



JALA International, Inc.

The Role of Telework in Internationalization

Trends and Opportunities

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The Nature of Telework

Fundamentals

What is telework?

Telework is the partial or total substitution of information technology—telecommunications and, often, computers—for work related travel; it involves sending the work to the worker rather than sending the worker to the work. The key point is that telework is a departure from “traditional” work practices; if a worker would ordinarily travel to a different location in order to accomplish the desired work, but now uses information technology to achieve the same results, then he/she is a teleworker.

This is a broad definition, broad enough so that arguments about the edges of it¹ have occupied academics for more than two decades. But the core of its impacts arises from the idea of **location independence**: in principle, teleworkers can work anywhere when they are teleworking. The relative geographic locations of teleworker and employer are largely a matter of indifference. This has powerful implications for the future.

Who can be teleworkers?

In principle, anyone who can perform his work without regard to his whereabouts—and uses information technology either to get work assignments or to transmit the work products—is a teleworker. In practice, most teleworkers are information (or knowledge) workers: their primary economic activity is the creation, manipulation, storage, or transfer of information, or the manipulation of information machines. Most census takers lump information workers into the “service industry” category but, because of their potential location independence, they are sufficiently different so that they should be classified as a separate group (one that has members in the manufacturing and agricultural sectors as well).

Figure 1 shows my estimate of the distribution of these main types of workers in the OECD member nations. Although the details vary from country to country, information workers constituted the dominant part of the workforce in 20 of the 24 member countries in 1987 and are likely to be more dominant today.

However, not all information workers can be teleworkers, and at present most cannot be teleworkers full-time. Yet, in terms of the nature of their jobs in the information sector, as many as 40% of the workers in countries like the US could be at least part time teleworkers.

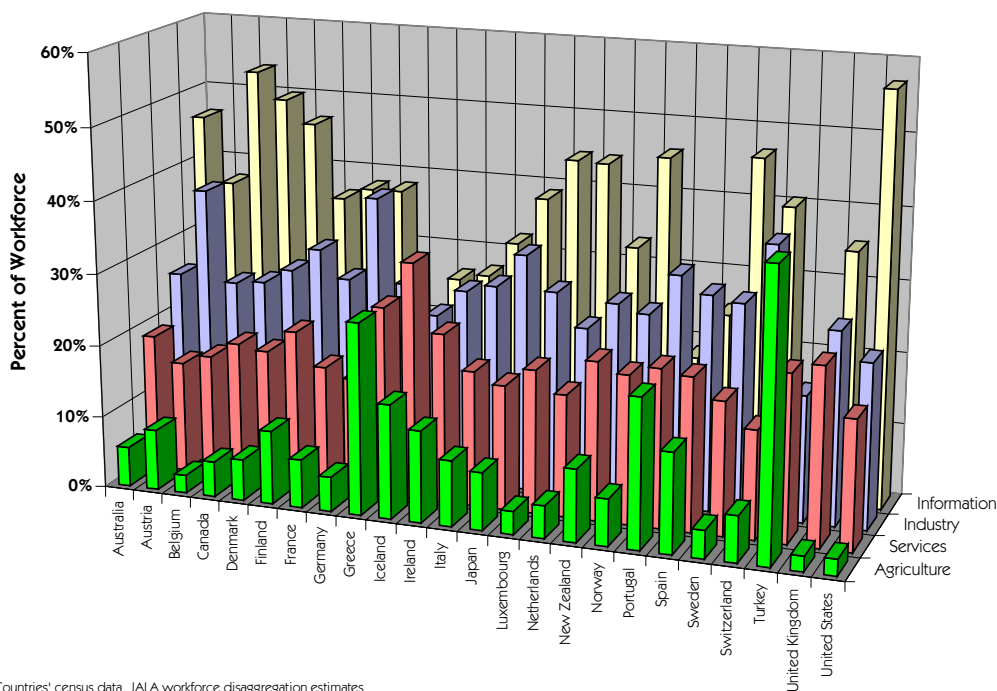
What are the options?

There are several varieties of telework and several options for teleworking. The particular version of telework that first got me interested in the topic around 1970 was *telecommuting*, that aspect of telework that focuses on reducing or eliminating commuting—the daily trips between workers’

¹ Question: If I talk to my secretary on the phone rather than going to his desk to talk to him, am I (is he) teleworking?
Answer: Yes, if your secretary is in another building/city/country; No, if he is two meters away. By the way, why do you still have a secretary?

homes and their workplaces. Telecommuting is a particularly important variety of telework because it affects family automobile use. About 40% of all automobile use in the US is for commuting. Hence, reduction of commuting can substantially reduce automobile use and its associated energy and air pollution impacts. Telecommuting is the dominant form of telework today, in terms of numbers of teleworkers who telecommute.

Figure 1: Workforce distribution for the OECD countries, 1987



Sources: Countries' census data, JALA workforce disaggregation estimates

Other forms of telework include telelearning (or distance learning), telemedicine, telemarketing (or tele-order taking), and other substitutions of information technologies such as various forms of teleconferencing for mid-day or other work travel that does not necessarily involve—or occurs as well as—commuting.

In addition to these *types*, there are different *modes* of telework. The most common of these is working from one's home, *home-based teleworking*. Our first tests of telecommuting in 1973 involved *telework centers*, ordinary office buildings located closer to employees' homes than their principal offices; the idea being that a teleworker reports to the telework center closest to her/his home. Varieties of telework centers range from large satellite offices, completely inhabited by workers from the same organization,² to neighborhood telecenters that have just a few workstations that may be available to whomever drops in.³

² See Jack M. Nilles, F. Roy Carlson, Jr., Paul Gray and Gerhard J. Hanneman. *The Telecommunications-Transportation Tradeoff: Options for Tomorrow*. New York: Wiley, 1976.

