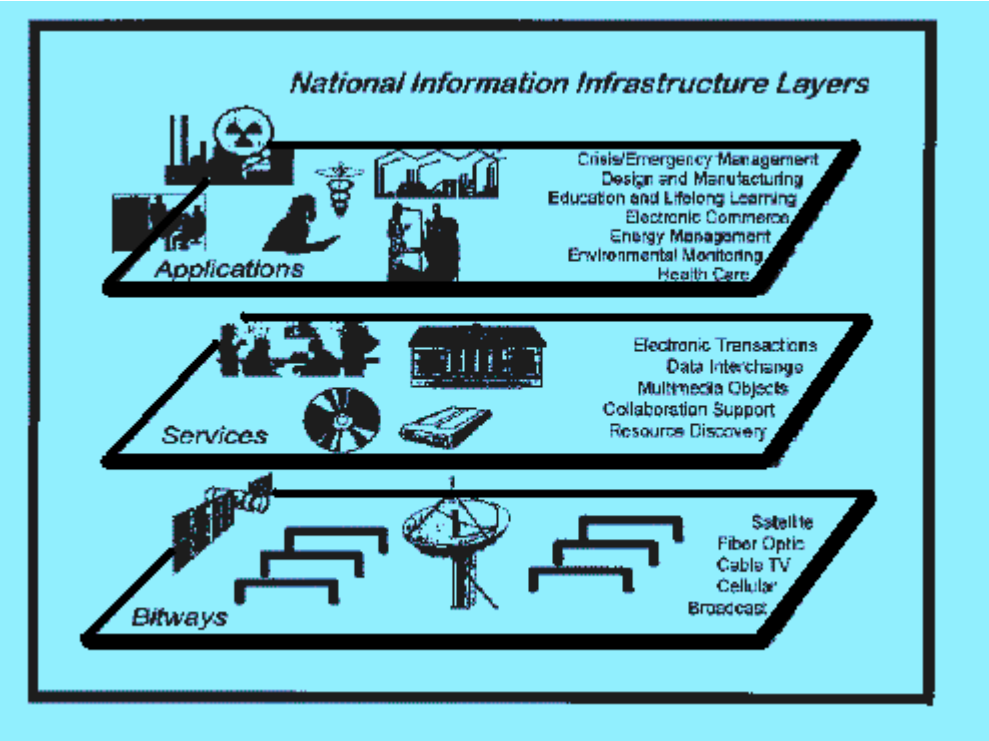
Applications are information technologies that can be used to accomplish tasks across a range of application areas.

Services provide the building blocks for applications and provide the interfaces for displays, sensors, and other input/output devices. For example, a library retrieval system would require at least two services to complete an information exchange: a text search service and a file transfer service.

Bitways, or physical infrastructure, are the "data pipes", the cable, fiber optics, and other means of transmission, plus controlling software to transmit data from one place to another.

Although the national information infrastructure is not directly associated with specific federal funding, it has had an impact on funding decisions by many federal agencies. The primary impact of the initiative was to raise public awareness on the need for a comprehensive infrastructure that could materially aid the country's growth into the information age.

Figure 10: Structure of the National Information Infrastructure initiative.



Source: US National Information Infrastructure Report

The Telecommunications Act of 1996 was the first major overhaul of telecommunications law in almost 62 years. The goal of the law was to let anyone enter any communications business and to let any communications business compete in any market against any other. In particular, the act authorized the Federal Communications Commission to create fairer roles for competition in this new era. The FCC was to act to open up local phone markets, increase competition in long distance telecommunications, and a variety of related steps. As of mid-1999, however, the results are mixed. Although some competition is finally becoming apparent in selected urban markets, the promise of the law is far from fulfilled.

The federal government has also played a role in the establishment of telework programs for federal employees. The Flexiplace initiative was begun by the Office of Personnel Management and transferred to the General Services Administration in 1995. By mid-1999 more than 25,000 federal employees were teleworking, some of them at telework centers established by the government in the Washington, DC region. The General Services Administration also had a role in the use of electronic commerce, particularly in the development and application of EDI techniques for federal purchasing.

Over the past decade federal agencies, notably the Department of Transportation and the Environmental Protection Agency, have produced positive reports on the possible impacts and future of telecommuting. In 1985 the National Academy of Sciences also produced a report, entitled Office Workstations in the Home. However, there has been little direct federal funding of telework research[14] or for implementation of telework in other than federal agencies.

In July 1997 the White House issued a report "A Framework for Global Electronic Commerce" that elucidated five major principles:

[14] The initial test project in 1973 and a later review of telecommuting; both projects were small (less than USD100 thousand) and funded by the National Science Foundation.

1. the private sector should lead;
2. governments should avoid undue restrictions on electronic commerce;
3. where government involvement is needed, its aim should be to support and enforce a predictable, minimalist, consistent and simple legal environment for commerce;
4. governments should recognize the unique qualities of the Internet; and
5. electronic commerce over the Internet should be facilitated on a global basis.

A variety of issues was covered in the report, including: customs and taxation; electronic payment systems; the development of a uniform commercial code for electronic commerce; the protection of intellectual property; privacy; security; telecommunications infrastructure and information technology developments; content on the Internet; and technical standards. One crucial statement was included in the background section: "knowing when to act and — at least as important — when not to act, will be crucial to the development of electronic commerce." So far, the government has adhered to the principles in the report by, for example, instituting a moratorium on taxation of the Internet.

Some other federal initiatives are more controversial. In particular, the current ban on export of high-quality encryption software has met with considerable resistance on the part of the software industry. The federal position is that all high-quality encryption software should have a "back door" by which law enforcement agencies could intercept and decrypt encrypted messages. The rationale for the position is that otherwise law enforcement agencies would be unable to successfully intercept the message traffic of lawbreakers such as spies and illicit drug traffickers. This issue has escalated to the international scene since other governments have similar positions.

State, regional and local

One of the major principles in the *US* Constitution is that of states' rights. Specifically, individual states of the United States have the right to maintain their own laws and to have their own constitutions as long as they do not conflict with the *US* Constitution. Among the impacts of this is that there are federal laws governing interstate commerce and state laws governing commerce within the individual states. There are regional and city-specific laws as well.

Consequently, each state has its own Public Utilities Commission, or equivalent regulatory body, that regulates telecommunications, electric power networks, air, train, rail, and road commerce, among others. Although the FCC can act to increase competition among the long distance carriers, the cooperation of state commissions is also required to increase competition locally. Since state commissions set the tariffs for new telecommunications technologies such as ISDN and DSL, rates for these services can vary widely among the states.

The picture becomes even more complicated in the case of Internet access via cable. Most cable franchises in the *US* are regulated by agencies of city governments. Thus there is yet another regulatory layer for a cable provider to cope with in order to offer ISP service on its cable system. Compounding the difficulty is the desire by the cable provider to maintain its own ISP service, as against the desire of other ISPs, such as AOL, to have access to the cable service. In Los Angeles, for example, this struggle was going on as this report was written (AOL appears to have lost).

Over the years, state and local governments have aided the development of telework with a number of initiatives. These have included the promulgation of air quality regulations that

require employers to reduce employee use of automobiles by means of a number of alternatives, including telework. Furthermore, state and local governments, particularly on the West Coast of the *US*, have shown great initiative in mounting telework demonstration programs. The first of these was begun by the state of California, followed by the states of Arizona, Washington and Oregon, and the city and county governments of Los Angeles. While most of these projects were confined to the government employees, the state of Washington project included private corporations such as Hewlett-Packard. Several states have enacted laws requiring state agencies to include telework either as part of their work options or in their disaster preparedness planning.

There have also been many attempts to enact tax incentives for telework in many states. California legislators have introduced various incentives since the early 1990s. The proposed incentives have included tax credits, rebates, prohibitions, and grants to nonprofit organizations. However, with one exception—in Oregon—none of these initiatives has been enacted into law.

Conclusions

The following is a summary of the conclusions reached during the preparation of this report. Many, but not all, of the conclusions are specifically mentioned (although rephrased) in the body of the report.

General

- Reliable data on either e-commerce or new ways to work are very hard to find. Most data publicly available are devoid of statements about assumptions, sample parameters, errors, and the like. The incredible rate of growth of Internet-related business activity, coupled with the reluctance of the players to release details, makes quantitative analysis—well, exhilarating.
- Non-governmental organizations, particularly standards bodies, are working intensively to provide the technical-protocols for more effective e-commerce and telework, with significant results due in the next two years.
- Most of the impetus for development of e-commerce and telework has come from the private sector.
- State public utilities commissions and local governments impede the rate of development of both e-commerce and telework by issuing regulations that vary from state to state and from locality to locality.

e-commerce

- Interest in e-commerce is already high in the US, in almost every sector of the economy, and is rapidly becoming pervasive in the business world.
- The greatest part, on the order of three-quarters, of e-commerce is business-to-business.
- The primary deterrent for growth in business-to-consumer e-commerce is the level of concern for security and privacy of transactions.
- New, online-only firms are growing in number, including such conservative sectors as consumer banking.

- The United States appears to be at least two years ahead of the rest of the world in the development of electronic commerce.
- The primary deterrents to international e-commerce, especially among SMEs, are the bewildering array of documentation required for transaction processing, the uncertainties in international payment systems and processes, and the reluctance of consumers in other countries to purchase products online (see the supplemental report).
- It is unlikely that companies that have never made a profit and have been in existence less than a decade can continue to enjoy multi-billion-euro stock valuations. The 18th century "tulipmania" comes to mind.
- The role of the US federal government in the development of e-commerce has been relatively minor, with the following important exceptions:
  - Financing the initial development of the Internet
  - Using EDI for federal purchasing activities.
  - Issuing a moratorium on e-taxes until 2001
  - Delaying the general acceptance of strong encryption because of concerns about its use by drug runners, terrorists, spies, and other undesirables.
  - Revising the telecommunications laws to encourage competition—but with subsequent court decisions approving mergers acting to reduce competition.
- The chief innovators/implementers of e-commerce and teleworking appear to be located along the east and west coasts—plus Texas.

New ways to work

- The United States appears to be at least five years ahead of the rest of the world in the development of new ways to work.
- The large and growing number of US teleworkers is primarily the result of individual decisions by organizations in both the public and private sectors that teleworking is good for business (increased effectiveness, enhanced retention/attraction of employees, and cost reduction as the top three motivators).
- The current economic climate in the US (excess demand for skilled workers) will act to increase the levels of teleworking, both for telecommuting (local workers) and national to international teleworking.
- State and some local governments have helped promulgate telework by mounting well-publicized and successful telework programs for their own employees.
- The federal government has supported telework by developing its own internal telework policies and by releasing studies of the environmental, energy and transportation benefits of telecommuting.
- Federal air quality regulations have had an effect in increasing awareness of telecommuting in congested urban areas, such as Los Angeles and Atlanta, and have triggered some municipal demonstration projects. However, subsequent local weakening in application of the regulations has reduced their impact. Recent reinvigoration of the regulations may reverse the decline.

- Unlike the European Commission, the US federal government has largely failed to support research, conferences, or demonstration projects related to telework, with the exception of a few small research projects in the early 1970s and 1980s, and partial support of the Telework America series of conferences.

Recommendations

The following are our recommendations for further progress in e-commerce and new ways to work. Although the recommendations are specific to the United States, they should be applicable to most countries. The opinions expressed here are those of the author and not necessarily subscribed to by other members of the project team.

Awareness raising

The effects of both electronic commerce and telework are profound and pervasive. It is essential that all citizens have at least some understanding of their implications.

One of the prime functions of any government is to raise awareness and help develop informed discussion, if not consensus, among its citizens. As the information technology infrastructure of the US develops, it is important for the government to proactively explain its importance through the public media. Yet most federal agencies appear to be deficient in public-awareness raising, seeming to consider advertising and promotion as listed somewhere among the deadly sins. The government frequently makes proactive policy statements, such as announcing the National Information Infrastructure initiative, the Emerging Digital Economy project, or the federal Flexiplace program, then fails to follow up with a succession of further exhortations.

Each federal agency should have a program in place by the end of the year 2000 to explain repeatedly to congress and the public how e-commerce and telework are—or are not—in its best interest and in the best interest of the public it serves. Furthermore, the Departments of Commerce and Transportation and the Environmental Protection Agency should have specific outreach programs to vigorously encourage teleworking.

In addition, an interagency commission should be formed with the explicit mission to explore *and implement* ways in which each agency can contribute to public understanding.

Education

The quality of a country's education system determines the country's future. Although it is often said that ten-year-olds know more about the digital economy than do their parents, the fact is that a substantial fraction of the population—of all ages—is "behind the curve" in its ability to adapt to an intensively digital world. Furthermore, as demonstrated in a federal report,[15] the gap between the information haves and the have-nots is widening.

It is clear from the activities and results summarized in this report that the digital world is upon us and is not about to go away. Therefore it is imperative that government act in the best interest of all its citizens by intensifying its efforts to improve educational standards and to increase emphasis on learning 21st century survival skills. At the federal level this may merely mean some shifts in emphasis and in strengthening such areas as the science education support of the National Science Foundation.

[15] Falling Through the Net: Defining the Digital Divide. Washington, DC: Department of Commerce, National Telecommunications and Information Administration. www.ntia.doc.gov/

At state and local levels, it is clear that these skills need to be taught in every area from kindergarten to adult education programs. For adults who are the victims of "structural unemployment" the task is by no means simple, but it is necessary nevertheless. Because of the continuing acceleration of change in the workforce, the acquisition of fundamental skills (logical reasoning, problem formulation, problem solving, mental flexibility) is vital to the continuing development of the workforce.[16] Many school systems, colleges and universities are already working toward these goals, so our only advice is: work harder and more effectively.

Possibly the most important area is in what has long been called "continuing education": something we all should do but rarely get around to. Here, the private sector may be taking over the primary educational role (for example, the many self-instruction, CD-ROM-based Microsoft Certified System Engineer programs and the like). In cases like the example, there is a well-defined educational product, certification, and a well known demand for skills—independent of the particular desires, biases, or whims of local school boards. Perhaps this mode of education will grow to surpass and make obsolete the traditional public school system, but that discussion is beyond the scope of this report. Nevertheless, a fundamental 21st century certification requirement is a certified ability to think logically and quantitatively.

American employers are notorious for spending far less time on employee training than their EU counterparts. High tech industries tend to support graduate education for their professional staff, at least in the form of tuition reimbursement. But, for the most part, employees are left to their own devices to augment their education. One side effect of this is the surge in demand for workers from other countries (i.e., teleworkers and short-term immigrants) to fill the demand for high-tech skills at low cost. This can be good news for the foreign workers and bad news for the US citizens. One approach to resolving this issue is to require American employers to provide certain minimum levels of training for all of their employees, but this argument has so far failed to prevail in Congress.

Pilot programmes

State and local governments have mounted successful telework programs for their own employees—and in some cases those of other government agencies and private companies—and published their results for all to see. These have invariably helped increase awareness of telework and provided facts to refute arguments against it. Federal funds should be allocated to all of the urban regions to develop more such programs, preferably ones with participation from both public and private sectors.

Currently, the funds available for such purposes come from gasoline tax receipts doled out by the Department of Transportation; their allocation is usually decided by people who have little understanding of, and less sympathy for, the benefits of telework. Therefore, the federal government should set up a specific structure for telework demonstration programs that include telework-educated program managers and proposal evaluators.

A well-designed telework demonstration program should include at least one year of active evaluation of the teleworkers, preceded by a one-year planning, design, marketing and training program. Therefore, demonstration projects should be at least two, and preferably three, years in length, should be followed by at least a one-year results dissemination period, and should begin as soon as possible. Priorities should be placed on the urban areas with the most severe air quality and/or traffic congestion problems.

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[16] That glorious day when the machines take over and we are put on perpetual holiday seems as far away as ever to this author.

Standards

Standards can be either grease or sand to the gears of progress. To the extent that they promote broader and/better application or lower costs of whatever is being standardized they are good. To the extent that they impede progress toward those goals they are bad. Electronic commerce has had a well-developed standard in EDI. However, because the cost of its implementation was high, its use was generally limited to large organizations; the smaller producers were left out. XML has the potential to move EDI to the Internet and to provide more universal access, but it is far from standardized as of this writing, although both national and international non-government standards groups are hard at work to correct that. They should be encouraged to persevere in their efforts.

Commercial standards also have been recently revised in the US, largely to the benefit of software suppliers and the disbenefit of consumers. The current revision should ensure a continuing flow of buggy software to computer users who will have little recourse against the manufacturers. This should be stopped immediately but will probably have to go through years of challenge in the courts before redress is obtained.

Much has been said already about encryption standards and related security issues. It is very important that these issues be resolved at the international level if e-commerce—or even international telework—is to flourish. International standards bodies are already at work on encryption standards (mostly focused on who should have access to the keys and under what circumstances) and their deliberations should proceed apace.

One of the means by which organizations can reduce telecommunications costs is by moving traffic from the Public Switched Telephone Network (PSTN) to the Internet. Since maintenance of security is often an issue in this decision, many organizations prefer to use virtual private networks (VPNs) to carry their Internet messages. The problem lies in the fact that there are no VPN standards; consequently companies must use the same proprietary VPN services for all of their branch offices and teleworkers—reducing competition. Although work on developing standards continues, it should be accelerated so that VPN access becomes widely available and competitive by 2002.

The failure to address labor standards issues may become a major deterrent to the spread of telework. What may be considered exploitation in country A might be considered a bonanza in country B. Whose standards should prevail? If an employer in country C violates the standards for a teleworker-employee in country D, who is punished and by what mechanism? These and related issues apparently have not been addressed by any international standards body.

Telecommunications policy and pricing

The intent of the 1996 Telecommunications Act was to increase competition at the local and long distance levels. Ensuing events, particularly the rash of mergers among “baby Bells”, as well as the failure of either major price reductions or improvements in services to appear, have caused considerable doubt as to the Act’s efficacy. The rapid increases in interest in the Internet have caused market shifts that were likely not envisioned when the Telecommunications Act was passed. Prices for higher than voice bandwidths vary widely from state to state—and even within states. Availability of wideband services also varies widely, even among municipalities—and certainly in rural areas. All of these issues are compounded when international telecommunications traffic is included in the equation.

Many regulatory bodies are involved in telecommunications pricing, from the Federal Communications Commission down to municipal cable franchise agencies. There is no

coherent national policy or enforcement mechanism to provide a set of pricing standards. Rather, city councils and state public utility commissions are free to set whatever pricing guidelines they feel are appropriate. The result is that wideband telecommunications services are less widely available in the United States than they are in Europe and elsewhere.