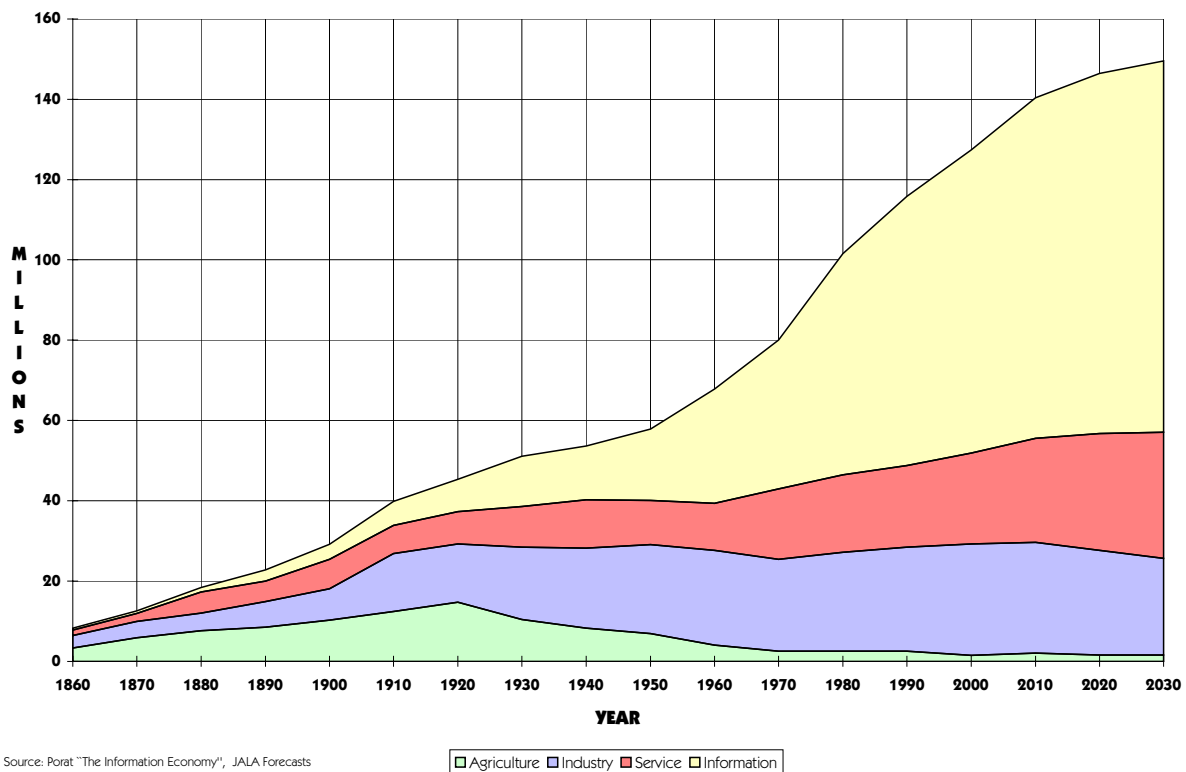
³ Kinko's, an office services chain in the US, has many neighborhood centers that provide computers and telecommunications services, including videoconferencing. Many executive suite operations globally can also qualify as telework centers.

Forces For

What is happening to work?

Although Figure 1 provides a snapshot of the distribution of the work forces in the OECD countries, it does not show the dynamics. In particular, information work is increasing, as a fraction of the economy, in every country in the world. This is largely a result of shifts from the agricultural and industry sectors to information, although the service sector is growing as well. Figure 2 shows some history as well as my forecast for the workforce changes in the US.

Figure 2: *The growth of the workforce in the US*



Although the details will vary from country to country, it appears that most of the world will follow the general evolutionary path shown in Figure 2. In some countries agriculture will retain a larger role, or manufacturing a smaller one, but it all comes down to a simple relationship. *It takes less than one-fourth of the working age population (about one-eighth of the total population) to provide the necessities: food, clothing, and shelter for all of us, so what are the rest of us to do?* For most of those not in these basic industries information work—or unemployment—is the answer.

Information technology

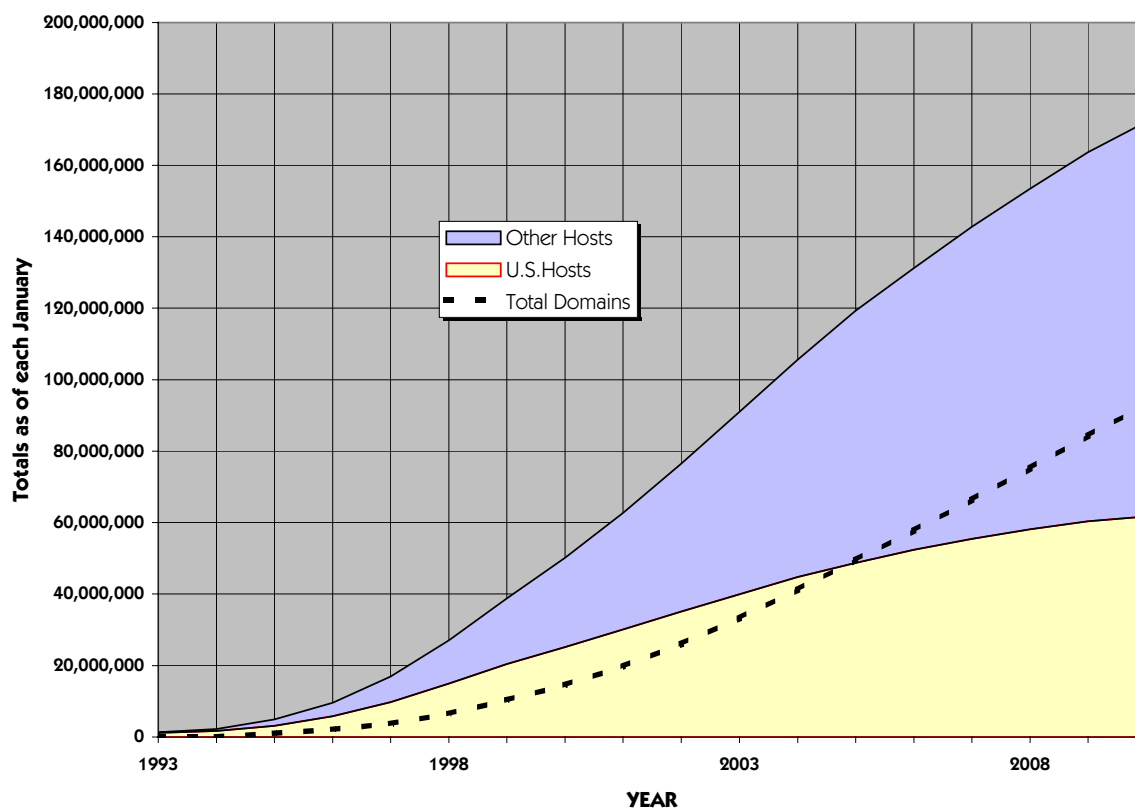
Information technology has had a fundamental role in these changes. Gordon Moore's famous empirical law of the development rate of microchips is still valid and will continue to be so at least for the next decade.⁴ What works for microelectronics and computers also works for telecommunications technology. Consequently, we have had an explosion in information processing capability since the mid-1960s—and the explosiveness is accelerating.

⁴ Loosely translated, it says that the information processing power of microelectronics digital devices such as microprocessors and memory chips doubles about every eighteen months—or about two years if the costs are kept constant. Another way of putting this is that for a given cost level, the amount of processing power you can buy increases by a factor of ten about every seven years.

Many of the consequences of this technological expansion have already been felt. Microprocessors are everywhere, in bank transaction cards, automobiles, watches, communication satellites, telephone switches, and on or near most desks in the developed world—even many of the desks in homes. As the processing capability keeps increasing, the market for these symbol-crunching devices keeps expanding. A growing number of information workers depend upon their personal computers to help complete their work.

The computers have also begun to talk to each other. Many people have grown accustomed to the growth rate in computers but are understandably surprised to see the expansion of the Internet at rates exceeding 100% **monthly**. From a few thousand in 1990, mostly in the US, the number of host computers on the Internet has grown to about 17 million today and should reach 50 million in the year 2000, only half of them in the US. Figure 3 includes my estimates for the next few years. Despite all the Internet's well-publicized growing pains and constant threats of implosion, these figures may be too conservative.

Figure 3: Growth of the Internet



Source: Internet Society; JALA forecasts

Add to this expansion the spread of wireless telecommunications, either ground- or satellite-based, and the need for major capital investments in a wired (fibered?) infrastructure is proportionally reduced. This provides a further nudge toward location independence of teleworkers and the rapid expansion of telework into remote areas of the world.

Congestion and the environment

A major trend accompanying the industrial revolution—and the shift in the work force from agriculture to industry—was the mass migration of people from rural communities to ever-expanding cities. As transportation technology improved it became possible to expand cities beyond their original boundaries to accommodate the new workers and still allow them to have commute times of about half an hour. With the arrival of the automobile, and then freeways, urban expansion was further accelerated and the phenomenon called urban sprawl became common. In the latter half of this century the laws of physics—you can't fit multiple solid bodies into the same

space-time—began forcing increases in commuting distances and times in most of the world's major cities. This year, traffic congestion in the US is expected to cost about \$90 billion in lost productivity.⁵

Health and the environment also suffer from this traffic congestion, most of which is caused by too many cars. Air pollution plagues most cities by reducing visibility, eroding buildings, and affecting the lungs of their citizens. The result is a world-wide pressure to get people out of their cars—at least when they are commuting.

Competition

Partly because of the pervasive global accessibility provided by the expanding telecommunications infrastructure, competition among business organizations has expanded from local to global as well. The reach of even very small companies has become the same as that of huge corporations.

This competition is in two areas: customers and resources. As an example of price competition, the World Wide Web allows even micro-companies to present their products and services to potential buyers anywhere, to compete in price or quality of product, or both, with their largest competitors. The arrival of secure transaction services on the Web, still in process today, will be the final link in this global competitive infrastructure.

Competition is also at the resource level. The most important resources in an information economy are information and information workers. Here, too, the playing field may be leveled, as critical intellectual resources and knowledge become globally available. One of the situations where this is important is that in which a particular skill is not available locally, but can be accessed via telework arrangements. We have had several clients who consider telework to be a competitive tool, allowing them to hire people in other localities—even other countries—who do not wish to move to the employer's location, or who can provide equivalent services for a better price.

Since price is always a consideration, a producer of information goods must always search for ways of reducing costs while maintaining or improving quality. We have repeatedly demonstrated that teleworkers out-produce their in-office colleagues by as much as 20%, on average. Furthermore, teleworkers who spend significant amounts of time away from the principal office (that is, the office where they would work if they were not teleworking) reduce the demand for office space; they usually will share office space, or only use conference space, when they are in the principal office. When they are teleworking, teleworkers work at home (generally at no cost to their employers) or at telework centers, which usually cost less per square meter than space in the principal office. Companies like IBM have saved millions of dollars annually just from telework-related office space reductions.

Forces Against

Industrial revolutionaries in denial

By far the foremost barrier to the acceptance of telework is the industrial revolution mindset. Inherent to the success of the industrial revolution—and of several failed forms of government—are the concepts of centralization and rigid hierarchies. These were perfectly reasonable attitudes for the times when large complexes of machines, each attended by many, poorly educated workers, were needed to mass produce millions of identical products. Further, since the characteristics of input and output were known exactly, the emphasis in the production process was on minimizing cost by controlling every step.

⁵ JALA's estimates, ignoring the effects of telecommuting, and expanding on A.D. Little estimates.

The information age presents an entirely different production environment, even in manufacturing. Although some information products are mass produced and standardized (microprocessors and newspapers, for example), the trend is toward customization. In the computer industry a product “generation” may be only a few months rather than years. This requires great flexibility in all aspects of the design, production and marketing processes. Teams of workers may combine for a specific task, manage themselves, and dissolve when the task is completed, only to reform, perhaps with different membership, when a new challenge arises. Flexibility and communication adeptness, as well as expertise, are critical attributes of successful information workers. Poorly educated workers are at a significant disadvantage in this economy.

Yet most of the management practices used in the world follow the industrial revolution model. Managers want to retain (the illusion of) control over their employees. The prospect of telework, with the workers spending large quantities of time out of sight—even though they may routinely do so in most real-life office environments—can be terrifying.

There are two keys to amending this situation where it is required: training and technology. Training is critical because most managers have not been trained to be managers of people (although they may have advanced degrees in finance, accounting, engineering, or other highly numerate fields). We have found that training in the fundamentals of setting goals and objectives, time management, quality interpersonal communications, and the like, can materially improve the chances of success of teleworking arrangements. As information technology improves, particularly with tele-technologies that enhance teamwork, the scope and potential of teleworkability also expands.

Culture clashes

As teleworking goes global, additional complications can affect work relationships. These can range from differing interpretations of common expressions and language translation problems, to differing business practices, to conflicting work regulations. For example, while English has become the *de facto* language for business transactions, even in the European Union, many potential European teleworkers either are not proficient in English or prefer to work in their native tongues; both situations tend to reduce the rate of expansion of international telework or limit its scope. On the other hand, the same situation provides an opportunity for translators (although translation costs increase the cost—and reduce the competitiveness—of telework).