This situation must be changed. Telecommunications pricing, availability and access at some minimum level of bandwidth suitable for the Internet should be uniform throughout the country.

Unfortunately, the central issues are political and jurisdictional; hence not readily solvable in short order. The initiative for more uniform practices is not likely to be taken by the telecommunications companies themselves, based on recent events, yet there appears to be no other organizations with national scope as well as pervasive local presence. In fact, American antitrust laws may prevent them from working in concert. Congress took years to produce the current Telecommunications Act and does not seem likely to repeat the effort in the near future. What's left is a grassroots campaign mounted by consumers, not entirely impossible given the activities and activists on the Internet.

Incentives

The primary incentives needed to encourage the growth of e-commerce within the US are a lack of disincentives. That is, maintenance of the current situation. The one imponderable lurking in the future is the taxation issue: what, if any, agencies will be allowed to tax e-commerce?

Still, there is the clear possibility that large, Internet-based businesses may out-compete small, local businesses, often by price competition but also by having a wider array of products and services. There is the alternate possibility that many small-Internet based businesses can successfully outmaneuver their larger competitors. But a primary characteristic of SMEs is a lack of capital. Therefore, it might be in the best interests of the country—in order to maintain a balance between large and small business—to subsidize e-commerce developments for SMEs, such as by preferential low cost loans from the Small Business Administration—accompanied by suitable levels of business/technology training. We recommend that the SBA investigate the possibilities of such a venture within the next year.

A somewhat similar situation exists for telework. Many state legislatures, particularly on the West Coast, have introduced bills providing incentives of one sort or another to increase the rate of acceptance of telework. To the best of our knowledge only one such bill was finally passed and enacted, with unknown consequences. More important are the incentives, including parking subsidies, for workers to continue driving alone to and from work and the fact that vehicle and fuel taxes fail to compensate for the environmental, health, energy, and economic damages inflicted by commuting as it is practiced in the US. Gasoline is far too inexpensive in the US. One-third of the area of most cities is devoted to automobile and truck transportation. But direct attacks on these icons of the American psyche are likely to be counterproductive. The only country we know of that directly and successfully addresses this issue is Singapore (see the supplemental report) with its very large duties on private automobiles and bans on most automobile traffic in the central city.

At the local level, the most desirable incentives are those that give tax breaks for home-based teleworkers, none of which have been enacted into law. Rather, some local codes discriminate against teleworkers, lumping them into more general undesirable categories of home-based enterprises such as certain personal services. The City of Los Angeles, for example, has passed an ordinance allowing many types of home-based businesses as long as they do not advertise —

but do pay for a business license. This should be encouraged. Furthermore, as long as Congress enacts tax laws that provide special benefits for certain interest groups, such as large corporations, teleworkers should receive equivalent attention since they now exceed 10% of the US workforce.

Special Supplement: e-commerce and new ways to work in key countries

Introduction

This is a special supplement to the main report on e-commerce and new ways to work. It explores these topics as they relate to ten countries outside the European Union, the United States, and Japan. These countries represent potential major powers in the economic landscape of the future. They include the largest countries in Asia (China and India); the so-called Asian Tigers of Southeast Asia (Indonesia, Malaysia, Singapore, Philippines, and Thailand); the main forces in South America (Argentina and Brazil); and one other member of the OECD, Australia.

The available data concerning e-commerce and new ways to work are considerably more sparse for these countries than for Europe and the United States. They are basically non-existent for some of the Asian countries covered here. Consequently, a substantial portion of the quantitative aspects of this report relies on input data from the World Bank (1999 World Development Indicators) and the outputs of a mathematical forecasting model developed by JALA international, Inc.[17]. In general, reliable data are only available, if at all, for 1997 and 1998. Therefore, the results presented here should be viewed primarily as strong indicators of the current and future situations in these countries rather than as the results of in-depth surveys within the countries.

A chart showing the changes in composition of the workforce is shown for each of the ten countries in this report. All the charts show four-sector distributions rather than the "normal" three-sector analyses, since the growth of the information sector of each economy is critical to the main themes of this report.

Both the telework and e-commerce models are built upon the primary assumption that the pattern of developments in other countries will follow those of the United States in terms of historical changes. Thus, the charts describing the growth for these countries show a nominal pattern modeled after the nature of developments in the *US* but possibly shifted in time.

The telework charts also have an additional curve or curves that serve to correct for differences between the US and each country in per capita purchasing power and in the cost of telecommunications, particularly for Internet access.

Finally, the report for each country includes a brief discussion of some of the special factors, usually political and economic, influencing the growth of these activities.

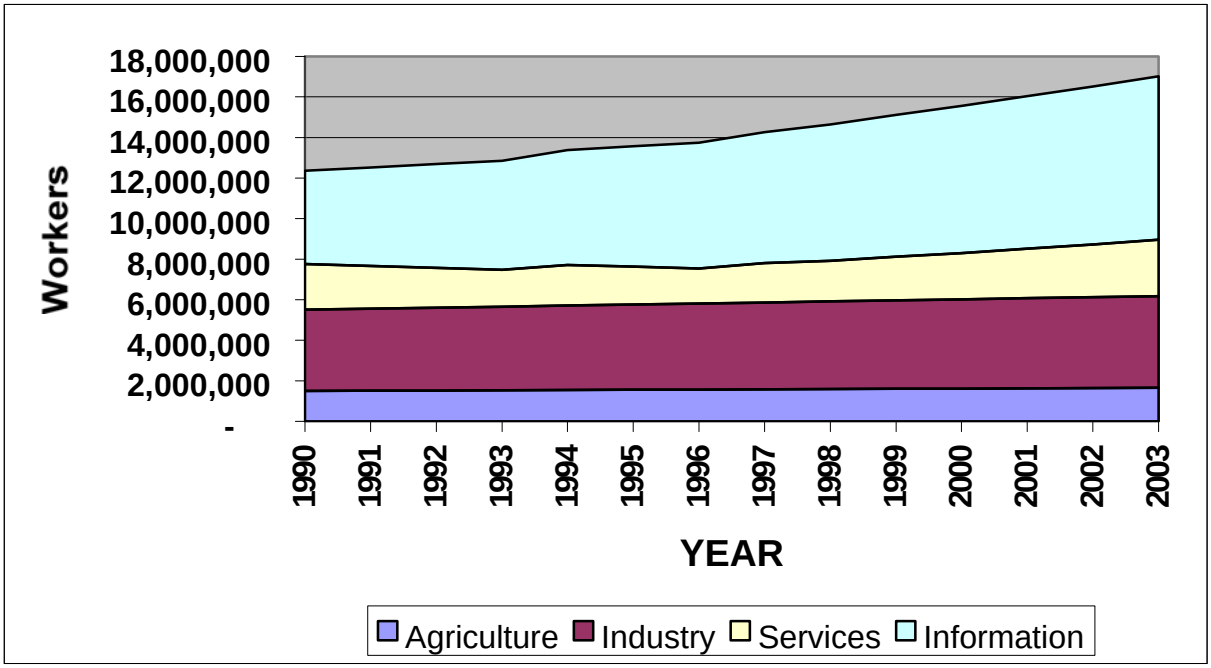
[17] http://www.jala.com

Argentina

The economy

Argentina is often considered to be the most European, and one of the most developed, of Latin American countries. This is evident in an analysis of the composition of its workforce. Figure 11 shows the four-sector analysis of the workforce and its likely growth patterns.

Figure 11: Estimated composition of the workforce in Argentina



The strong and growing information sector is an indicator of likely long-term growth both in e-commerce and new ways to work.

As in the rest of the world, the Internet has been well received in South America. Although the total numbers are still relatively low, roughly 8.5 million Internet users in 1998, annual growth rates are high — approaching 800 percent. Similarly, the number of Latin American Web sites is approaching 500,000.

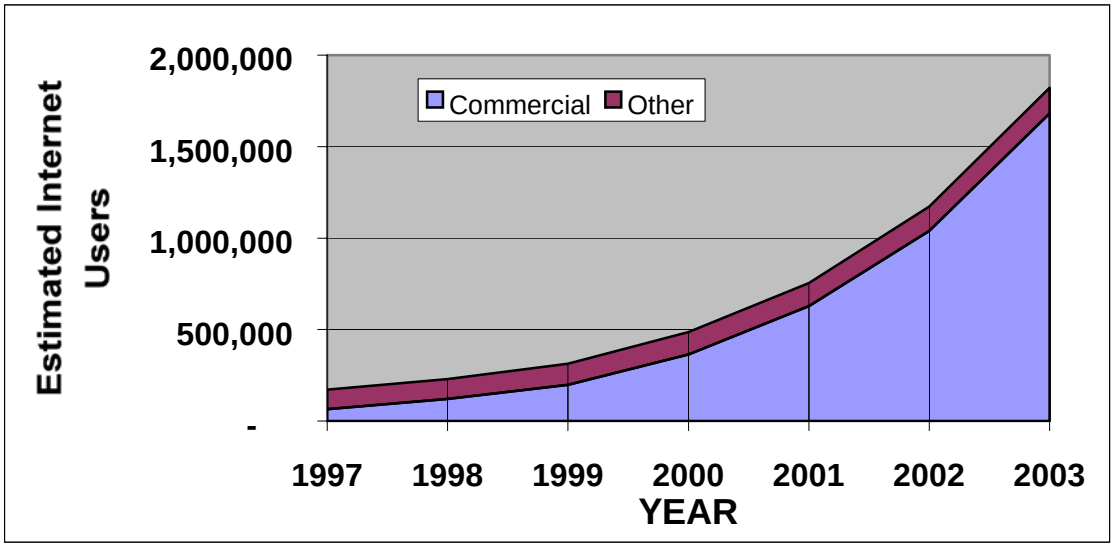
However, like many countries in this transition period, growth in Internet usage in Argentina has been hampered by the relatively high cost of telecommunications. For example, Telintar, the long distance monopoly, was charging up to $32,000 monthly for a 64 kbps international link before the telecommunication reforms began in 1997. The post-reform price for the link in 1998 was $2,000. In mid-1999 the average monthly charge for Internet access, including ISP and telephone costs, was USD54—more than double the cost in the US.

Another barrier to Internet growth in Argentina is the lack of Spanish content Web sites, particularly those with local content. In 1998 there were only about 4,000 Argentinean Web sites. The absence of local content, or the prevalence of English-only content, is a strong deterrent to curiosity of potential Internet users. The lack of region-specific content makes the country dependent on its higher cost international connections for access to information.

In 1997 the privatization process began in earnest. By the end of 1999 there will be an additional two telecommunication carriers competing for business in Argentina. Furthermore, subscribers will then be able to choose their local and long distance carriers. The fixed network

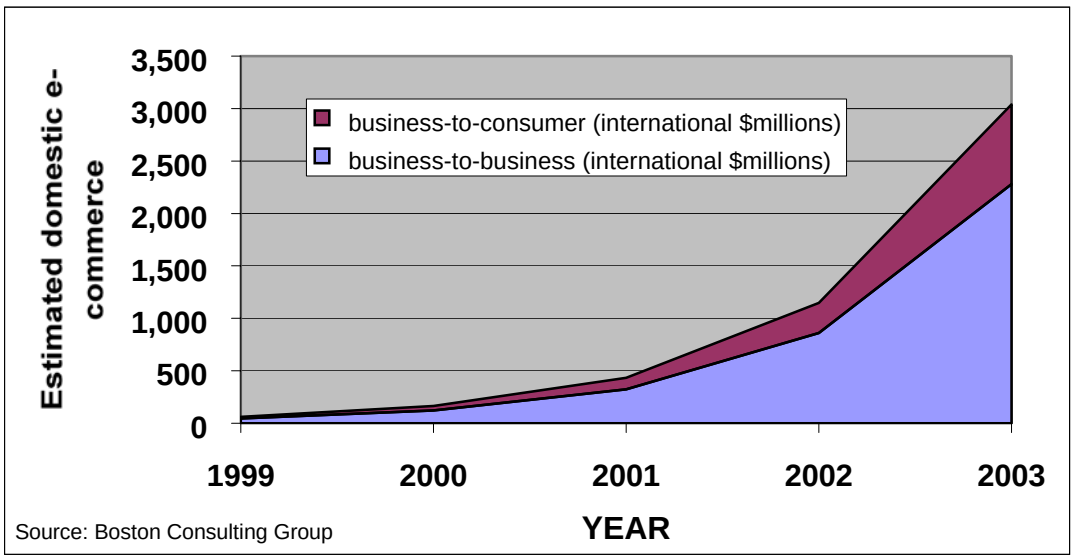
will be completely digital. The consequences of this began to be felt in increased Internet growth in 1997. In addition to the rapid growth rate of Internet access, possibly accelerated by decreasing telecommunications costs, the number of main telephone lines and mobile telephone connections also has been growing rapidly. Our current estimate of the Internet access status and future is shown in Figure 12.

Figure 12: Estimated changes in Internet usage in Argentina.



e-commerce

Figure 13: Domestic electronic commerce in Argentina



It is difficult to find any evidence of electronic commerce in Argentina of a magnitude similar to that occurring in United States and the EU countries, since the financial services infrastructure is not yet ready to support extensive e-commerce activities. Most of the emphasis to date is upon business to consumer e-commerce, with little public evidence of business-to-business e-commerce.[18] Still, as the growth rates of networked computers and Internet access continue,

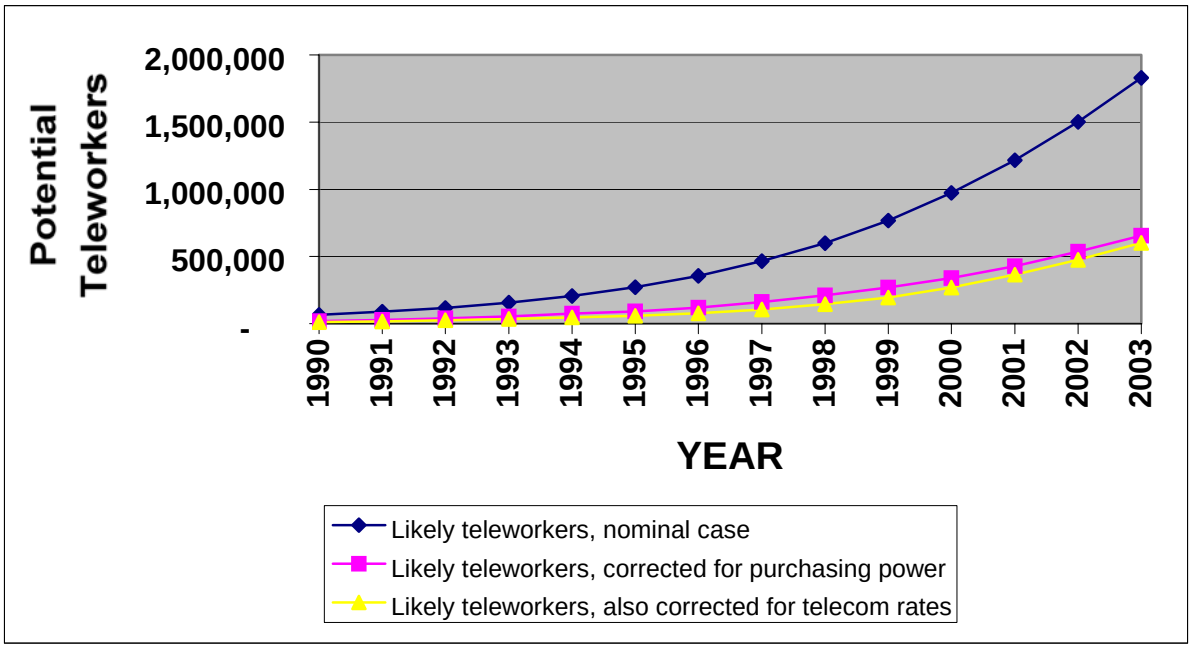
[18] Ingram-Micro, one of the case studies for this report, is represented in Argentina, as are many other multinational corporations.

significant levels of electronic commerce should begin to appear in the next few years. Figure 13 provides our current estimate of the status and future course of electronic commerce in Argentina. The figure only shows domestic e-commerce activity; a roughly equivalent volume is expected in international e-commerce.

New Ways to Work

Approximately one-third of Argentina's population lives in the Buenos Aires vicinity. Like most large cities, with a population estimated at over 12 million in the year 2000, traffic congestion is a growing problem, as is interest in telework. The current forecast for telework in Argentina is shown in Figure 14. Unfortunately, no survey data are available indicating actual status.

Figure 14: Estimated growth of telework in Argentina



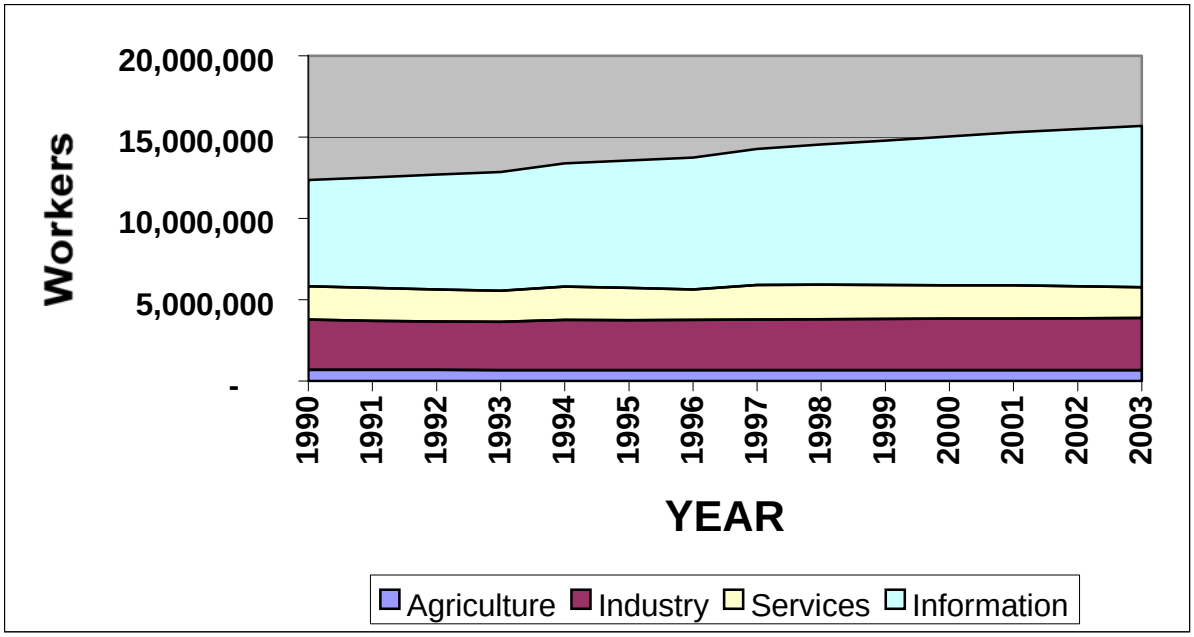
The Argentina government hosted a seminar on telework in 1995 and there has been some effort in the private sector to promote more telework, but no implementation projects have grown to the point where they have received public notice.