Differing labor standards also present both opportunities and obstacles to telework. For example, suppose country A has lower standards than country B, in terms of working hours, pay scales, health benefits, unemployment insurance, etc. If an employer in country B hires teleworkers in country A, which standards prevail?⁶ In which courts do the parties have standing in cases of dispute? If telework is perceived to be causing job drain in country B, will new regulations or diplomatic initiatives be developed to restrict trans-border work flow—or to require that country A raise its standards? In short, to what extent will the added complications of international commerce restrict—or the opportunities promote—telework developments?

Telework aside, the North American Free Trade Agreement presents an example of this situation. Much resistance to it in the US stemmed from the fear of, as Ross Perot put it, “that great sucking sound” of jobs moving from the US to Mexico. In fact, the evidence to date is that both countries have experienced net increases in trade and employment. Specifically, “Mexico is [now] the third largest export market for United States goods and the third largest supplier of imports in the

⁶ “. . . if you are employed, for example in France, from a UK company, and you live permanently in France then you are considered as an agent of the UK company and the employer must pay French social security. It is up to the employee to arrange this as most employers don't know how to go about it. (the cost is not conducive to this type of arrangement). However, if the UK company offers a permanent job which is UK based then the employee pays UK social security contributions despite, perhaps, doing most of the work from France. I can assure you that the situation is not the most simple to resolve.” Email, via the European Telework Forum, from Alan Husselbee, a teleworker in Paris, 5 May 1997.

United States market.”⁷ That is, once equitable agreements have been negotiated, reduction of trade barriers appears to improve conditions for all parties to the agreement.

Most countries have had their telecommunications infrastructures as direct government operations until fairly recently. Next year, and for the next several years, privatization is supposed to occur, opening most telecommunications markets to competition. In principle, this trend should act to materially reduce telecommunications prices. This, in turn, will act to enhance demand for telework since the primary operating cost of teleworking is the cost of telecommunications. Nevertheless, rates today are generally still much higher outside the US. Further, real competition may take longer than hoped for by backers of free markets. In the US, for example, the large telephone companies are merging rather than competing.

What do we do with all these buildings?

One of the characteristics of concentration of power is what Paul Gray, a colleague of mine, calls “the edifice complex;” the desire of an organization to have its name or logo adorning a large building in the city center. In the past half century many city—and suburban—centers have become deserted at night as the office and store workers left for their distant homes. Now telework has the added threat of causing desertion of office space even during daylight hours. For decades I have been trying to convince urban developers to convert downtown structures from office- and retail-only to multi-use purposes, providing housing as well (like most cities in Europe). Few have paid much attention and there is renewed effort in many cities to revitalize their centers—often by repeating the same policies that drove workers away in the first place—even though there is a glut of office space in the centers. An article in the *Wall Street Journal* (24 January 1997) notes that downtown Chicago “is slowly pulling out of its early-1990s tailspin, and it is largely due to the suburbs.” That is, office space rental rates downtown have fallen enough to be competitive with suburban space, thereby shifting the office space glut from downtown to suburban centers.⁸ The problem hasn’t been solved, just moved around.

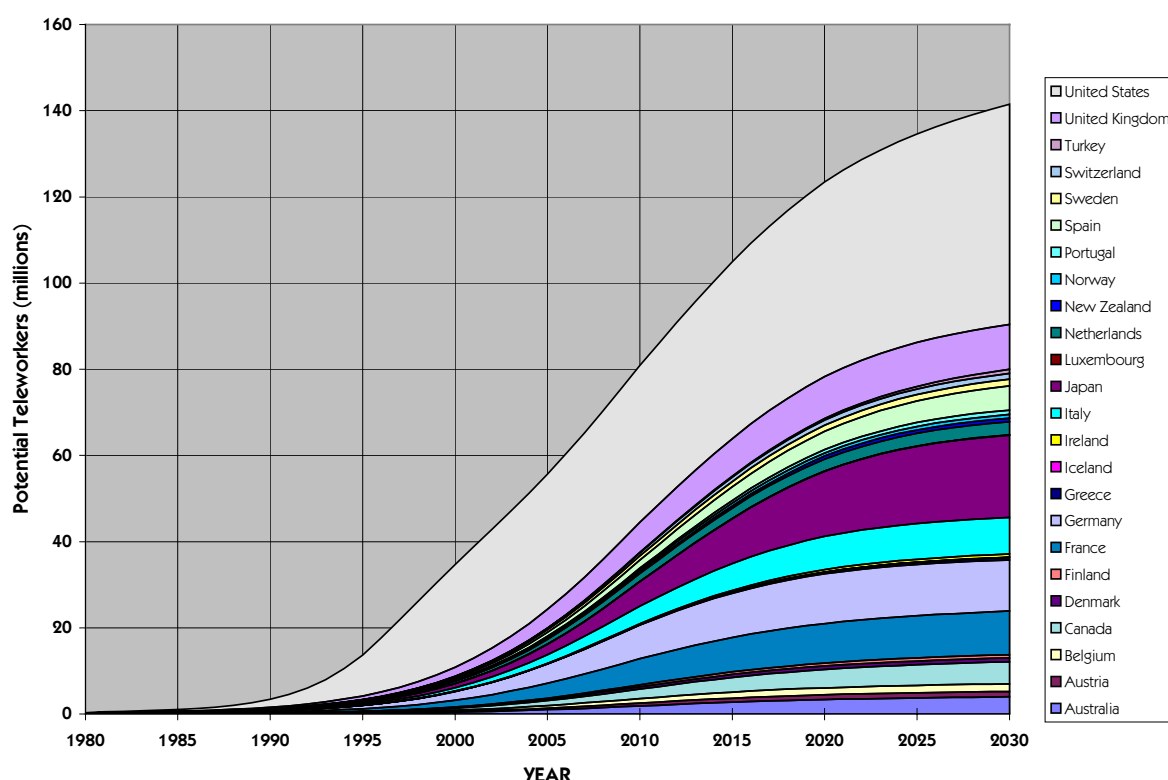
⁷ Janet Nuzum. *How Mexico Has Fared Under United States Trade Remedy Laws*. Albuquerque, NM: The United States-Mexico Law Institute, Inc., 1994.

⁸ But only for quality space. The article goes on to note that IBM reduced its office space by 50% and that one-third of the bottom tier office space is still empty.

Global Telework Trends

Some Preliminary Forecasts

Figure 4: *Estimated growth of telework in OECD countries*



Assumptions and influences

The following forecasts are the preliminary results of JALA's continuing study of the global prospects of telework. They are based on a large number of assumptions about the influences of various factors on the level of telework implementation. The data used for the forecasts were all available publicly, and we have tried to use only fairly reliable sources for our mathematical forecasting model. Nevertheless, there are several areas in which we have been forced to make educated guesses. For example, no government collects (or organizes) data on either information workers or teleworkers for their statistical reporting; we have had to disaggregate data under the assumption that the evolution of telework in other countries would be analogous to that in the US. Income per capita, the extent and competitiveness of the information infrastructure, technology import/export restrictions, government regulations, educational levels, a variety of demographic factors, all affect the acceptance—as well as our estimates—of telework. In particular, we have assumed that population growth rates worldwide will be roughly the same as they were in the early 1990s. In reality, third world growth rates may decline, while those of the OECD countries remain small or negative. Therefore, these estimates should not be depended upon for long term market planning, but we do feel that they are good indicators of the future course of events.

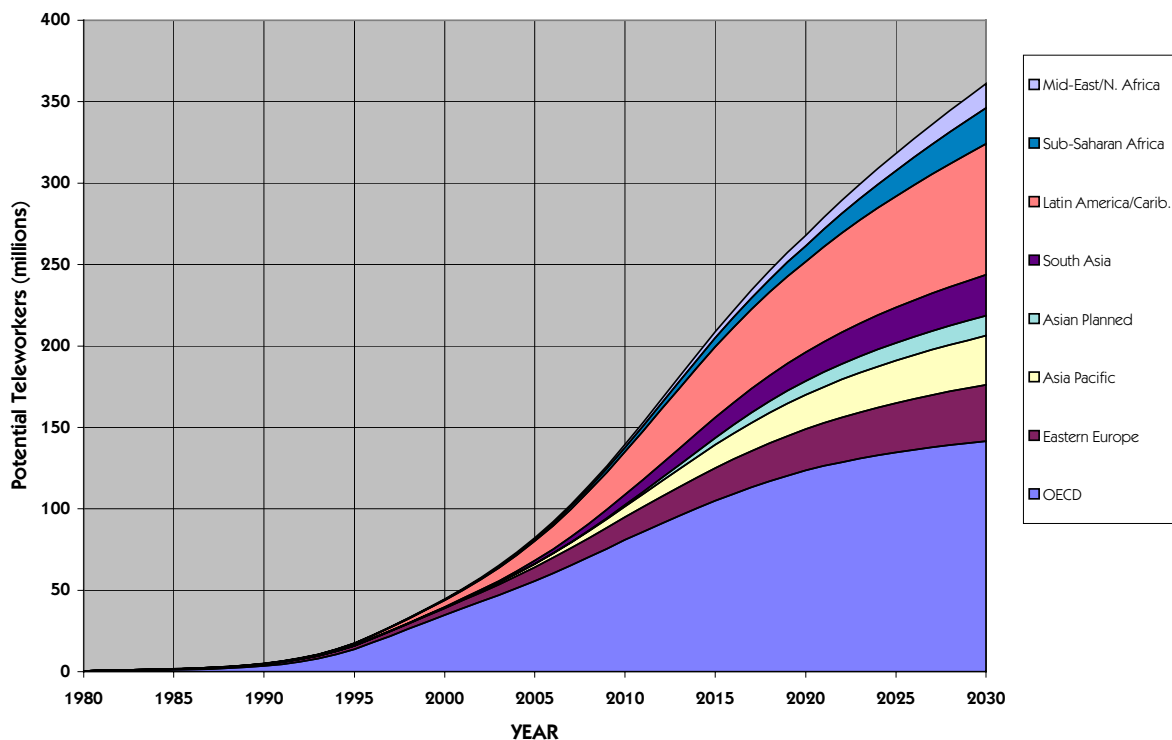
OECD countries

Although we have developed data for essentially every country in the world, it makes sense to divide the preliminary results into two clusters for purposes of illustration: 1) the OECD countries, and 2) everyone else. The Organization for Economic Cooperation and Development comprises countries representing a major sample of what is known as the developed world. This includes western Europe, Australia, Canada, Japan, and the US. The current results of our analysis are shown in Figure 4. Note that, while the US has the largest number of teleworkers today, we expect the rest of the OECD countries to catch up (in aggregate) some time in the next decade.

The rest of the world

Figure 5 shows our nominal global forecast, including the OECD countries. Again, the OECD countries are the primary sources of teleworkers today, but may be surpassed by the rest of the world in two decades. The forecast for the rest of the world is much more problematic than the one for the OECD, for the reason that population, national income, and education growth rates are much less certain. In this forecast large populations, such as in Brazil, China, India, Indonesia, and the Philippines, can produce substantial numbers of teleworkers even where the teleworkers represent small percentages of their country's populations. However, if the necessary infrastructures fail to emerge or develop, then the growth rates will be below those show here.

Figure 5: *Estimated global growth of telework*



In the nearer term, we estimate that there may be as many as 40 million teleworkers worldwide by the end of the year 2000. More than half will be in the US, with the next largest group in the European Union countries.

Implications of Location Independence

All of these changes in the processes of work can have consequences not only on global economics but on the geographic distribution of populations as well. Here are some of the possibilities.

The urban dilemma: rehabilitation or death by sprawl?

The evolution in the nature of work of the dominant work group is coupled with the development of transportation technologies. Historically, cities and megalopolises developed by population accretion from small, strategically located villages. Now we find ourselves in the position, for the first time, that huge cities aren't necessary any more. Worse, huge cities, even merely big cities, are counterproductive. Although centers of culture, learning, and commerce, such cities are also foci of pollution, crime, and destruction of the environment. As information technology transforms our economies it is altering the constraints on where we live and will change the shape of cities.

In most economies (whether or not the government agrees with it) residence location is closely tied with access to work. Clusters of residences serve as nexuses for commercial developments, expansion of infrastructure, and introduction of services such as schools, local government, public safety, etc.

Telework's location independence is a double-edged sword: (first, the good news) it allows cities to rearrange themselves so that they retain their cultural advantages without rebuilding, and while reducing the ill effects of commuting; (next, the bad news) it also can have the same effect as introduction or extension of freeways—increased urban sprawl.⁹ Either or both impacts are possible in a given region.

Proper regional planning can use telework both to decrease congestion in overcrowded areas and to move work—and training—into economically challenged sections of a city. By helping to keep workers in the neighborhoods where they live—or by increasing the work opportunities for the jobless in the neighborhoods, telework improves their economies. In many urban areas today the majority of commuting is between suburbs, not between suburbs and the dying city core. As teleworkers move to city centers to avail themselves of the remaining cultural attractions then, together with improvements in inter-center traffic, a more reasonable and sustainable balance can be struck between the attractions of the city, access to them, and the environment.