Australia

The economy

Unlike the other countries in this supplemental report, Australia is a member nation of the OECD (Organisation for Economic Co-operation and Development), the so-called developed world. Like most of the OECD countries, the majority of Australia's workers are information workers, as shown in Figure 15, with agricultural, fishing and mining employment at less than 10% of the workforce. The GNP per capita ratio (relative to that of the United States) is about 0.67 in purchasing power terms.

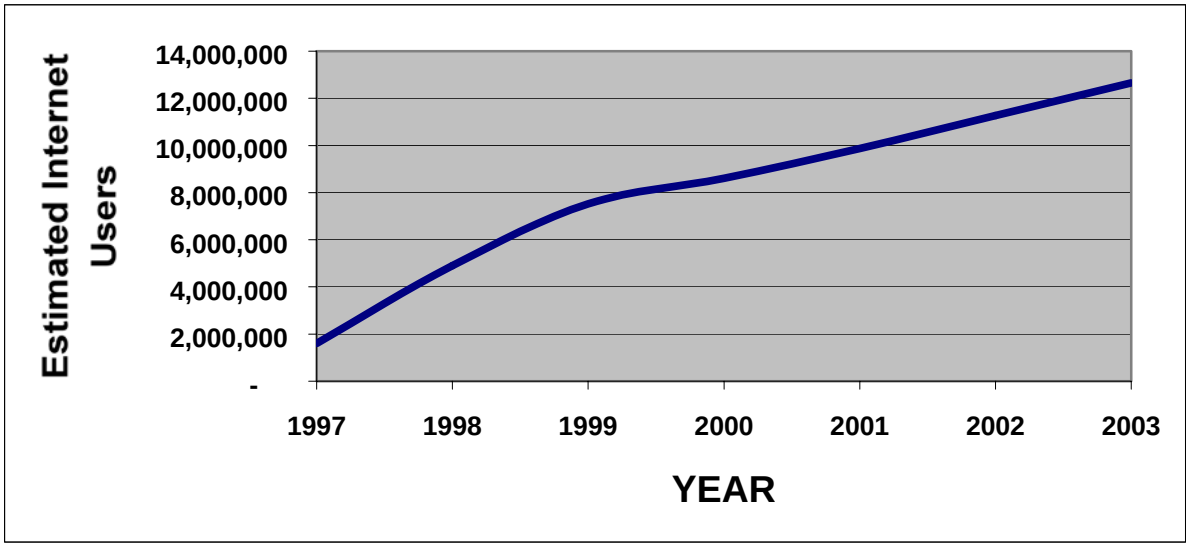
Figure 15: Estimated composition of the workforce in Australia



The telecommunications industry was deregulated and opened to competition in 1992. By February 1999 18% of all Australian households (1.3 million) had Internet access from their homes—a 50% increase over the prior year and comparable to the household Internet penetration in the United States (although less than that of Finland). The Internet usage forecast is shown in Figure 16.

Although the Internet is quite popular, the cost of a telephone call to the US is still high, about 16 times the cost of a local call. This necessarily has some effect on both call frequency and duration, at least until (and if) Internet telephony becomes widespread.

Figure 16: Estimated Internet users in Australia

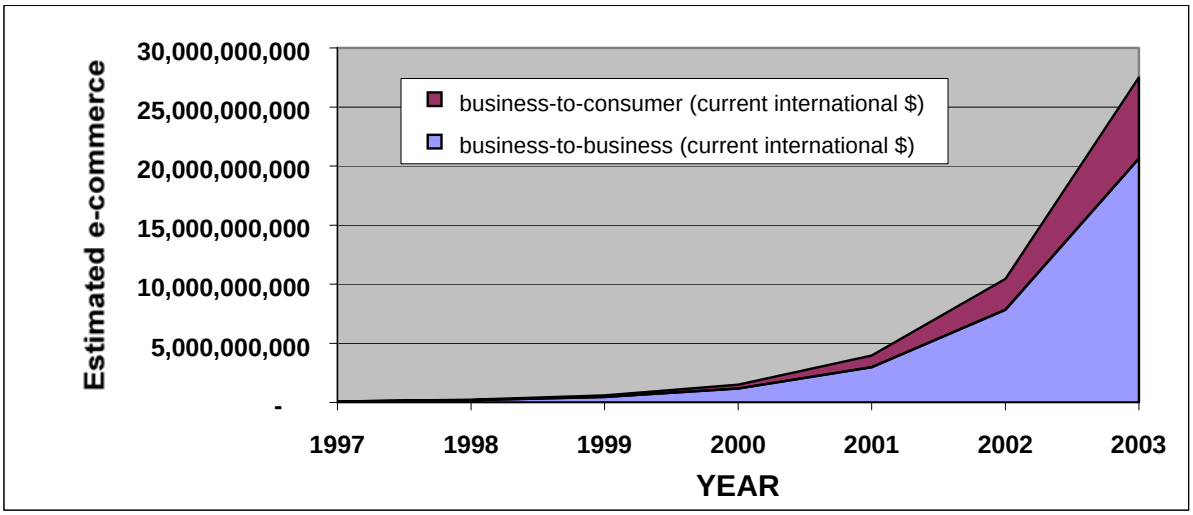


E-commerce

Electronic commerce activity in Australia began to expand rapidly in 1998, more than doubling over the USD83 million value in 1997. That growth rate of about 260% annually is expected to

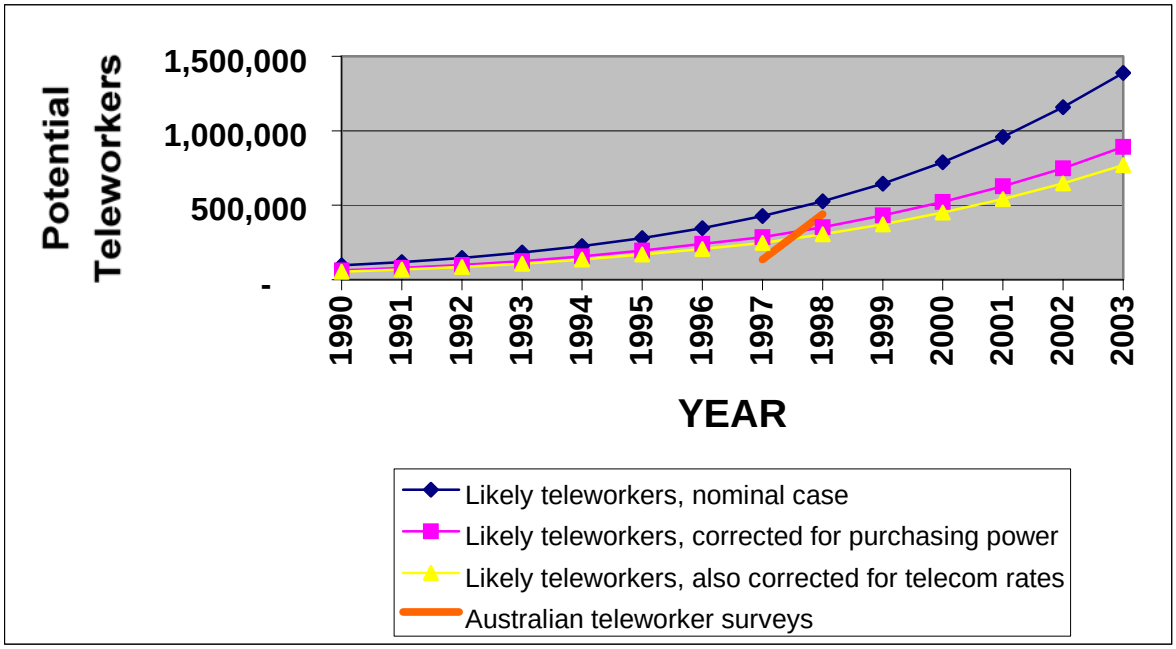
continue for the next few years. As in the US, the dominant portion of the e-commerce volume will be in business-to-business trade rather then the more publicized business-to-consumer e-commerce. Figure 17 shows the anticipated growth of e-commerce in Australia.

Figure 17: Electronic commerce in Australia



New Ways to Work

Figure 18: Estimated growth of telework in Australia



Australia has been involved in various modes of telework for at least half a century, for both conventional work as well as education, if the outback radio communications system is included in the definition. For the more restrictive telework-with-computers version, Australians have been developing programs since, or before, the mid-1980s. Australian Telecom (now Telstra) and the central government have been assisting development by advocating telework programs and supporting symposia throughout the country. Figure 18 shows the results of the forecast model for Australia, together with the results from the summer

(February) surveys of home-based teleworking carried out by the Australian Bureau of Statistics in 1998 and 1999. The country appears to have been well below its forecast potential prior to 1998 but also seems to have more than recovered lost ground in 1998. Quite possibly future growth will be at or even above the nominal growth curve. In any case, the 1998 values are within the performance parameters produced by the forecasting model.

Brazil

The economy

Like Argentina, Brazil's entry into the information age is hampered by low average income, high telecommunications prices, and considerable instability in financial markets. Brazil is at a greater disadvantage than Argentina since the average GNP per capita is only 63% of Argentina's. However, Brazil's large population can more than make up in numbers what it lacks in percentages, when compared with other countries. As can be seen from Figure 19, the information component of the Brazilian workforce is proportionally lower than that of more developed countries, but still constitutes a substantial number—about 11.5 million in the year 2000.

Also like most countries in the world, the telecommunications infrastructure historically was government owned. A holding company, Telebrás, controlled all the 28 operating subsidiaries in Brazil. The federal government of Brazil was the controlling shareholder. Telebrás was broken up in 1998 as part of Brazil's telecommunications deregulation and privatization process and the federal government sold its shares to private concerns. Prior to 1995 the government closely restricted Internet access but, in 1995, first allowed commercial access to the Internet. Still, the international carrier, Embratel, charged significantly higher rates for calls originating in Brazil, thereby acting as a barrier to international Internet access by Brazilians. The cost of a telephone call to the US from Brazil is 156 times the cost of a local call. Figure 20 shows the estimated number of Internet users.

Figure 19: Estimated composition of the workforce in Brazil

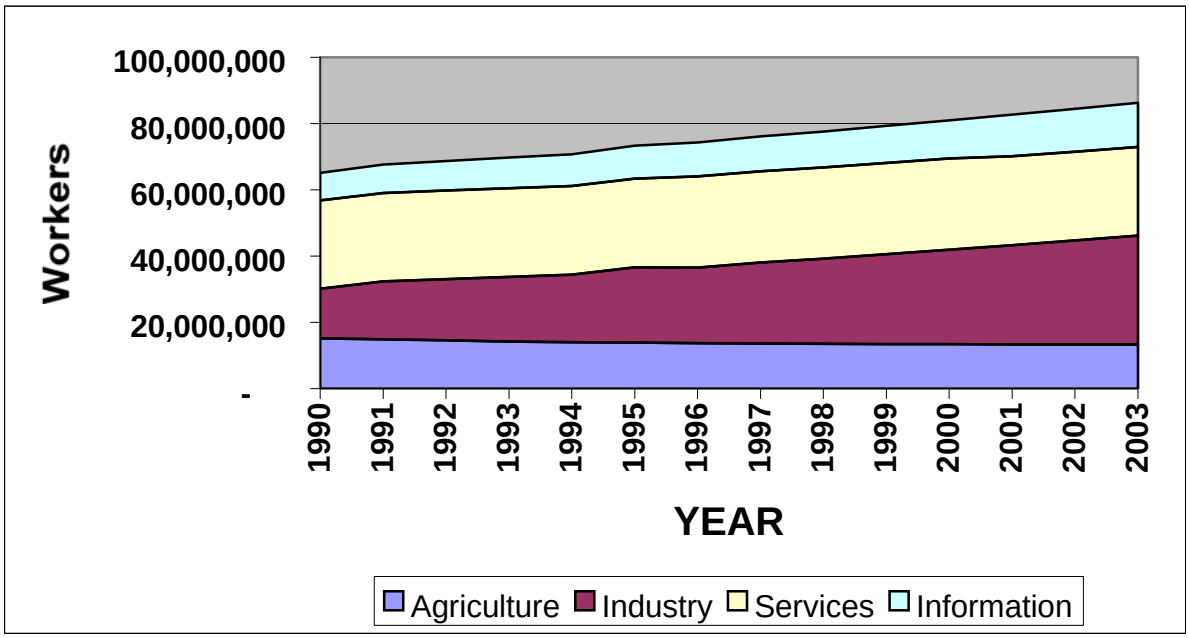
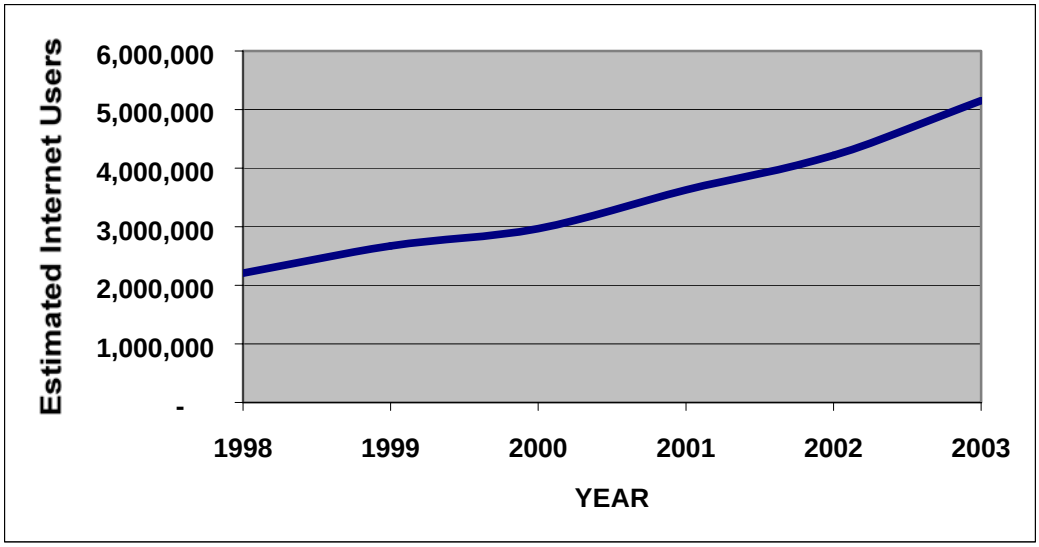


Figure 20: Estimated Internet users in Brazil



Curiously, an explosion of interest in the Internet was triggered by a popular Brazilian soap opera in 1995. The *novela*, titled *Explode Coração*, had both heroes and villains connected via the Internet. With a TV audience share of 50%, reaction to the series resulted in increased pressure on the government to ease Internet access. It also stimulated the initiation of a similar series on, rather than about, the Internet.

E-commerce

Brazil has taken the lead in facilitating electronic commerce within Latin America. As one of the largest Internet users among developing nations, with an 88% share of Latin American e-commerce, Brazil has proposed many modifications to a WTO (World Trade Organisation) study program geared toward analyzing all aspects of e-commerce pertaining to Latin America. The Brazilian government is particularly concerned with import taxes charged on e-commerce related activities.

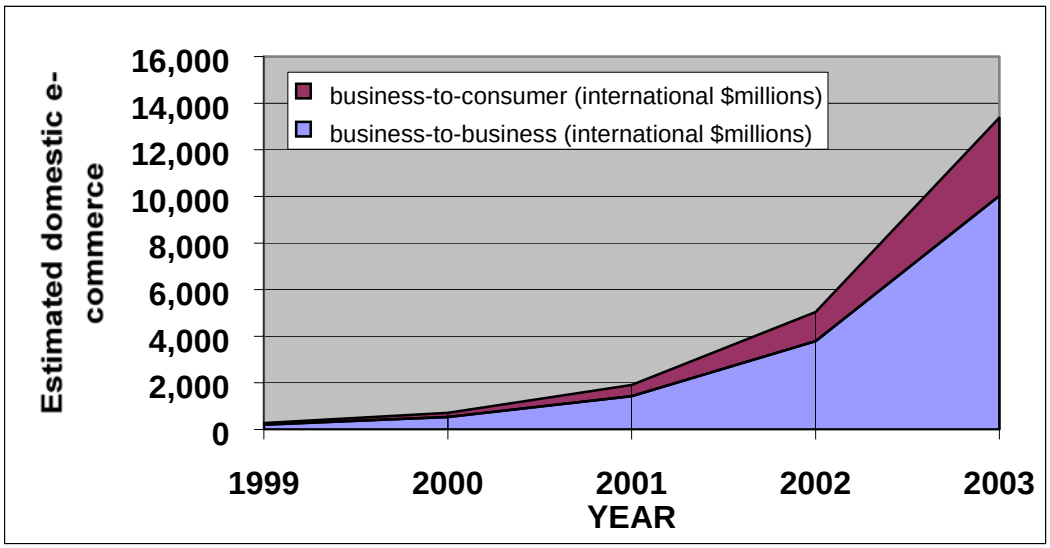
In spite of its worries, the Brazilian government, along with a variety of Brazilian companies, continues to pursue its interests in electronic commerce. In fact, MSS Telecommunications, an electronic commerce company representing AT&T's interests in Brazil, is in the process of creating an Internet site in which information will be available on all Brazilian companies that are seeking to sell their products online. The site, known as Tradegate, (www.tradegatebr.com) illustrates production, commerce, and service opportunities available in Brazil in a web-based format.

Large companies are taking advantage of electronic commerce opportunities as well. Volkswagen do Brasil has established an extranet computer network in order to create electronic links with all of its suppliers. The supplier network was scheduled to be fully functional by June 1999. As mentioned in one of the case studies for this project, Ingram Micro also has affiliations in Brazil.