Yet the threat remains that telework will act to make things worse by allowing workers to move farther away from their work sites while still requiring the transportation and utilities infrastructures of the city, and lowering residential densities—that is, creating more urban sprawl. Our research to date, admittedly limited in duration and scope, shows no such trend but the threat remains.

Rural development

One of the promises of telework is that it will allow work to move from the over-congested cities, not by increased sprawl but to rural communities, thereby helping revitalize them. Over the past decade or so, several tests of this possibility have been made, mostly in European Union member countries. The telecottage movement is an example, as are several initiatives sponsored by the European Commission, France Telecom,¹⁰ and others. The principal concept is that the city, in terms of work and many cultural opportunities, is available at the end of a telephone line, fiber optic or microwave cable, or satellite dish, while the neighborliness, contact with nature, and feeling of community characteristic of a small town is available just outside the front door.

There are two contrasting aspects of this situation. One is the idea that information technology can be used to train the existing inhabitants of small communities so that they have work skills competitive with city dwellers. The other is that the same technology, coupled with the attractiveness of life in a small community (including substantially lower home prices), can lure

⁹ For more details, see *Telecommuting and Urban Sprawl: Mitigator or Inciter?* by Jack M. Nilles. *Transportation* 18: 411-432, 1991.

¹⁰ See Anita Ronzenholz, Bruno Fanton and Alain Veyret. *Telework, Tele-Economy: Enhancing Employment and Regional Attraction*. Montpellier: IDATE, 1995.

already-skilled workers from the city to the community. Success of either of these goals depends on satisfaction of some infrastructural preconditions.

First, the technological infrastructure (hardware, software, telecommunications services, and maintenance) must be in place, and at a price that is reasonably competitive with that of the cities. It need not be entirely competitive since lower costs of living in the community may make lower-than-city wages acceptable to the teleworkers. Second, there must be affordable access to quality education; teleworkers will need to continually upgrade their skills. Third, the necessary business support services must be available although, with the steady decreases in the price of do-it-yourself support technology, that is a diminishing requirement.

Given these caveats, examine the alternatives as world population growth continues: further increases in urban densities, sprawl, and congestion; or revitalization of smaller, livable communities. Europe has an advantage over the US in this regard, Europeans and most of the rest of the world are accustomed to living in high density communities, while Americans appear to be sprawl addicted.

Vanishing borders

All of the telework trends portend continuing erosion of national borders as teleworkers conduct business and form relationships with colleagues independent of their relative locations. Already large multinational corporations have formed what Robert Reich calls global webs¹¹ of interconnected divisions, subsidiaries, suppliers, and customers. With telework it is possible to extend that ability to network down to small, even micro-companies. The primary missing element at this time are the information brokers, the agents/brokers who search out demand for skills and match it with qualified providers. The market will supply that capability as well.

Islands of excellence

However, even though location independence is greatly increasing, it is important to note that, to paraphrase George Orwell: All locations are equal, but some locations are more equal than others.¹² Given the chance—and the important caveat: all *other* things being equal—people are more likely to move to places that they feel are especially attractive, usually because of physical beauty, cultural advantages, enhanced quality of life, or recreational opportunities. Real estate developers learned that centuries ago.

Islands have a unique attractiveness for many people. Certainly large bodies of water are attractive to humans, witness the larger population densities on coastlines. But islands seem to have a particular exotic mystique and are especially attractive. The problem is that islands also tend to have resource limitations of one sort or another. With smaller islands, many everyday goods need to be imported, hence subsistence costs are higher unless the population is satisfied with what can be gleaned from the sea. Limited fresh water supplies may put a cap on the size of supportable population unless desalination plants or imported supplies (again, at extra cost) are used. In short, the attractiveness comes at a price. Many of the same issues apply to non-island special communities (such as Yosemite National Park in California) as well. Finally, islanders have traditionally been information deprived, when compared with the rest of the world's population centers, because of limited communications.

But now suppose that, given the low cost of importing information into an island, the net cost of residing there—or at least staying longer than the usual vacation period—although possibly higher than on the mainland, is deemed to be well worth it. Further, suppose that additional facilities are built on the island that augment the ability of residents/visitors to do their work. Then the island

¹¹ Robert B. Reich, *The Work of Nations*. New York: Alfred A. Knopf, 1991.

¹² George Orwell, *Animal Farm*. 1945, Chapter 10.

may become a strong attractor of specialized skills with an enhanced ability for economic development.

In order for this to happen, the island must satisfy some key requirements. I'll outline them in terms of a check list, using a major non-island region of excellence—the famed Silicon Valley—as a standard. Table 1 shows the relationships.

Table 1: *Some minimum requirements for centers of excellence*

Factor	Silicon Valley	Your favorite park/region/island
Climate, physical attractions	Mediterranean climate, sunshine, mountains and seashore (also earthquakes)	
Critical mass of entrepreneurs, investment capital	Major high tech companies and technology leaders (Apple, H-P, IBM, Intel, Xerox PARC, etc.)	
Support infrastructure	Highly trained workers, many small to medium sized support businesses	
Access to centers of learning	Stanford, UC San Francisco, UC Berkeley within one hour commute or via interactive TV	
Employment advantages	Continual ferment, frequent job shifting and resultant technology transfer	
Accessibility, global	Major airport at north end, with more than 2 million international arrivals in 1994, major regional airport at south end	
Accessibility, local	Congested freeway system, telecommuting is increasing	
Recreational opportunities	Almost anything within one day's drive	

Clearly, an area of restricted geographical expanse cannot hope to match the numbers of the Silicon Valley; nor is it likely to want to. But it is very important to consider these factors when developing strategies for designing, or enhancing the relative attractiveness of, a science park in the information age.

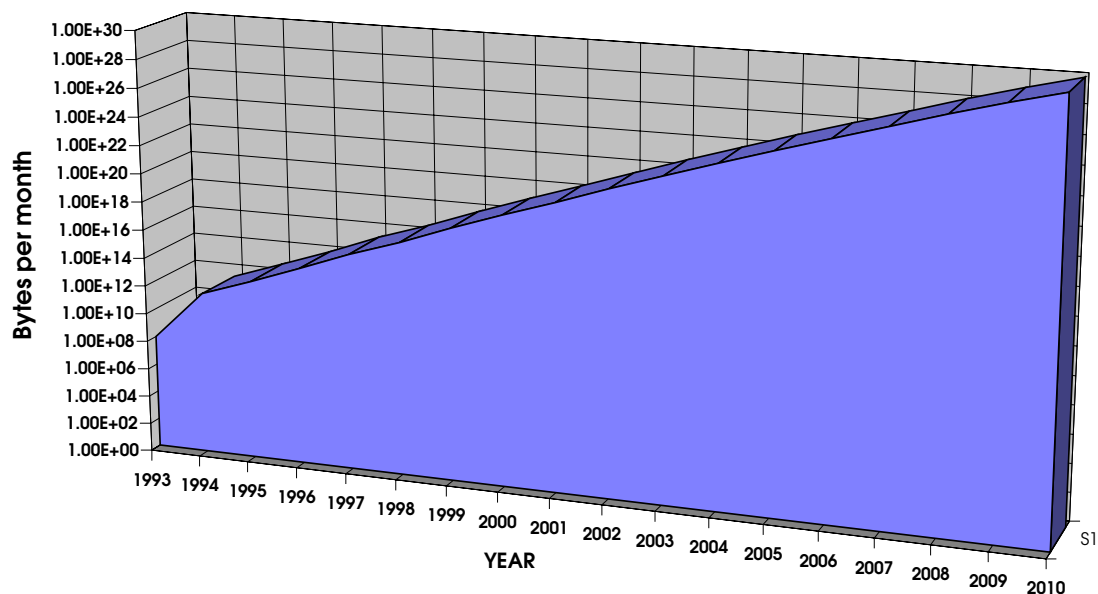
The central point that a science park planner or manager must keep in mind is that the individuals who are most location independent in the information society tend to be those who are most adept at exploiting information technology. They are also likely to have higher incomes than the less adept—which further enhances their freedom of choice. They will also be among the most demanding of the park's information infrastructure.

What to do

Some consequences

Clearly, the trends and issues I have just described portend some striking differences between the present and the future. Information technology *is* changing work and the way we work. Growing location independence *is* increasing the numbers of teleworkers and *will* act to alter the shapes of towns and cities. All of this *will* increase the amount of international communication and act to erode communication barriers. As an added example, Figure 6 shows our current estimates of the global growth in information traffic over the Internet.

Figure 6: *Estimated growth of Internet traffic*



Source: Internet Society, JALA forecast

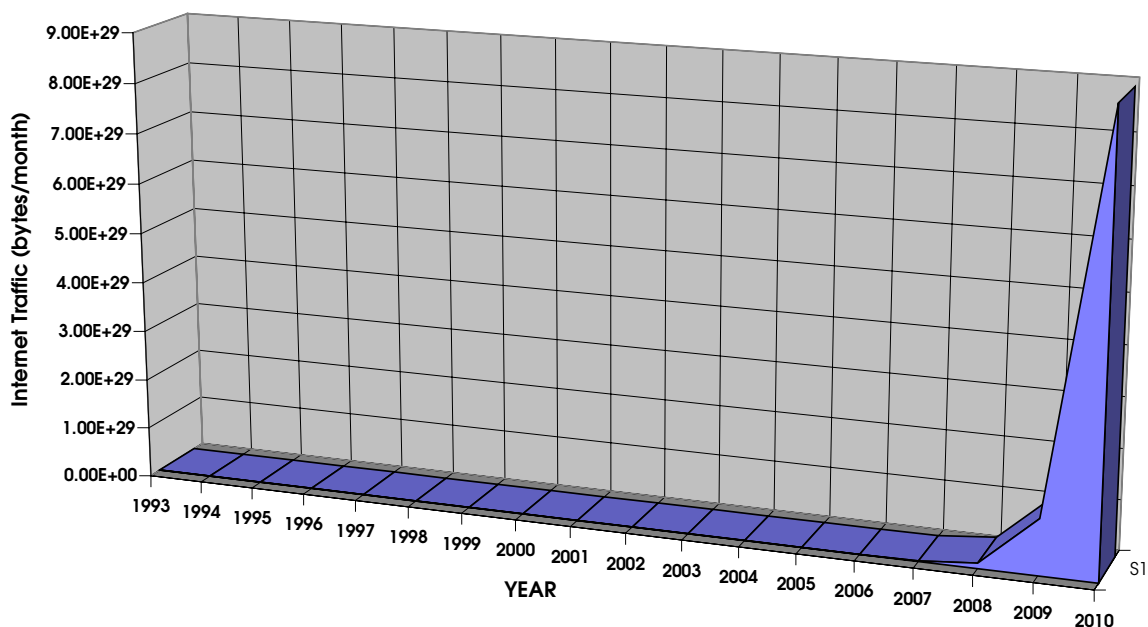
Note that each index line on the vertical scale represents a factor of ten increase in Internet message traffic (where “message” means anything that is sent over the Internet, from e-mail to live video). Our forecasts call for increases in traffic of at least 100% monthly for the next decade. A substantial proportion of this traffic will come from increased volumes of messages (and increased message complexity) per user, another large component will come from the increasing numbers of users of the Internet. Both will include a growing proportion of telework-related exchanges. In case you are unaccustomed to thinking about charts with a logarithmic scale, Figure 7 gives the same results on a linear scale.

All of these trends point to a certain number of conclusions about the future of telework. Some are as follows.

- The number of teleworkers in the world will double about every three years for the next decade
- At first, most of the teleworkers will be telecommuters but the number of long-distance teleworkers will also grow by more than 10% annually
- The number of teleworkers living outside what today is called the developed world will surpass those living in those developed world countries by 2020

- There will be a steady—and growing—migration of urban-dwelling teleworkers to more rural communities, including islands
- A new infrastructure of telework support services will grow in response to the needs of this market; many elements of the infrastructure will be multinational
- There will be a growing array of virtual organizations comprising loose groupings of teleworkers with complementary talents and capabilities; they will organize on a project-by-project basis, with individual members acting both as entrepreneurs and employees, although most will have a stable central marketing, management and operations (database, networking, accounting) core of traditional nature
- As portable benefits packages become more readily available, a growing number of teleworkers will opt out of the industrial-revolution-style single employer mode and work on a project-by-project basis for multiple clients, possibly via a broker, a generalized project management team, or one of the virtual organizations; as currency fluctuations diminish, these interactions will be increasingly international

Figure 7: *Estimated growth of Internet traffic—linear version*



- Similarly, large organizations will continue to shrink; outsourcing many of their episodic functions to teleworkers or telework consortia, while increasing the proportion of their own teleworking staff
- Teleworking will result in perceptible decreases in air pollution—and reduced dangers of global warming—by the early 2020s

At this point I must point out that these conclusions are not predictions. That is, the future will probably not turn out exactly as I have depicted it here. Rather, this discussion has focused on what seems to be a reasonable course of events, given our current knowledge about the world and its existing trends. Essentially all of the conclusions just stated are alterable—for better or worse—by our collective decisions over the next few years. Particularly when it comes to applying technology, we are (or should be) in control.