Bradesco, a leading private sector bank that has helped launch electronic commerce systems throughout Brazil, has reported positive results in conjunction with its partnership with Brazil's Di Monaco chocolate factory in Sao Paulo. On average, Di Monaco reports receiving 150 electronic orders per day at an average price of USD16 per order. Overall, orders received via electronic commerce represent one-half of all orders to the factory. Bradesco acquired a 30% stake in the operations of the Brazilian subsidiary GE Information Services do Brasil. The

acquisition will allow Bradesco to offer electronic data interchange services (EDI) to its 500,000 corporate clients. According to industry analysts, this acquisition will establish Brazil as the forerunner of electronic commerce integration among Latin American countries.

Figure 21: Electronic Commerce in Brazil.



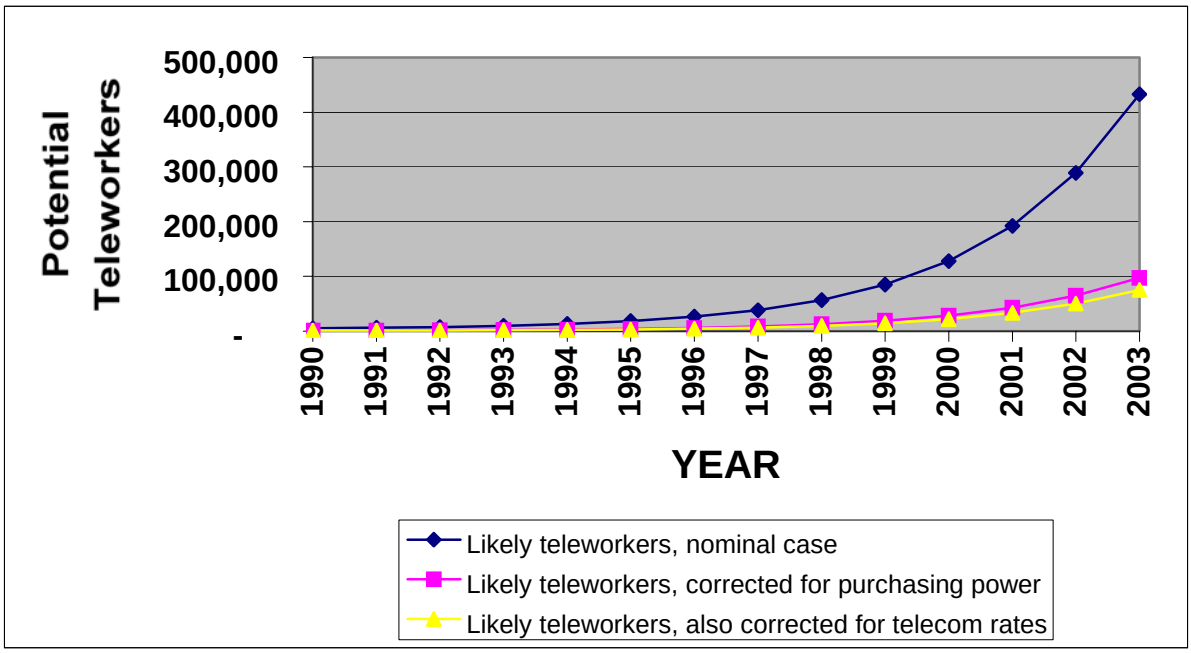
While Brazil is considered to be at the forefront of electronic commerce in Latin America, there have been a few setbacks within Brazilian firms in regard to realizing economic gains from electronic commerce applications. In fact, business-to-consumer sales have fallen below the expected volume for many of the Brazilian virtual shopping centers. Analysts site a lack of security as a consumer hurdle, and as a result, the administrators of these virtual shopping centers are investing in Internet security measures. Brazil has a proportionately higher number of web sites in its dominant language than does Argentina, thereby easing the entry of new e-commerce users.

Figure 21 shows the current estimate of domestic electronic commerce in Brazil. Like Argentina, the level of electronic commerce with firms outside Brazil is likely to be of slightly higher than comparable size.

New Ways to Work

Although there was a 1999, EC-sponsored, symposium on telework in Rio de Janeiro, there is no reliable source of information on the extent of teleworking in Brazil. Consequently, the information in Figure 22 is entirely the result of the analysis of Brazil's economy and workforce.

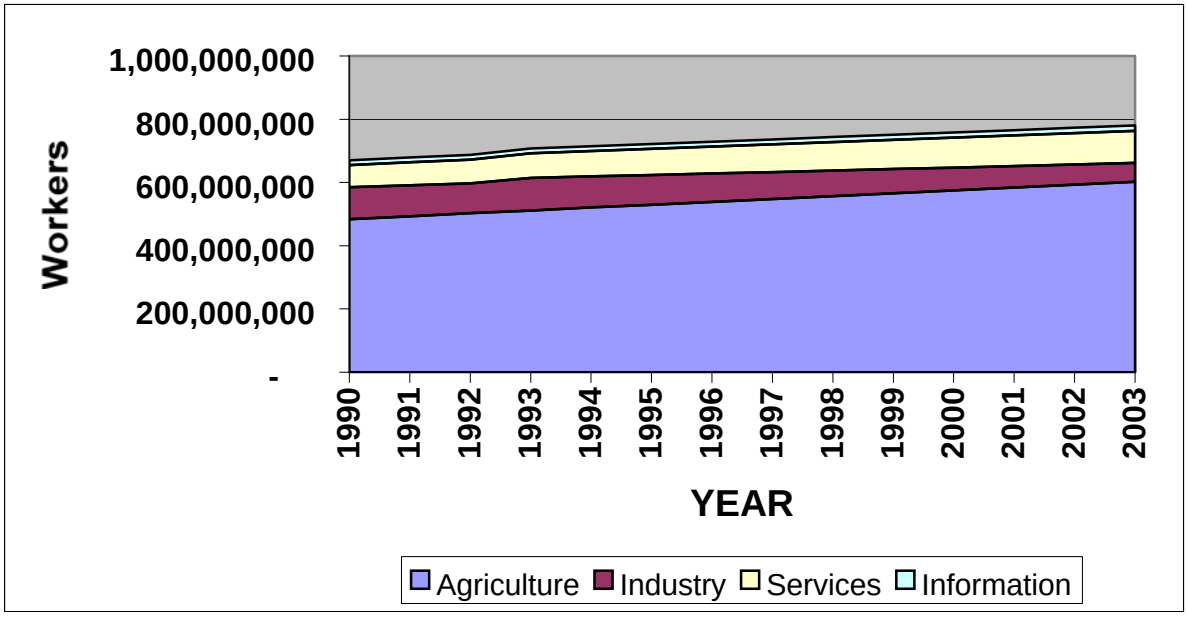
Figure 22: Estimated level of telework in Brazil



China

The economy

Figure 23: Estimated composition of the workforce in China

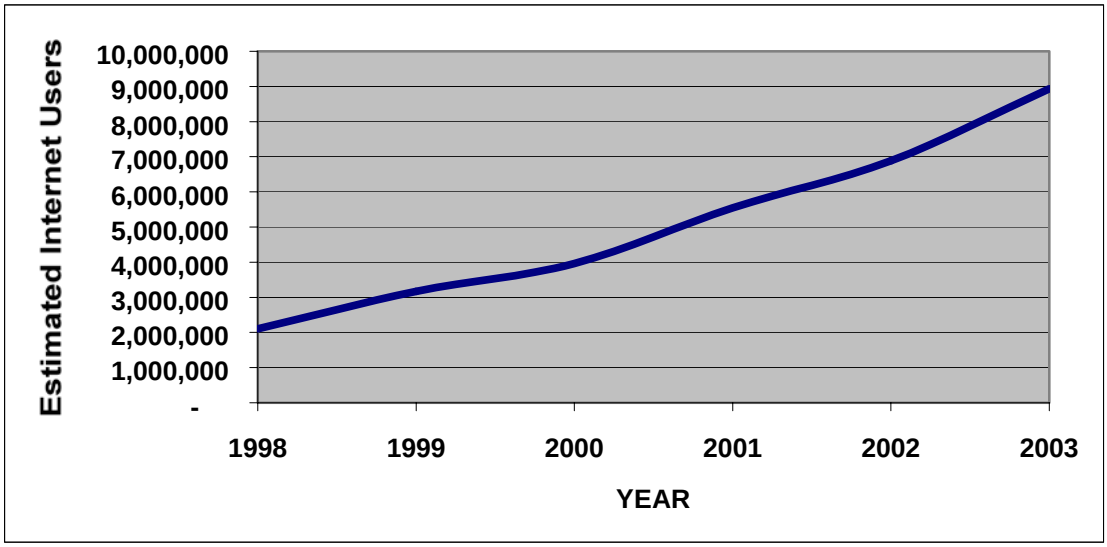


China is often called the world's largest sleeping giant. With a population of more than 1.25 billion, China comprises 20% of the world's population. Yet it is still definitely a developing country. Three-quarters of its workforce is engaged in farming and, although economic growth has been rapid in the past decade, GNP per capita is only about 12% of that in the United States, measured in purchasing power terms. Furhter, the country is in a recession, with 45% of

state-owned industries losing money. Nevertheless, it has a growing information sector, as well as a continuing migration from the countryside to the cities. Figure 23 shows the expected changes in the composition of China's workforce.

Although the information sector appears to be a small sliver in Figure 23, it amounted to 16 million people by the end of 1998, one-fifth the size of the US information workforce.

Figure 24: Estimated Internet usage in China



While it might be said that the lack of telecommunications infrastructure (89 telephones per 1,000 population) is a handicap, it can also prove to be an advantage in China. Since there is essentially no antiquated plant to renovate, the network can develop digitally from the outset. The Chinese government began accelerating the development of the infrastructure to an annual growth rate of nearly 30% in 1998, while population growth is less than 1%. Still, the infrastructure is highly regulated, with heavy surcharges on international telecommunications (the charge for a three-minute phone call to the US is more than 600 times the cost of a local call), although local Internet access is very inexpensive. Furthermore, the government controls all telecommunications and tightly regulates Internet access to "undesirable" sites.

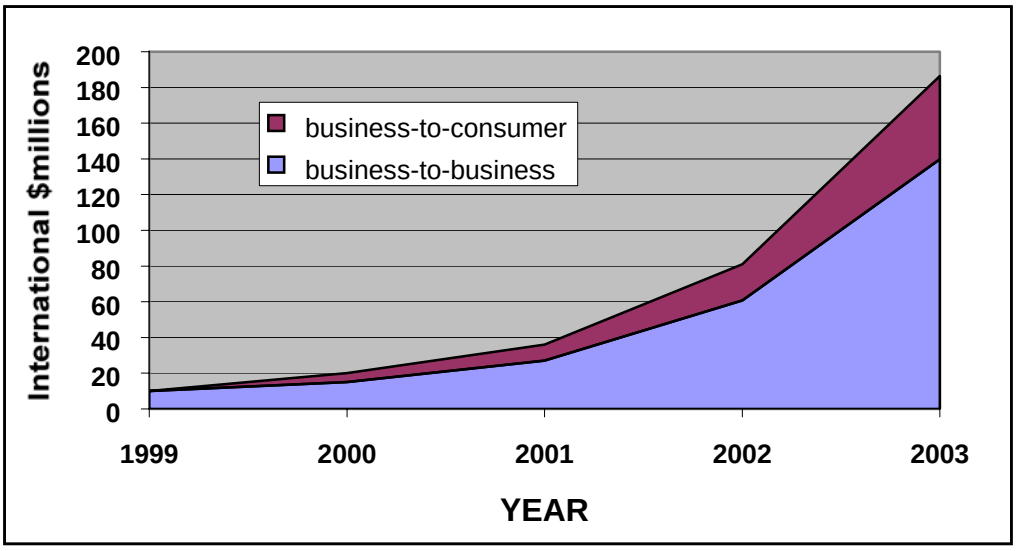
Nevertheless, privately operated ISPs and web sites are coming on line and Internet use is growing rapidly in China. Figure 24 shows the trend, with 9 million Chinese 'Netizens expected by the end of 2003.

E-commerce

There was very little active e-commerce in China as of mid-1999 but a number of tests were underway, from electronic banking with the Bank of China to some business-to-business trials by mainland Chinese firms. However, a number of factors inhibit the growth of e-commerce, ranging from regulatory issues to such fundamentals, for business-to-consumer e-commerce, as limited credit card use and security concerns. Multinational companies such as Hewlett-Packard (HP) are helping to solve the security issues. HP is also working with the Shanghai municipal government to develop an "e-commerce laboratory" to test and evaluate new e-commerce transaction technologies before they are made generally available.

Nevertheless, extensive levels of e-commerce in China appear to be several years away. Figure 25 shows our estimates for the country.

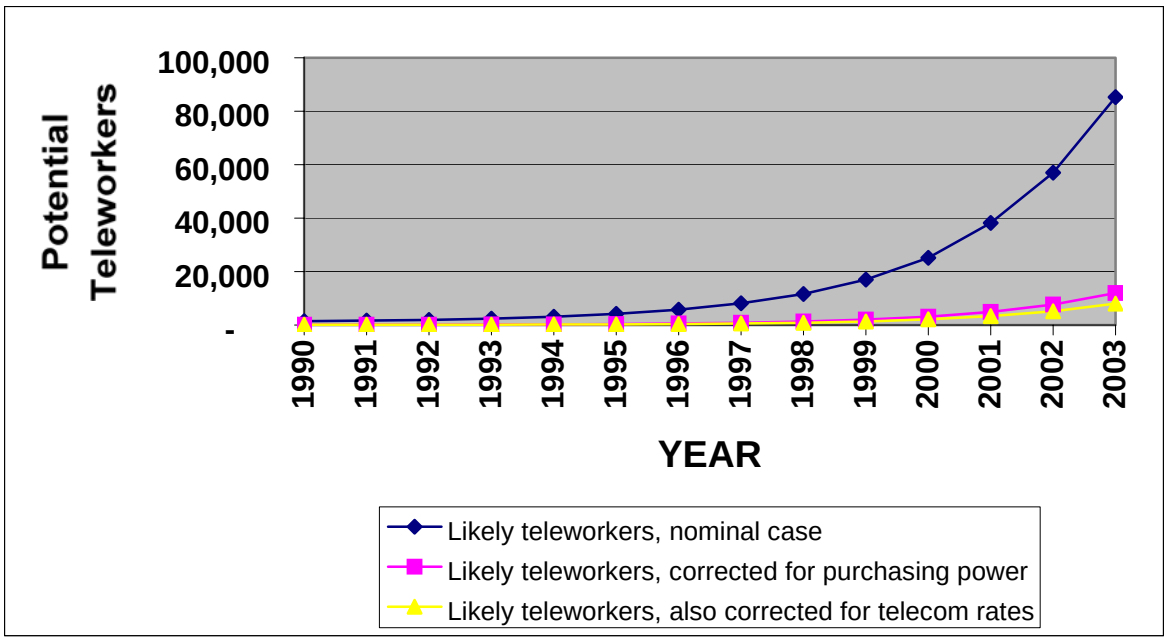
Figure 25: Estimated value of China' electronic commerce



New Ways to Work

Although data regarding telework in China are almost as scarce as those for e-commerce, it is possible to make some predictions of the growth of telework, based on decades of experience in the US. The current forecast is shown in Figure 26.

Figure 26: Estimated development of telework in China



Note the relatively high level of uncertainty here. If China were to follow the same development patterns as the US it might have as many as 85,000 teleworkers by the end of 2003. However, if matters are left to the private sector, the entry and telecommunications costs of telework could drastically reduce that number—to less than 10,000. The Chinese government shows much more interest in e-commerce than in telework.

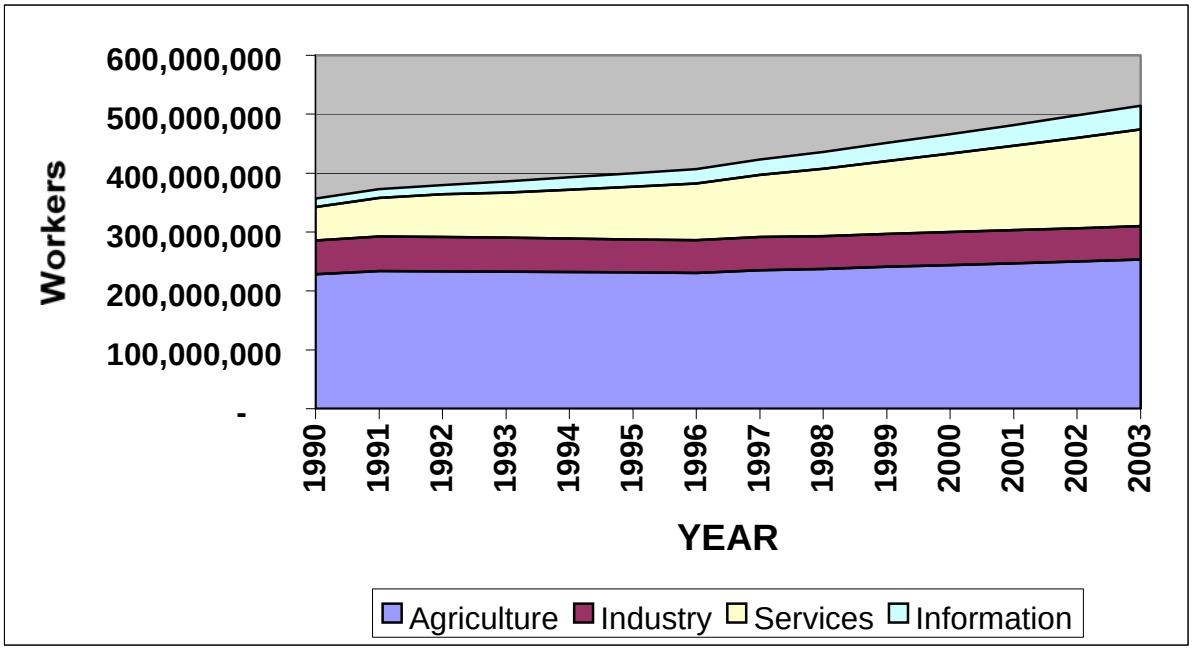
India

The economy

Like China, India has a huge population—just short of one billion by the end of 1999—with more than half its workforce in agriculture. Most expectations are that both the agricultural and industrial sectors will continue to decline in terms of their proportions of the workforce, while services and information will expand their shares, as shown in Figure 27.

With only 15 telephone lines per 1,000 people in 1996, the number is expected to increase to 27 per thousand by the end of 1999. As in most developing countries, the greatest proportion of these phone lines goes to businesses and wealthier residents. Nevertheless, interest in the Internet is high and growing rapidly, as shown in Figure 28.

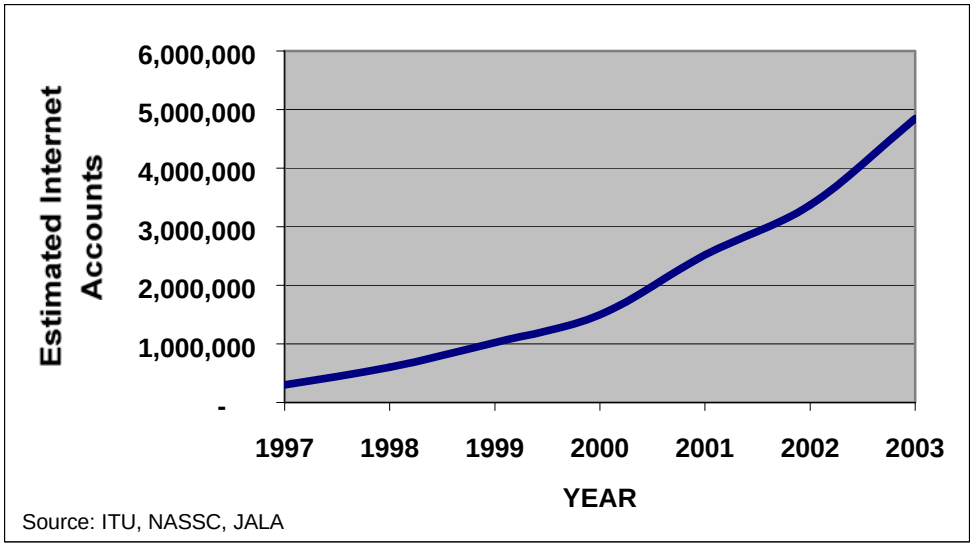
Figure 27: Estimated composition of the workforce in India



Although the figure shows the expected number of accounts, the number of actual users is probably 4 times that value (e.g., 6 million users vs. 1.5 million accounts by the end of the year 2000).

The first dial-up email network was established in India in1987, connecting two institutes in Mumbai (Bombay). The network was expanded by a link to Amsterdam in 1988, followed by a satellite link in 1994. Commercial Internet access was introduced in August 1995. However, the telecommunications network and Internet access in India was controlled by a government regulated monopoly, involving four different companies, until November 1998. In a matter of weeks after the end of the monopoly, 41 companies signed up to be ISPs, seven of which were to provide national coverage. According to India Internet World, 13 prospective ISPs are targeting states and major metropolitan areas; 21 are concentrating on the larger cities. That is, most of the activity is directed at providing services only for urban areas. By mid-1999 India had licensed 132 private ISPs.

Figure 28: Estimated Internet accounts in India



Long distance telephone calls and Internet access are still very expensive, in purchasing power terms, with a phone call to the US costing about 280 times the fee for a local call in India. In 1997, the monopoly ISP was charging USD450 for 500 hours of connect time with a graphic browser and USD140 for text-only browsing. Per capita GNP is only 6% of that in the US, in purchasing power terms. That barrier and the fact that there are at least ten major language groups and many dialects spoken in India, together with an adult literacy rate just above 50%, constitute serious impediments to the potential of information technology for development—at least in percentage terms. Yet, simply because of its size, India is likely to be a major player in the future e-world.

E-commerce

Electronic commerce is still in its infancy in India. For the reasons just stated, growth has been slow, confined to a few major cities and some industries, usually those with multinational companies. With the 1998 opening of the Internet market, however, a large number of new entrants have appeared. Still, as Figure 29 shows, the major boost in e-commerce is not expected until the year 2000 and beyond. The National Association of Software and Service Companies (NASSCOM) has importuned the Indian government to set up a national Internet exchange. Currently, local Internet traffic goes through the US.

Figure 29: Estimated value of e-commerce in India

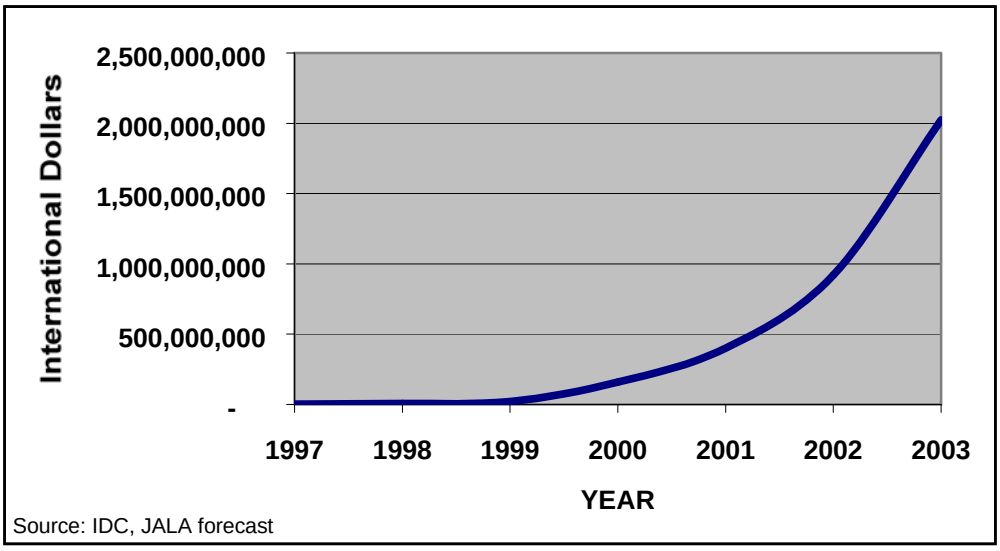
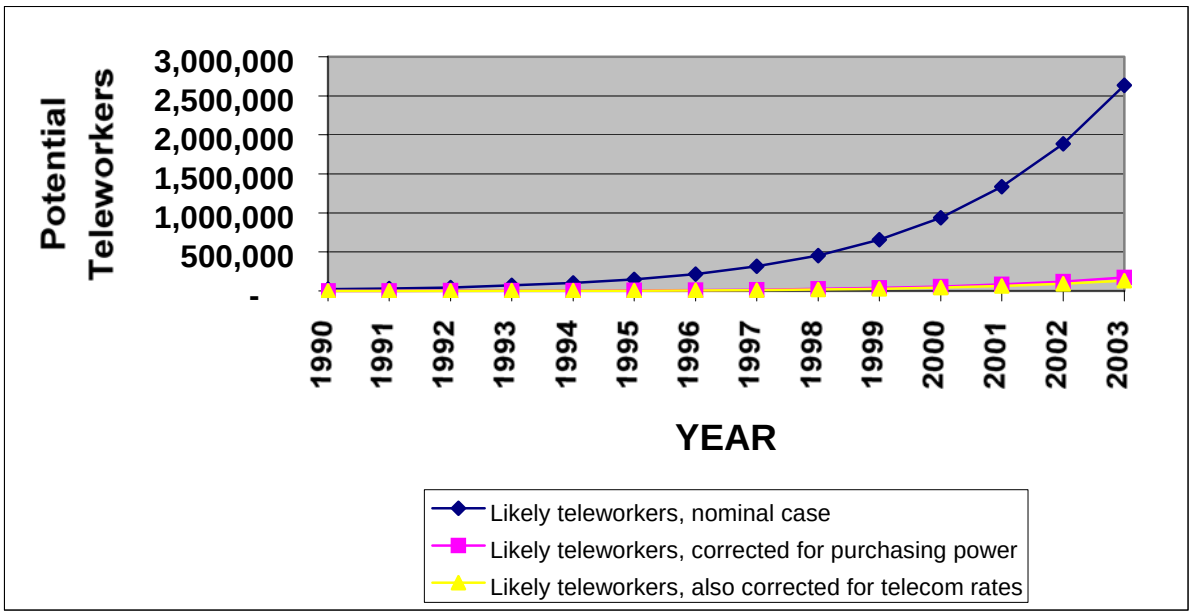


Figure 30: Estimated growth of telework in India



Telework may be another matter entirely. Although small in size proportionately, Indian information workers are well educated—and English-speaking—and the Indian software industry is growing rapidly, with total 1998 revenues exceeding 3.4 billion euros, according to NASSCOM, almost 10 percent of India's GDP. Annual growth is expected at rates exceeding 50%. Software exports exceeded 2.5 billion euros in 1998, for a growth rate of 68%. A significant , but not well documented, fraction of that industry involves some form of telework since many Indian software developers work for organizations in the US and Europe.

However, as far as we can determine, little telecommuting is occurring in India, even though large Indian cities are notoriously congested and there are no four-lane highways interconnecting major cities. When the cost and income factors are taken into account, the

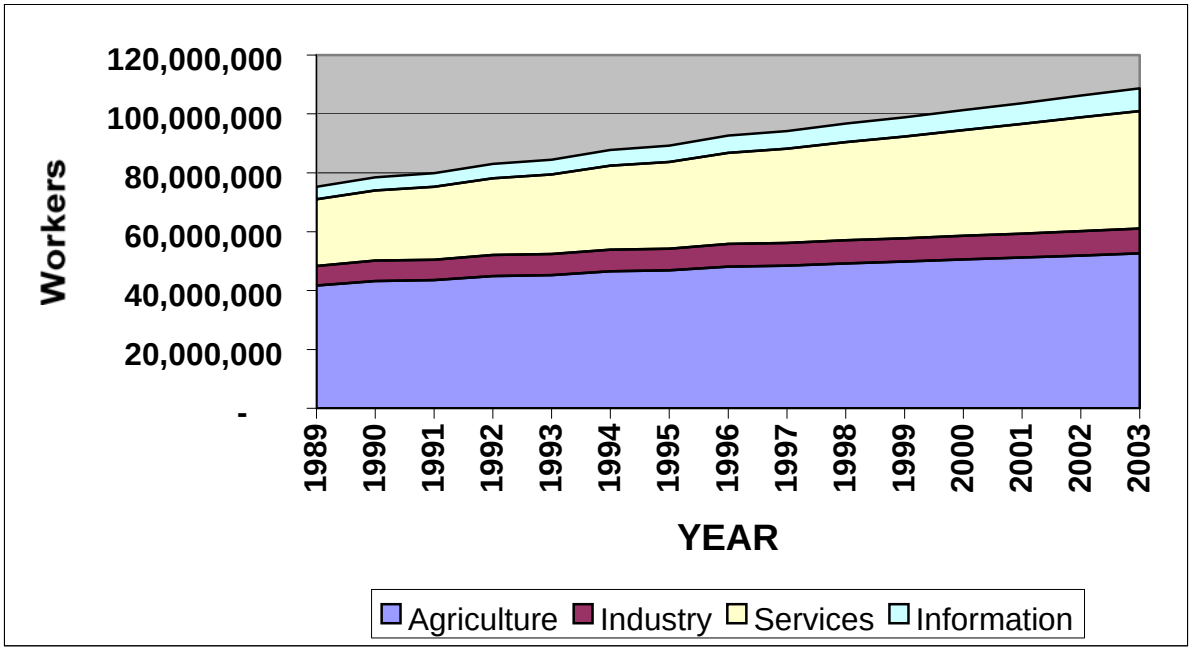
result is a wide spread between "nominal" rates of telework and the more likely cost-corrected values shown in Figure 30.

Indonesia

The economy

Indonesia is the world's fifth largest country, with a population of almost 204 million at the end of 1998. Like India, about 53% of Indonesia's workforce are in farming and other extractive industries. Only a small fraction of Indonesians are currently information workers, as shown in Figure 31, but both the information and other service sectors of the economy are growing. The figure does not fully reflect the past two years of economic turbulence in Indonesia, nor the potential changes in the economy that may result from its recovery and its turn toward more democratic government; these factors have yet to show up in available demographic and economic data.

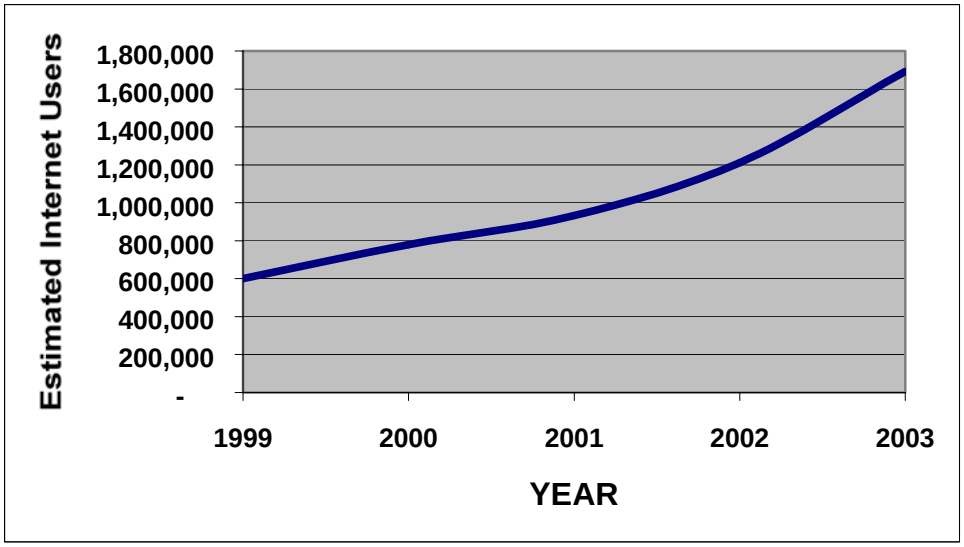
Figure 31: Estimated composition of the Indonesian workforce



Unlike some other developing countries, Indonesia's telecommunications industry is still government controlled. PT Telkom, the government-controlled monopoly, will keep its monopoly status until 2006. It will also retain exclusive rights to provide domestic calls until 2011. This should insure a relatively leisurely pace of expansion of Indonesia's telecommunications infrastructure at about 10% until competition is introduced.

Indonesia, although more than double India's per capita GNP at about 12.5% of the US value, still has a major uphill fight to have a high tech infrastructure available for the average citizen. Even though Indonesia has two communication satellites to cover its more than 13,000 islands, most of their use has been for military purposes. Therefore, most of e-world developments in Indonesia will accrue to the benefit of the wealthier fraction of the populace. This is reflected in the Internet access data and estimates shown in Figure 32. Since late 1997 there have been 23 ISPs in Indonesia, none of which has a large customer base.

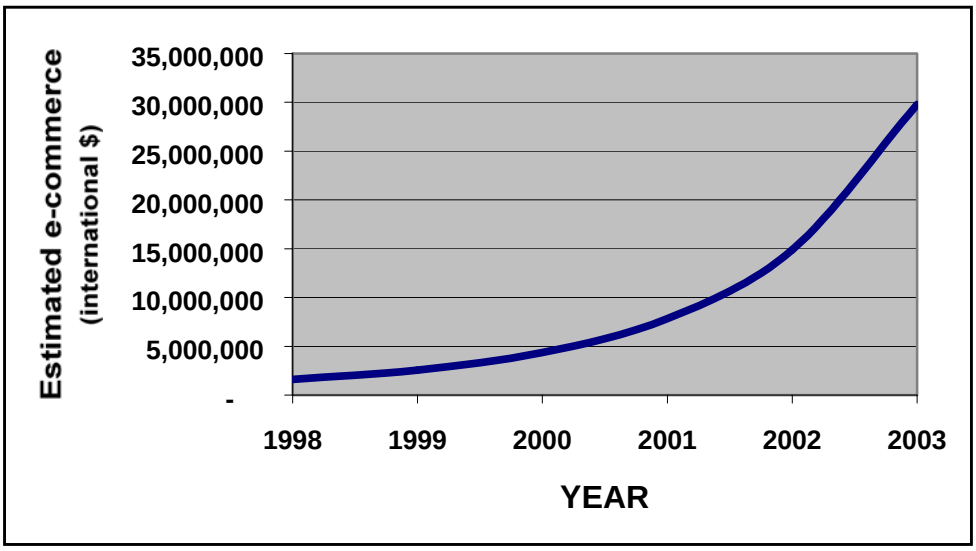
Figure 32: Estimated Internet users in Indonesia



E-commerce

There is very little evidence of e-commerce in Indonesia and it is not expected to develop in any substantial way until after the breakup of PT Telkom or the introduction of competition in the country. What e-commerce occurs is largely through sites in Singapore. Because of the dearth of data and the current uncertainties in Indonesia's government, our forecast in this area should be considered tentative. Figure 33 shows the results of the forecasting model.

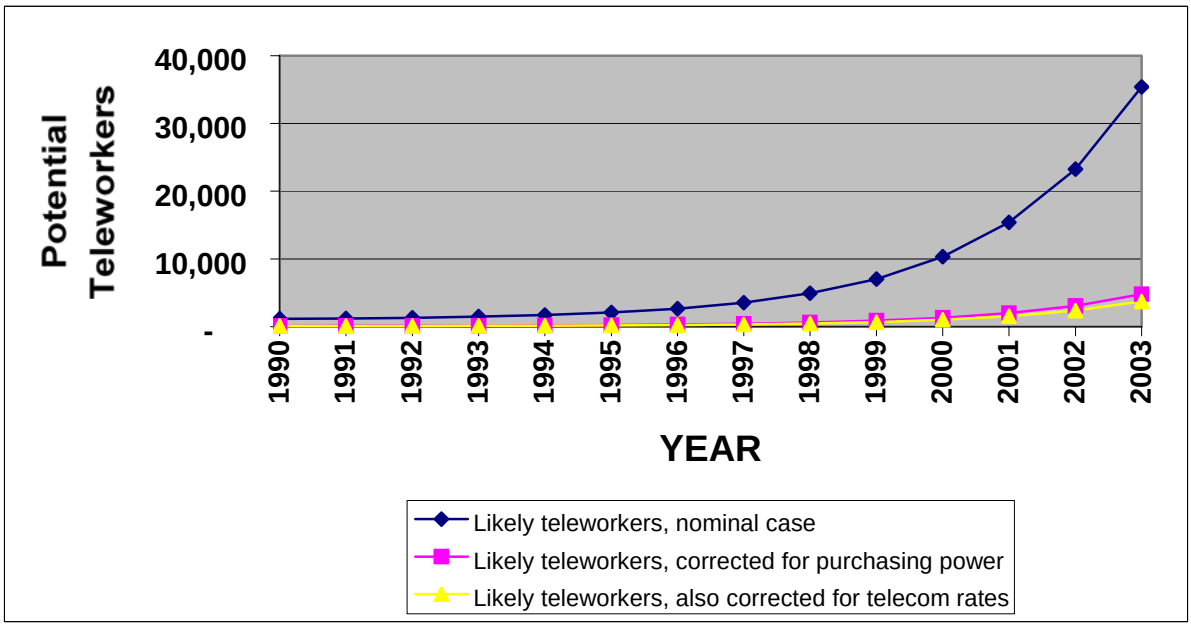
Figure 33: Estimated e-commerce in Indonesia



New Ways to Work

Slightly more effort has been made to develop telework in Indonesia, including government plans for a pilot project involving government employees in Jakarta. There is also a certain amount of Internet-mediated telework on an international scale, but not of the magnitude seen in India. The current estimate of Indonesian telework levels is shown in Figure 34.