An action agenda

If you are pleased and satisfied with the current directions of change, then it is likely that you can be passive—sit back and watch—until or unless the trends shift. If your interest is in accelerating the rate of acceptance of telework, either at a local or global level, or both, then there are some actions that can affect the rates of change. Here are some that I believe to be critical.

Educate employers

By far the most serious obstacle to the growth of telework is the understandable reticence of employers to hire invisible people. The best way to convince employers that telework can work for them is by publicizing successful telework programs—especially if they have been done by competitors. Unfortunately, those successful competitors are generally very reluctant to share the information; why advertise the fact that you have a low cost way to materially improve productivity and reduce operating costs? Our approach over the past decade has been to develop large projects in the public sector, then make the results publicly available. More such projects are needed. A key element in all such projects is a credible cost-risk-benefit analysis.

Particularly important in the case of science parks, where a continuing flow of visiting professionals is envisioned, is demonstrating that this is not only a viable, but a very attractive option, one that can accelerate intra- and interdisciplinary communication and cooperation. One specific myth to put to rest is the black hole of serendipity: “I need my <researchers, marketers, designers, etc., etc.> to always be in the same location; otherwise they’ll never have those chance meetings in the <bathroom/cafeteria/parking lot/hallway/playing field> that spawn the world-changing new ideas that ensure our future!” My personal experience is that the Internet is more serendipitous than the corporate (or university) campus. Anyway, it’s the young people who are more likely to have the earthshaking ideas—and they’re more likely to interact on the Internet than the corporate CEOs.

Demand telecommunications competition

The primary, almost the only, operating cost of telework is telecommunications. The US today has telecommunications costs that are markedly lower than those in most of the rest of the world. Hence, the ratio between benefits to employers and the operating costs of telework in the US is often close to 10:1. This is one consequence of greater competition in the US market.¹³ Similar experiences can be had in the rest of the world if the current trend toward deregulation and privatization turns out to be true in fact as well as in principle.

Certify and track the environmental impacts

As we become more environmentally sensitive, we also become more aware of and sensitive to the pollution produced by cars and to the irreparable reductions in fossil fuel and petrochemical reserves caused by rampant over-consumption. Our tests of the travel patterns of teleworkers show that teleworkers—and their families—reduce their daily travel by at least as much as the amount otherwise directly related to work.¹⁴ Yet, the lurking suspicion remains that teleworkers may increase their travel in other ways, such as by moving farther away from their employers (to whom they still travel part time) or by increasing other work-related, holiday, and leisure travel. Our own research—to the effect that additional travel is *not* generated—is based on one-week sample periods; more longitudinal studies are needed to firmly assess the travel impacts of teleworking.

¹³ It is also one of the reasons why firms providing US long distance dial-back services to Europe have been so successful; European prices are artificially inflated.

¹⁴ Jack M. Nilles, *op cit*.

Develop telework standards, rules, and brokerages

Another barrier to acceptance of teleworkers by employers is the pig-in-a-poke problem; that is, how does the prospective employer certify *a priori* that the teleworker is qualified and able to perform the desired work on time and at the agreed-upon cost? For routine, well-defined work this is not a severe problem, witness the growth of long distance data entry, telemarketing, and routine computer programming services via telework. However, as the nature of the work becomes more complex, it is more difficult to specify the desired output and agree upon the terms of work. Similarly, it is more difficult for employer and prospective employee to find each other. Consequently, many employers simply give up and hire someone local, or train an existing employee, rather than spend the extra effort to find a possibly better-qualified and equally reliable person elsewhere.

One element of the solution to this situation is some form of formal telework performance standards or credentials akin to, or possibly allied with, professional credentials. This is of special importance in international telework situations, where the quality of training and experience of the prospective teleworker may be in question. If there were a set of international standards and testing services for many information jobs, then the apprehension of employers toward teleworkers would lessen. TAC, the International Telework Association, is currently developing preliminary telework standards.

The same argument is true for international work rules governing not only the conditions under which telework is to be performed, but the respective responsibilities of teleworker and employer. I always insist that organizations for whom we design telework programs establish formal rules and agreements covering telework.¹⁵ Not all employers will wish to do so; the idea that telework can be a high tech electronic sweatshop has already occurred to—and been acted upon by—more than one employer. This aspect is the core of considerable apprehension in the developed world concerning the impending ability of citizens in developing nations to compete both in terms of work quality and price with those in the more advanced countries. Already faced with unacceptable unemployment levels, governments can view telework either as a panacea or a plague. Although neither extreme outcome is likely, telework will cause some disruption. The point of having work rules is to minimize the ill effects.

Finally, telework brokers are needed. The function of a telework broker is, like a stock or commodities broker, to make a market between the available telework talent and the employers seeking same. However, to be successful, given the barriers just mentioned, the broker must also provide some level of certification for both the teleworkers and their prospective employers. Many temporary help agencies do this today; however, the level of certification required is likely to be higher than for a temp agency since many teleworkers may never actually visit their employers' facilities. Additionally, until portable benefits packages are universal, the telework broker may have to provide/arrange health insurance and pension coverage for the teleworkers.

¹⁵ Examples are in my book: *Making Telecommuting Happen*. New York: Van Nostrand Reinhold, 1994. ISBN 0-442-01857-6.

Facing the Future

Telework represents one of the faces of the new information age. It is an age in which in some sense we can eat our cake and have it, too. We can have access to the cultural and educational riches of the world while living in a community that, to outward appearances, is like something out of the 19th century. We can dwell in a comfortable and human-scale locality, yet act and interact globally.

Telework, like all innovations, also presents threats to the status quo. Telework does change things. By changing the nature of work, a fundamental component of one's self image, telework will change the ways in which we interact with other people. It will cause us to rethink our values and cultural differences. It will change the physical structure of our communities (if you don't need so many roads, why build them?).

But the opportunities telework presents are far more important. Most importantly, by accelerating the rate at which we communicate across cultures and begin to understand the interconnections between us and the rest of the environment, telework may just help us to survive civilization as we know it. Even though, as John Donne said, no man is an island, islanders have a particular perspective on the world that may be essential to the future of telework and to the future of us all.

The future begins today.