Figure 34: Estimated growth of telework in Indonesia.



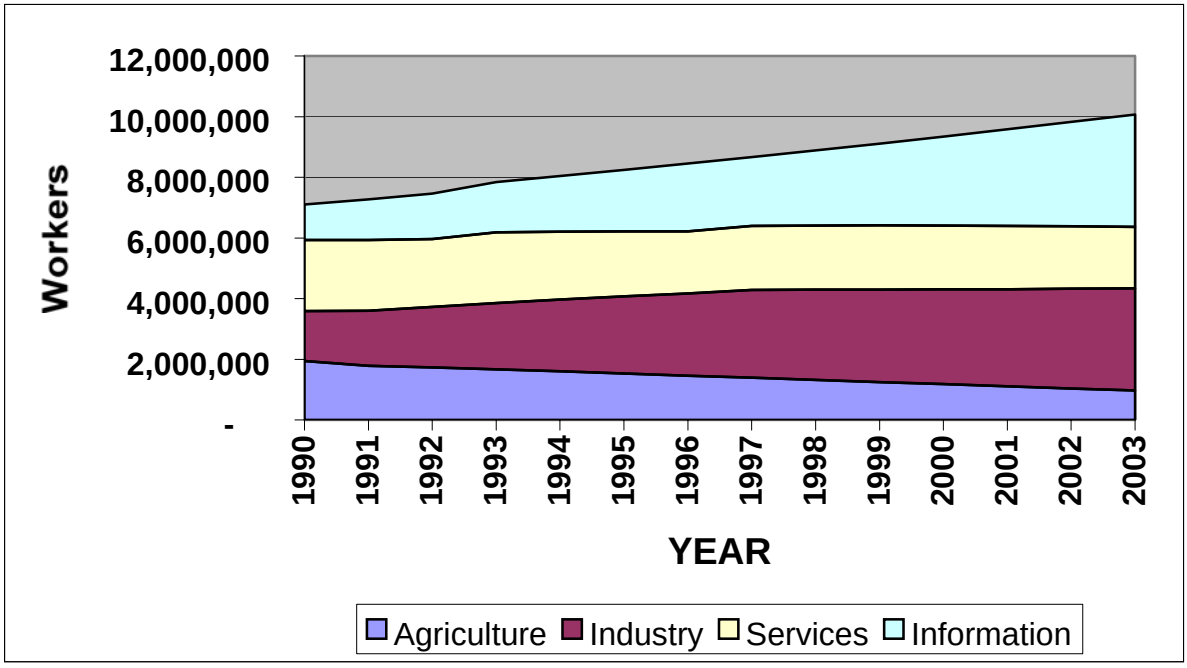
Also like India, there is a wide gap between the nominal potential for telework and the more likely actuals when corrections are made for Indonesia's economic troubles. As traffic congestion continues to worsen, the number of urban information workers increases, and the telecommunications infrastructure improves in cities such as Jakarta and Jogjakarta, the actual values may more closely approach the nominal potential curve. However, we know of no household or business survey data covering teleworkers in Indonesia.

Malaysia

The economy

Malaysia is one of the key "Asian Tigers" as a consequence of its energetic efforts to transform itself into an information age nation. Unlike its larger neighbors, Malaysia's workforce is well under way on the road to becoming an information dominant economy, as shown in Figure 35. The information sector is estimated as constituting 28% of the workforce at the end of 1998; it is expected to grow to 38% of the workforce by the end of 2003. Malaysia's GDP has had annual growth rates in the 7% to 9% range throughout the early to mid-1990s.

Figure 35: Estimated composition of the Malaysian workforce

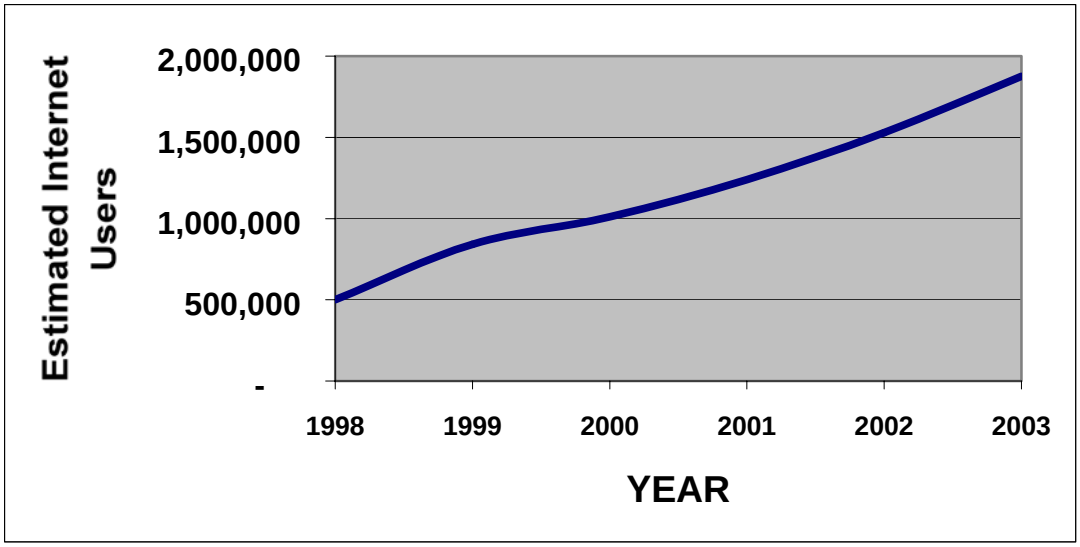


Malaysia is heavily involved in manufacturing electronic products and has as a national goal the development of its Multimedia Super Corridor (MSC) to attract leading edge technology companies in the information technology and multimedia industries as part of the government's Vision 2020 master plan. Physically, the MSC is a corridor 15 km wide and 50 km long, starting at the Kuala Lumpur City Center and ending at the Kuala Lumpur International Airport. It includes the world's tallest building, with plans for two "smart cities". A variety of incentives are provided by the government to attract high tech companies to the MSC. The 20-year plan for the MSC is focused on a very high level of information infrastructure in order to serve both as a test bed and a demonstration site for new technologies. One of its stated goals is: "A world of Smart Homes, Smart Cities, Smart Schools, Smart Cards, and Smart Partnerships."

Although Malaysia's per capita GNP has almost tripled in the past decade, to an estimated 28% of that in the US by the end of 1999, it still presents some barriers to more rapid growth in the use of relatively expensive information technology. In mid-1999 a telephone call to the United States was still almost 200 times the cost of a local call. However, Internet access calls are relatively modest, consisting of an annual fee of about 6 euros and per-minute connect charges of about 0.0025 euros. The current estimate of Internet use is shown in Figure 36.

The government telecommunications department that operated the telephone network was privatised in1984, becoming Telekom Malaysia. However, the company remained a monopoly until 1 January 1999, when the Malaysian telecommunications industry was formally opened to competition. The results of the newly competitive environment should begin to become apparent within the next five years but little noticeable change is expected before yearend 2000.

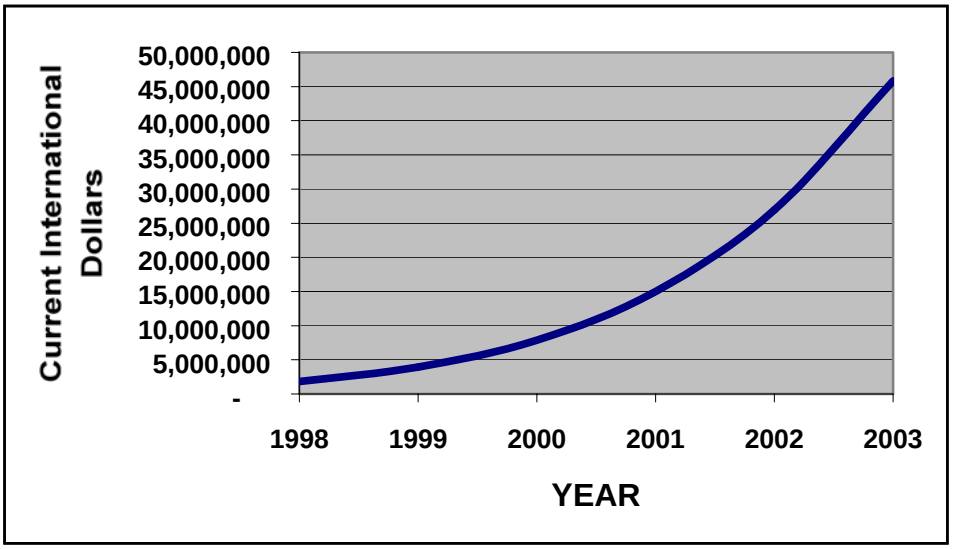
Figure 36: Estimated Internet use in Malaysia



E-commerce

There is a high level of interest in e-commerce in the Malaysian government and in its resident information industries. Beginning in 1997, the government established an Inter-Agency Task Force on Electronic Commerce to develop a national strategic action plan and recommend policy initiatives on security, encryption technologies, and transaction tracking mechanisms for facilitating e-commerce. One of the key topics for discussion was the relative advantages and disadvantages to Malaysia on e-commerce vis-à-vis international trade. So far, the conclusion appears to be that the advantages outweigh the disadvantages but that the country should proceed with caution.

Figure 37: Estimated growth of electronic commerce in Malaysia



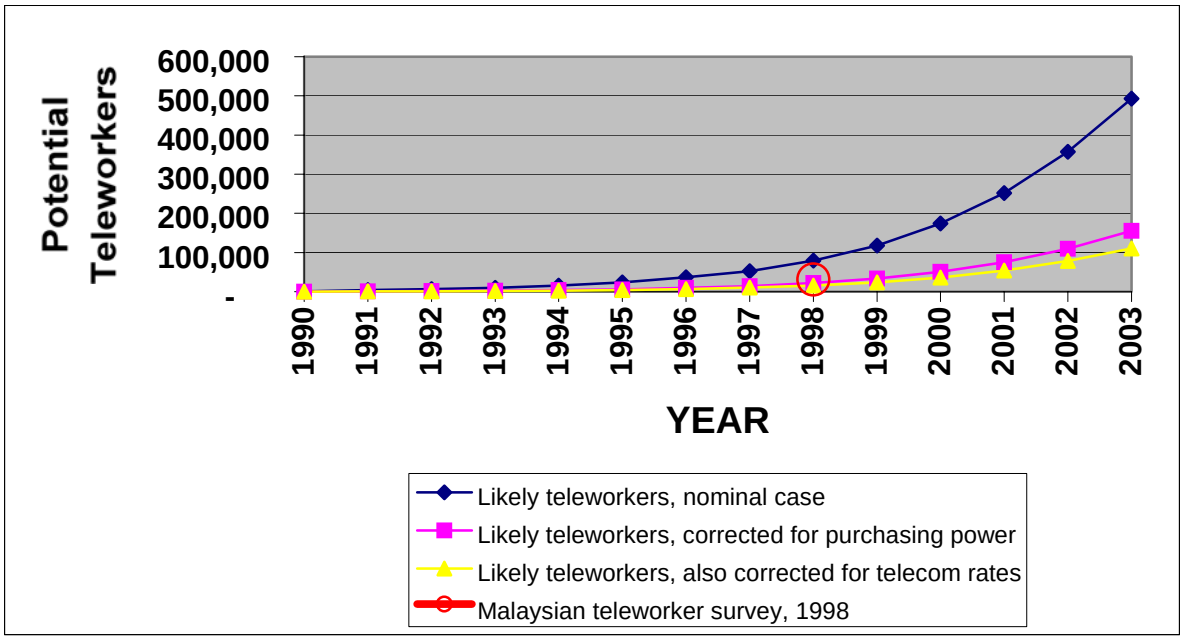
There is very little in the way of hard data concerning the overall levels of e-commerce in Malaysia. Thus, Figure 37 represents the results of the current forecasting model. Similarly, there are no data concerning the apportionment of business-to-business and business-to-consumer e-commerce. Typically, business-to-business e-commerce represents 75% to 80% of the total volume.

New Ways to Work

Malaysia has also been involved in telework developments since the early- to mid-1990s. The earliest known[19] telework research in Malaysia was conducted by the Technical University in Johore Bahru as an implementation pilot project, beginning in 1995.

A survey of teleworking in Malaysia was carried out by Malaysia's United Institute for New Technologies, with funding from the United Nations Development Programme.[20] The study concluded that there were about 3.45 teleworkers per 1,000 workers in Malaysia in 1998, which translates to 30,660 for the country. The nominal estimate of the forecasting model for 1998 is 79,000 teleworkers if Malaysia were to match its potential without regard to economic issues. The model estimate, when corrected for purchasing power, is 22,000 teleworkers for Malaysia (see Figure 38). Hence, the reality depicted by the survey can be interpreted as an indication that most Malaysian teleworkers have above average incomes. The survey found that a substantial portion of the teleworkers surveyed were employed in routine data processing jobs and call center operations. Very little home-based teleworking was reported, most of it in manufacturing and the software industry. Teleworkers with professional or managerial level jobs constituted about 20% of the teleworkers.

Figure 38: Estimated number of Malaysian teleworkers



The incentives and barriers to teleworking reported by the survey were very similar to those mentioned elsewhere in the world: convenience and flexibility; greater productivity; and reduced travel time as major incentives, with setup costs; the need for face-to-face interaction; and management apprehension as the primary barriers.

[19] To the author of this report.

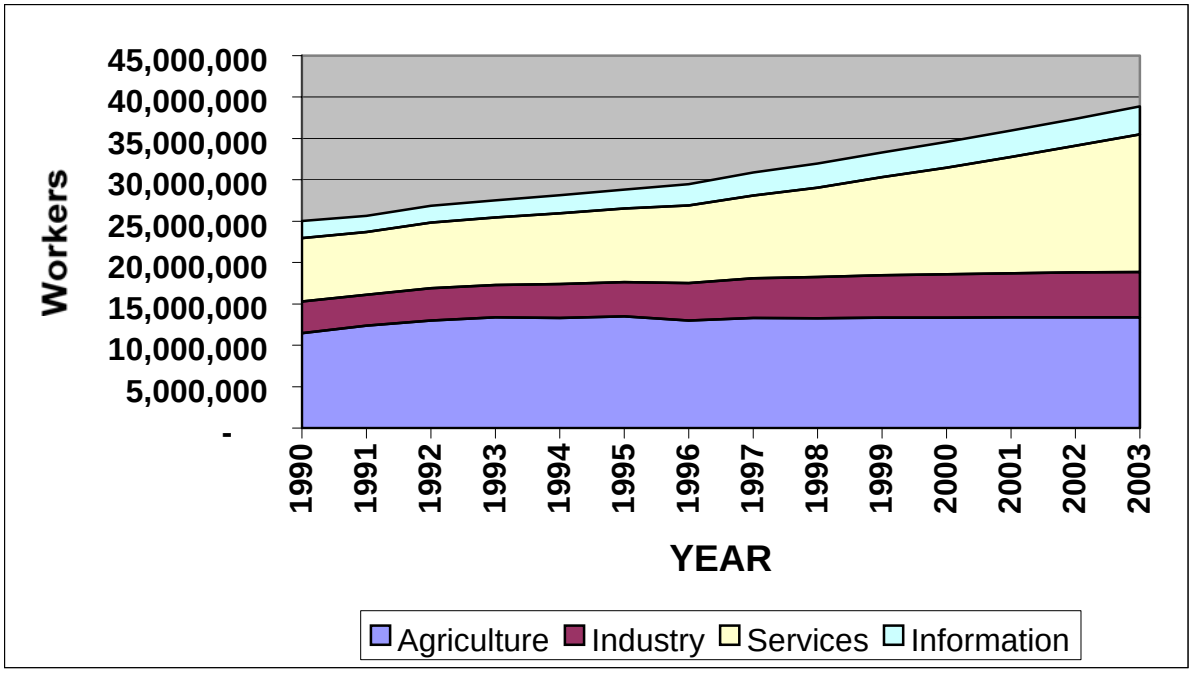
[20] See www.jaring.my/ksm/teleworking/default.htm

Philippines

The economy

The Philippines is clearly in the transition stage from an agriculture-dominant economy to one that is more service and information intensive. Figure 39 shows the history and expected near future of its four-sector workforce.

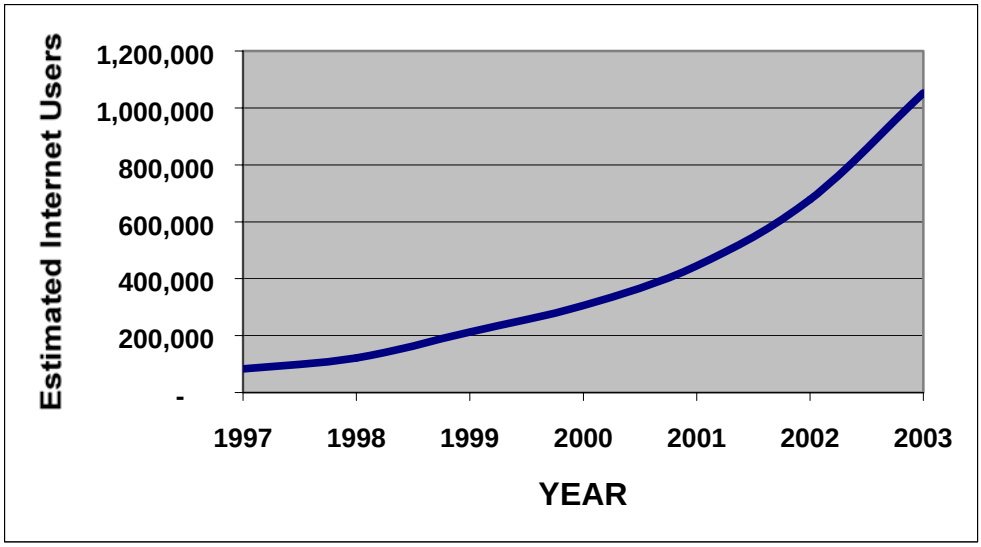
Figure 39: Estimated composition of the Philippine workforce



In 1992 the Philippines had one of the lowest levels of telephone penetration in Asia: slightly more than1 per 100 inhabitants. By 1995 there were about 60 telephone companies, but most were operating only in urban areas and the long-distance traffic was controlled by a single company, the Philippine Long Distance Telephone Company. In 1995 a new telecommunications policy act was passed which, although still favoring the dominant carrier, acted to both deregulate telecommunications and increase coverage in more rural areas. One result was an increase in the number of phone lines to almost 4 per 100 inhabitants by the end of 1999. However, the cost of a phone call to the United States is more than 120 times the cost of a flat rate local call. In June 1999 the Philippine League for Democratic Telecommunications called for a boycott of both local and long distance telephone services to protest the high rates being charged and the threat of incipient call metering.

Still, interest in the Internet in the Philippines is growing. Although there are almost 100 Internet Service Providers in the Philippines, most of them have connections through backbones located in the United States. Internet dial-up connection charges are approximately 2 euros hourly (or 33 euros for up to 60 hours monthly). This fee is approximately 80% higher than similar charges in the United States. Since GNP per capita in the Philippines is only 12% of that in the United States, it is clear that access to the e-world is currently limited to the wealthier citizens and companies. The current estimate of Internet usage in the Philippines is shown in Figure 40.

Figure 40: Estimated changes in Internet usage in the Philippines

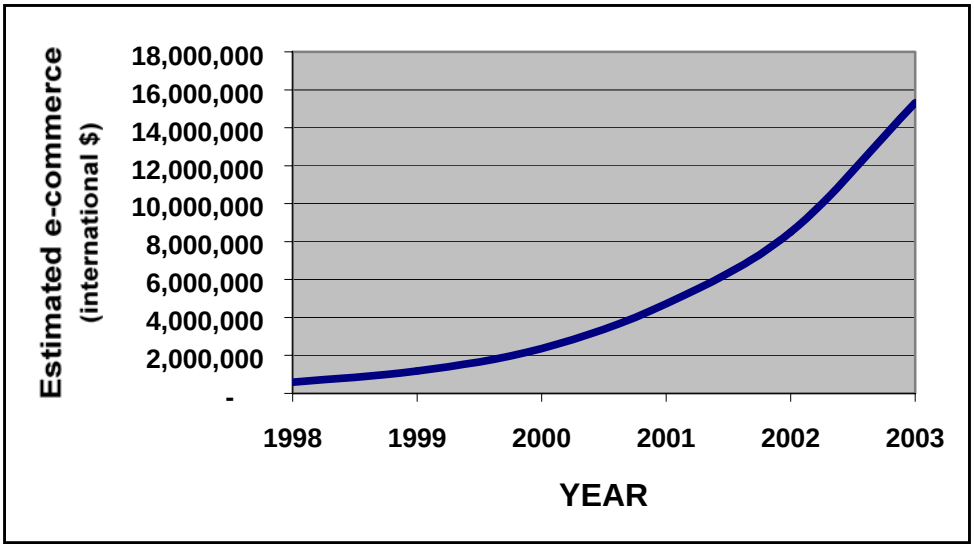


E-commerce

Several events in 1998 lead toward the development of electronic commerce in the Philippines. One was the creation of the Electronic Commerce Promotion Panel by then President Ramos. A variety of issues was addressed by the e-council, including changes in the laws to give legal status to electronic contracts, purchase orders and other e-documents necessary for effective electronic commerce; to develop standards for electronic transactions; and to work on marketing and promotion of e-commerce. Also some joint e-commerce ventures were begun between leading Philippine telecommunications providers and multinational corporations.

But the onset of e-commerce was just beginning in 1998 and no data are yet available as to the results. Hence, Figure 41 should be viewed solely as a preliminary estimate of the growth potential there.

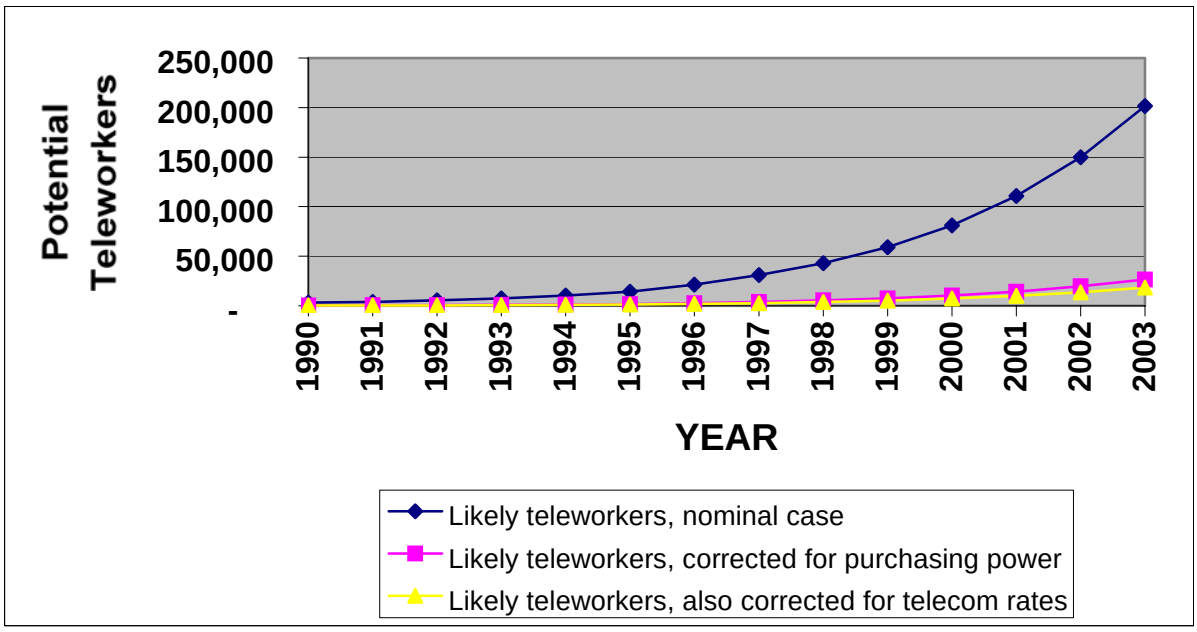
Figure 41: A very preliminary estimate of e-commerce in the Philippines



New Ways to Work

According to a 1992 study funded by the World Bank, the Philippines was the foremost country for producing remote data entry services, producing more than 100 billion keystrokes annually. The Philippines is still a center for such services but has also expanded in other forms of telework, including computer programming, as well. As the local telephone networks expand and improve—and as traffic in Manila and other major cities in the Philippines becomes even more congested—telecommuting will also grow in importance. The estimate for the rate of growth of telework is shown in Figure 42.

Figure 42: Estimated growth of telework in the Philippines



Singapore

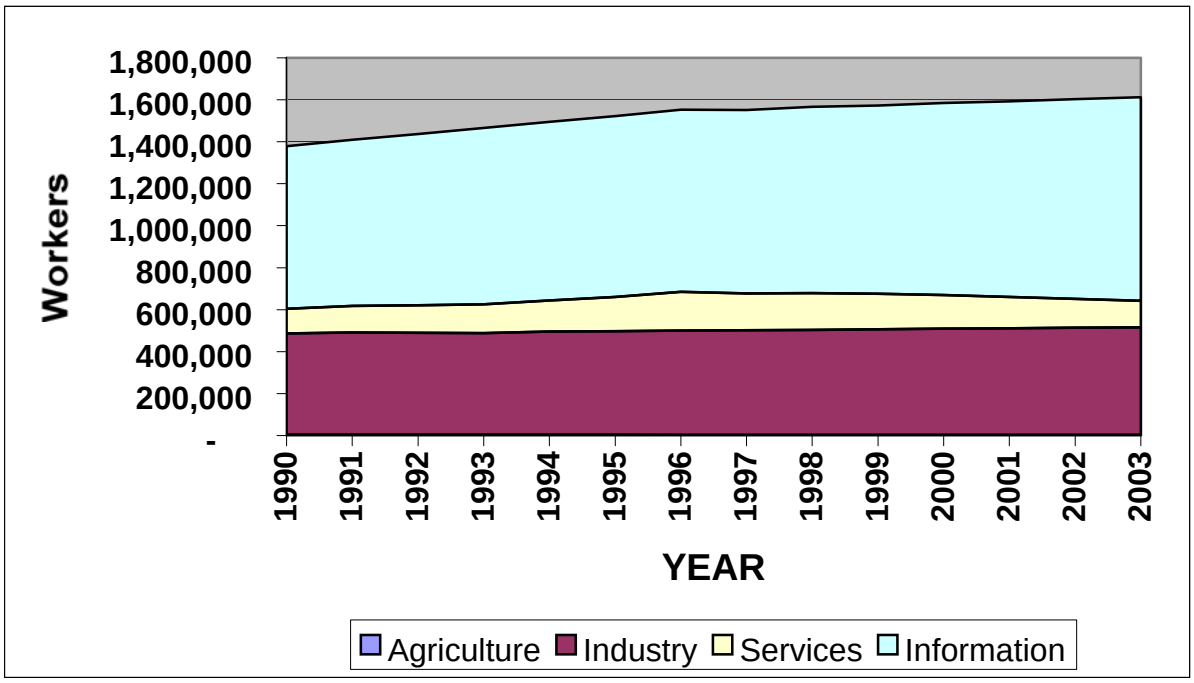
The economy

Singapore is probably the most developed of the so-called developing countries. In fact it may be more developed than some of the so-called developed countries. As can be seen from Figure 43, the largest component (28%) of Singapore's workforce is in the information sector. Information technology production constitutes a major portion of Singapore's export income and the country has long had the ambition of being the telecommunications hub of Southeast Asia.

Singapore's Ministry of Telecommunications and Information Technology, a government agency, controls all the telecommunications services in Singapore via the Telecommunications Authority of Singapore (TAS). The TAS will be merged with the National Computer Board by the end of 1999, as evidence of the government's realization that digital communications are the core of future development. Singapore Telecom, Ltd. Is the primary provider of telephone services on the island. Singapore is already very "wired" with 85 telephone lines for every 100 inhabitants. Internet access and usage is high and several of Southeast Asia's larger ISPs have headquarters in the country. Singaporeans also enjoy a high standard of living, with a per capita GNP approximately 9 percent higher than that of the United States in 1999. The cost of a telephone call to the US is about 75 times the cost of a local call but is one of the lowest costs

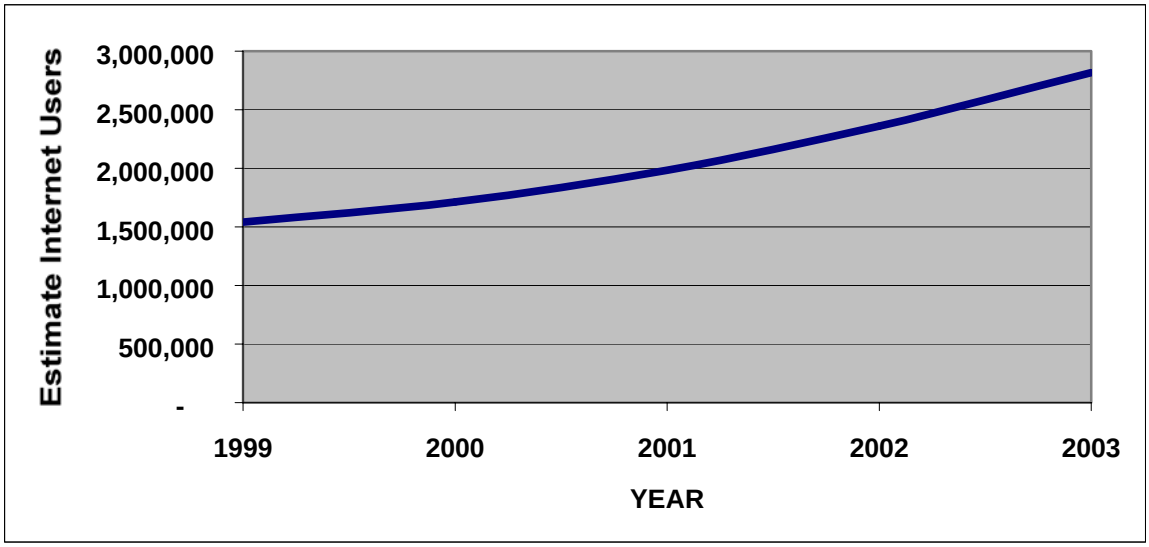
in Southeast Asia. Two-channel residential ISDN access costs are 5.6 euros per month plus 0.008 euros per channel-minute during peak hours. For 56 euros monthly—plus phone charges, web surfers can have unlimited Internet access.

Figure 43: Estimated composition of the workforce in Singapore



The estimated use of the Internet is shown in Figure 44. In 1999 half the population had Internet access.

Figure 44: Estimated Internet usage in Singapore



E-commerce

Given Singapore's important role in the manufacture of information technology products, combined with the high level of telecommunications penetration, it is not surprising if Singapore were to be an active player in the development of e-commerce. In August 1996 the

Electronic Commerce Hotbed Programme was introduced to serve as a focus for identifying the key issues of implementation and growth.

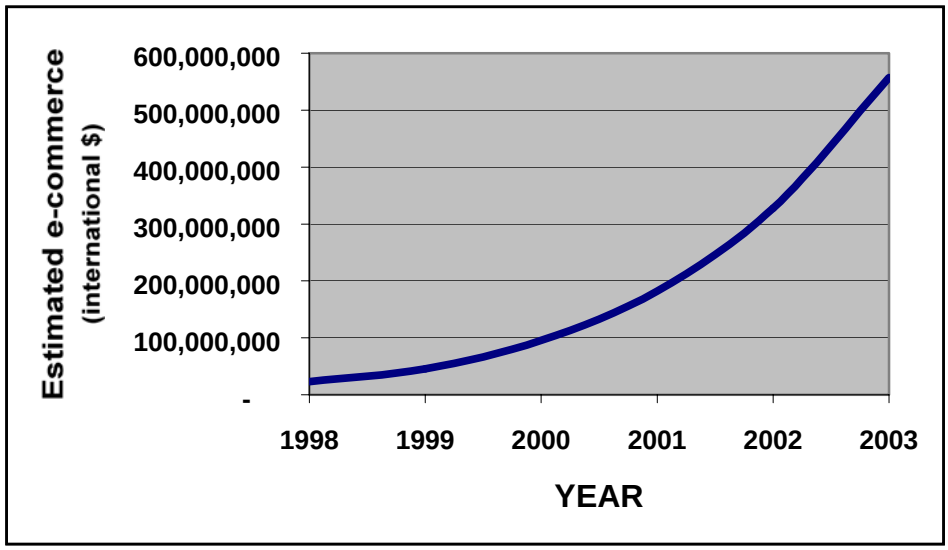
The Electronic Transactions Act of 1998 came into force in July 1998 as part of the Singapore government's commitment to e-commerce. The act provides a legal foundation for electronic transactions and is intended to give predictability and certainty to electronic formation of contracts. The government also launched its Electronic Commerce Plan "to drive the pervasive use of electronic commerce in Singapore, and to strengthen Singapore's position as an international e-commerce hub." The plan has five main thrusts:

1. To develop an internationally linked e-commerce infrastructure
2. To jump-start Singapore as an e-commerce hub
3. To encourage businesses to use e-commerce strategically
4. To promote usage of e-commerce by the public and businesses, and
5. To harmonize cross-border e-commerce laws and policies

Goals are to have a critical base of e-commerce services and a reliable infrastructure by 2000, and to have a sizeable amount of e-commerce transactions, an e-commerce services sector, and the widespread adoption of e-commerce by the industry by 2003.

In 1998 the National Computer Board polled more than 1000 companies, from small to large, and covering eight industry sectors, on e-commerce. Almost three-quarters (73.3%) of the companies surveyed had corporate Internet access and one-third had their own web sites. Our estimate of the growth of e-commerce in Singapore is shown in Figure 45.

Figure 45: Electronic commerce in Singapore



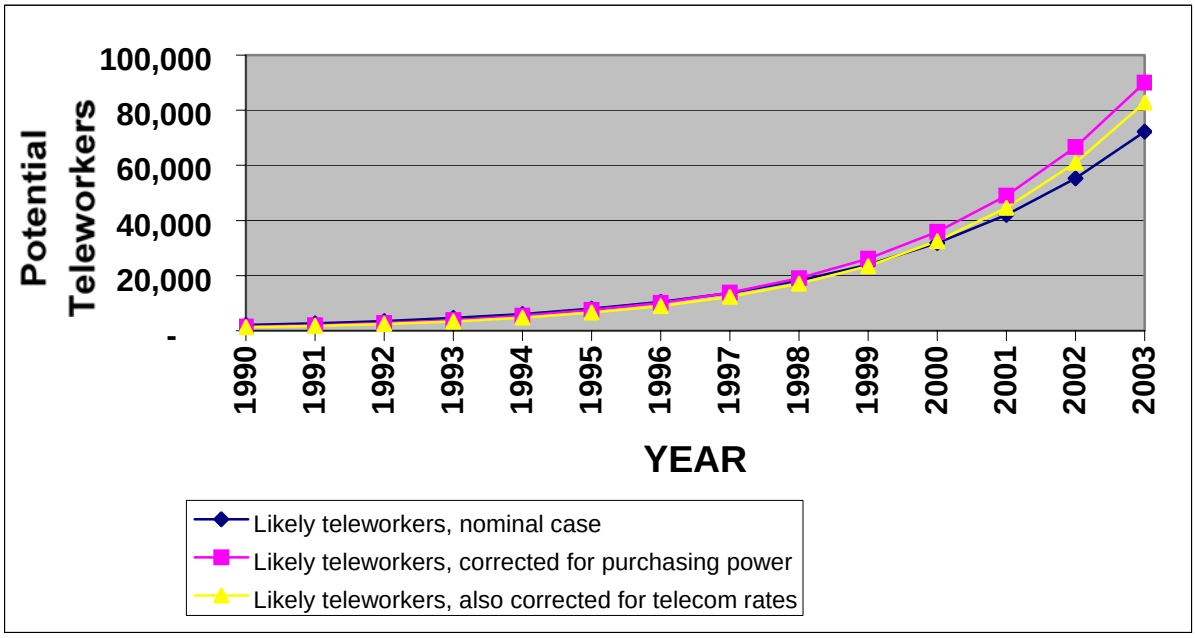
New Ways to Work

Singapore has necessarily been involved in telework since the early 1990s, if for no other reason than the fact that the island consistently has had negative unemployment rates: more jobs available than skilled people to fill them. For example, Singapore newspapers, including the *Straits Times*, are partially edited and designed in satellite offices in Sydney and Manila. Much of the domestic computer industry uses designers and other information support personnel from several other countries. Of course, Singapore also hosts subsidiaries of multinational firms, with manufacturing in Singapore and design in the host country.

As Singapore continues to pursue its path of high tech development, this pattern of multinational team development via telework is likely to grow and intensify. Figure 46 shows the current estimate of telework development in Singapore, although no survey data are available to verify the numbers. Curiously, the purchasing power parity corrections show higher levels of telework than the nominal case because of Singapore's higher per capita GNP. In any case, only the relatively small population of Singapore prevents it from being a world leader in numbers of teleworkers.

A 1998 Symantec survey of teleworkers in the Asia-Pacific region indicated that 83% of Singaporean teleworkers were part-time telecommuters and were mostly in managerial and professional jobs. The 14% of mobile teleworkers were primarily in sales or customer service jobs, and the 3% who telework full-time from home included a high proportion of female, self employed, customer service/support professionals. Unlike the United States, where telework is about evenly split among the genders, most of the teleworkers were male, except those working full-time.

Figure 46: Estimated growth of telework in Singapore



Thailand

The economy

Thailand is still a largely agricultural economy, with 48% of the workforce farming. But the agricultural component of the workforce is declining steadily and the service and information sectors are expanding, as is shown in Figure 47. GNP per capita is 22% of that of the United States.

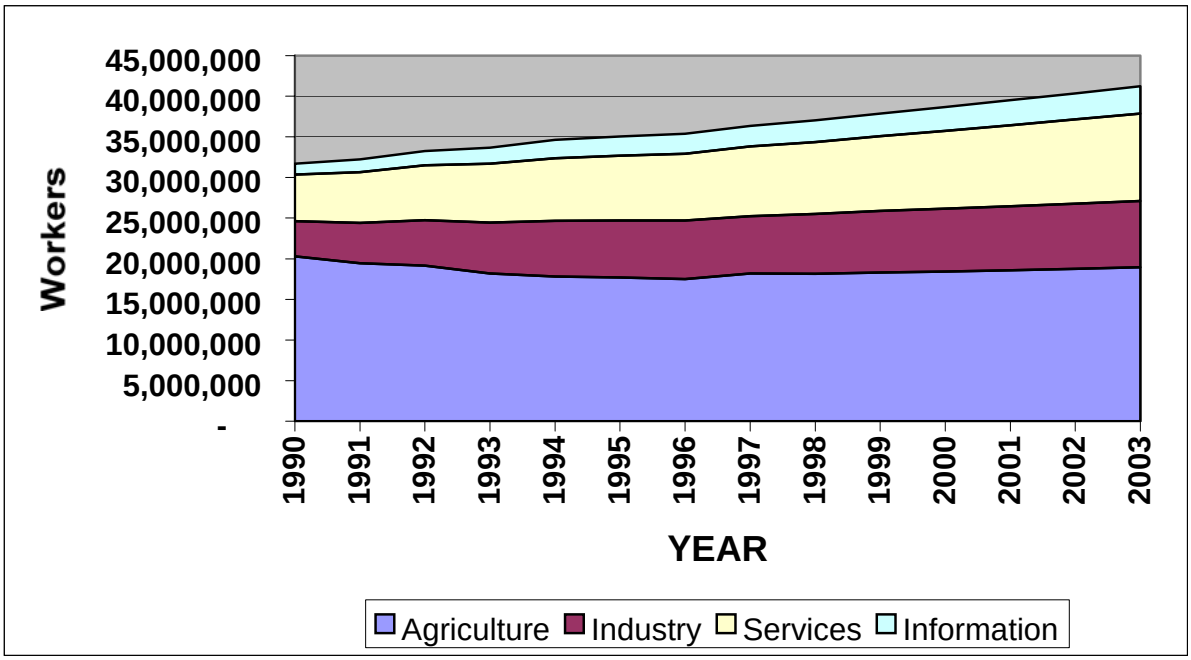
Thailand's information infrastructure historically has been controlled by the government under two organizations: the Telephone Organization of Thailand (TOT) for local traffic and the Communications Authority of Thailand (CAT) for long distance service. As part of Thailand's agreement with the World Trade Organization, both of these organizations are to be transformed into non-monopolistic telecommunication operators, beginning in 2000, like the

"concessioned companies" that have been operating under their control. In 1999 a long distance phone call to the United States was about 59 times the cost of a local call.

As one consequence of the economic crisis beginning in 1997, Thailand has instituted a number of reforms that focus on development of its information economy, elaborated in its IT-2000 plan. The plan comprises three main components:

1. Better telecommunications infrastructure, including deregulation.
2. Improved human resource development and education, including development of its software industry.
3. Good governance, including elimination of corruption and development of better IT services to the public.

Figure 47: Estimated composition of the workforce in Thailand



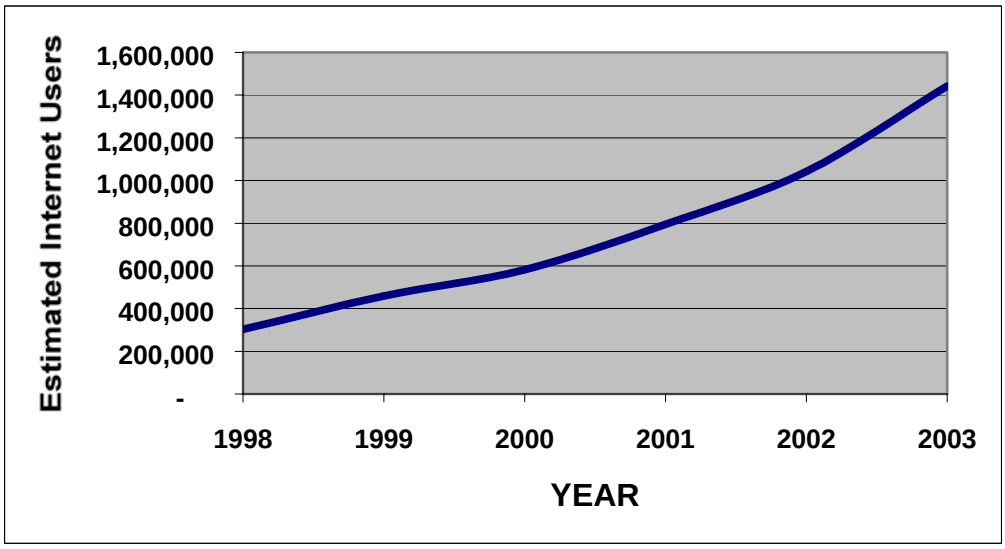
Thailand's first Internet use was in 1991. In 1992 the Thai Social/Scientific, Academic and Research Network (ThaiSam) was founded. As of 1999, ThaiSam had about 100 connections to all of the state-owned university sites. In 1995, ThaiSam extended its service to secondary schools. This was expanded in 1998 to allow schools to access the Internet without incurring expensive long distance charges.

Also in 1998 the National Information Technology Committee (NITC) empowered six subcommittees to draft information technology-related laws. These are:

1. Data Protection Law to protect privacy rights;
2. Computer Crime/Computer-related Crime Law to criminalize computer-related offenses;
3. Electronic Data Interchange Law to set the legal framework for electronic contracts;
4. Digital Signature Law to provide electronic commerce transaction security;
5. Electronic Funds Transfer Law to promote consumer protection and allocate liability; and
6. Universal Access Law to promote universal access to the National Information Infrastructure.

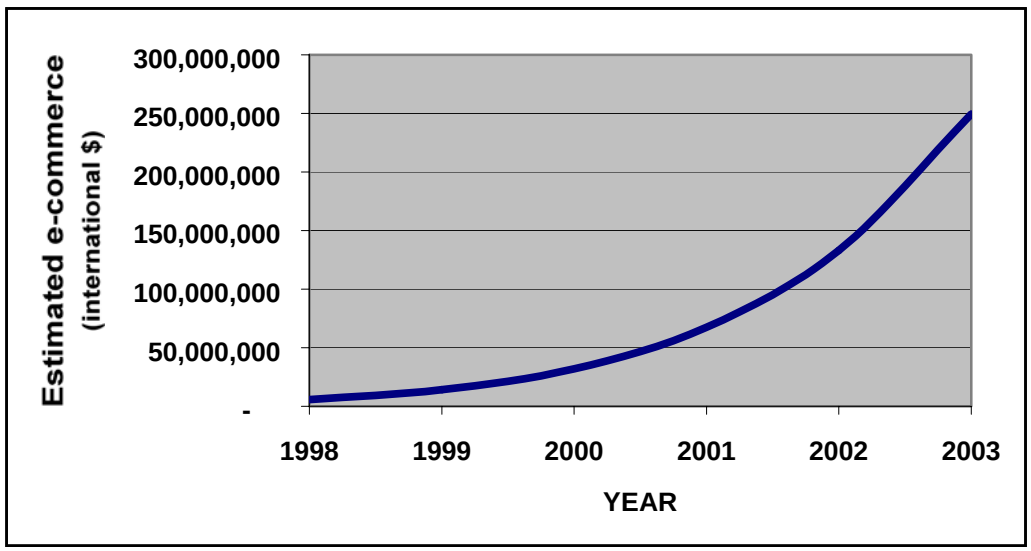
As a result of all of these initiatives, foreign investment in the telecommunications industry has been expanding and the new telecommunications regulations allow up to 40% foreign ownership of ISPs in 2000, expanding to 75% by 2006. Official registration, but no license, is required for opening a web site or online information service. In 1999 a typical monthly charge for a dialup Internet service in Bangkok was about 30 euros for 50 hours. The estimated growth of Internet usage in Thailand is shown in Figure 48.

Figure 48: Estimated growth of Internet usage in Thailand



E-commerce

Figure 49: Estimated growth of electronic commerce in Thailand



The development of electronic commerce is one of the keystones of Thailand's IT-2000 plan. In January 1999 the government approved a proposal to set up an Electronic Commerce Resource Center to provide e-commerce-related information and training programs, particularly to SMEs. One goal of the center is to prepare SMEs to compete internationally via e-commerce—as well as to defend themselves against competition from outside the country. The activities of the center are part of the APEC (Asia Pacific Economic Cooperation organization) Virtual E-commerce Resource Network. Related initiatives include a smart card development program, a

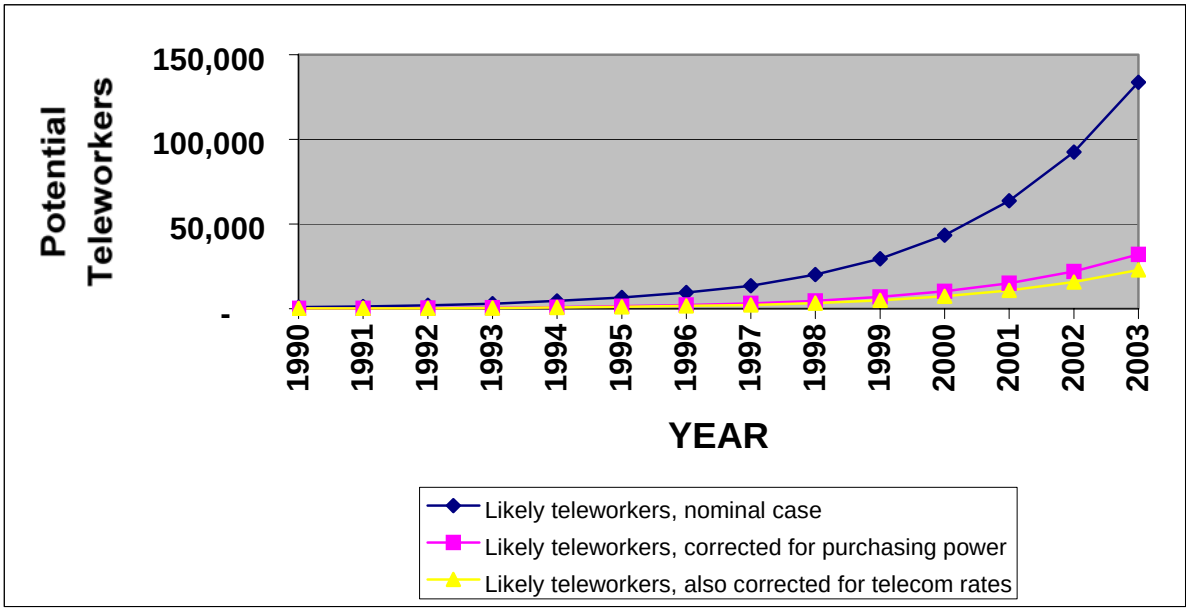
center to provide EDI services between government agencies and the private sector, and a one-stop trading service to smooth the procedural processes for the export trade.

Even though the coordinated government efforts just began in 1999, there have been some e-commerce operations prior to that as various entrepreneurs began online and Internet-based operation. These are expected to accelerate as the government initiatives come to fruition—particularly those efforts involving transaction security. Our estimates of the growth of e-commerce in Thailand are given in Figure 49.

New Ways to Work

The evils of traffic congestion in Bangkok are becoming well known around the world, with stories of multi-hour trips just to get from one side of the city to another. Air pollution is also becoming a deterrent to tourism and business development in general in and around Bangkok. As yet there is no concerted government effort to promote telecommuting or other forms of telework, nor are there any available survey data of the level of teleworking in Thailand. Nevertheless, teleworking is expected to increase, particularly as the information sector of the economy continues to grow and the telephone network expands from its 1999 level of 10.4 telephone lines per 100 inhabitants. Our estimate of the growth of teleworking in Thailand is shown in Figure 50. Note that the potential for telework in Thailand by 2003 is significantly higher than our economy-corrected forecast.

Figure 50: Estimated growth of telework in Thailand.



Summary and Conclusions

The key elements of the 10-country survey are contained in Tables 5 through 7. They include the figures from the main report for comparison.

Table 5: Summary of Internet user estimates (millions)

Country	1998	1999	2000	2001	2002	2003
Argentina	0.230	0.313	0.486	0.755	1.173	1.822
Australia	4.900	7.517	8.603	9.869	11.274	12.652

Brazil	2.208	2.674	2.967	3.631	4.221	5.155
China	2.100	3.174	3.963	5.548	6.888	8.937
India	0.600	1.500	1.500	2.519	3.374	4.849
Indonesia	0.360	0.600	0.779	0.933	1.211	1.692
Malaysia	0.500	0.841	1.012	1.240	1.529	1.875
Philippines	0.121	0.213	0.306	0.445	0.678	1.052
Singapore	1.329	1.541	1.712	1.984	2.359	2.817
Thailand	0.302	0.459	0.582	0.794	1.043	1.443
United States	87.517	101.000	115.202	124.430	132.240	137.919

Table 6: Summary of e-commerce volume estimates (USDmillions)

Country	1998	1999	2000	2001	2002	2003
Argentina	25	62	163	433	1147	3040
Australia	218	574	1511	3975	10458	27510
Brazil	0	271	718	1904	5047	13376
China	0	10	20	36	81	186
India	8	21	160	400	920	2024
Indonesia	2	3	4	8	15	30
Malaysia	7	15	30	57	102	174
Philippines	1	1	2	5	9	15
Singapore	23	46	96	182	328	557
Thailand	6	14	32	67	133	249
United States	70900	144863	317458	620432	1050174	1658800

Table 7: Summary of telework estimates (millions)

Country	1998	1999	2000	2001	2002	2003
Argentina	0.210	0.269	0.340	0.429	0.535	0.655
Australia	0.353	0.431	0.522	0.627	0.749	0.892
Brazil	0.013	0.019	0.029	0.045	0.069	0.104
China	0.001	0.002	0.003	0.005	0.008	0.012
India	0.027	0.039	0.058	0.084	0.121	0.173
Indonesia	0.001	0.001	0.001	0.002	0.003	0.005
Malaysia	0.022	0.033	0.051	0.075	0.109	0.155
Philippines	0.005	0.008	0.010	0.014	0.020	0.026
Singapore	0.019	0.026	0.036	0.049	0.067	0.090
Thailand	0.005	0.007	0.010	0.015	0.022	0.032
United States	18.643	21.408	23.815	25.862	27.563	28.992

The following are the conclusions reached during the preparation of this report supplement.

- With the exception of Australia, most of the countries are either in the initial stages of e-commerce development or are just beginning planning such ventures at the federal level. Substantive results are not expected until 2003 or later, with Australia and Brazil most likely to be in the lead. Large countries such as China and India have high long-term potential for both e-commerce and telework, but it is not likely to reach significant international impact for at least a decade.
- A primary impediment to the development of business-to-consumer e-commerce and, to a lesser extent, business-to-business e-commerce, is the lack of a reliable and dependable online transaction system. This includes low use/acceptance of credit/debit cards.
- Most of the developing countries have yet to attain the information infrastructure necessary for efficient e-commerce or telework. Telephone penetration is low and

telecommunications prices are excessive when compared to consumer/business purchasing power.

- Language barriers constitute a problem in two respects: in non-English-speaking countries, there is often little online content in indigenous languages; and in some cases there are many indigenous languages and low literacy rates, further reducing both effectiveness of, and demand for, access to the Internet.
- The proportion of information workers in each country's workforce is roughly proportional to its per capita GNP; the higher the per capita GNP, the larger the fraction of information workers. Conversely, the lower the per capita GNP, the later the country is expected to have high proportions of either e-commerce or telework.
- There are teleworkers in all of the countries surveyed but most of the countries have no telework policy or plans for support of demonstration projects. The exceptions are Australia, Malaysia and Singapore.