

# The Problems of an Information Society

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Japan today is in the midst of a rapid transformation from an industrial society to an information society. This is a change with far-reaching implications for the nation as a whole, and for the role it will play in international society.

Japan is a heavily populated nation, and one critically poor in natural resources. For most of the postwar era, the questions of how best to manufacture large quantities of goods and secure the energy necessary to do so were the prime determinants of national policy. Of course, information was extremely important even then. But to this resource-impooverished nation, material production and energy supplies seemed far more urgent issues.

Today, as Japan's national income has risen and the economy has achieved unparalleled prosperity, the weight of information vis-à-vis material production and energy is steadily on the rise. Just because income has doubled, it does not necessarily follow that people will eat twice as much, or wear twice as many clothes. It is only natural that the growth of consumption of goods and energy should lag behind expanding incomes. Conversely, as people have found more leeway in their lives, their consumption patterns have veered toward education, health services, travel and hobbies. All these are invariably accompanied by a growing need for information.

In this way, Japan today is shifting steadily toward a service, software economy. In short, it is evolving from an industrial society to a society founded on and moved by information. Needless to say, computers are playing an important role in this process of informatization. Twenty years ago computers were nothing more than simple calculating machines. With the steady advance of technology, they have come to possess vast memory capacity, a kaleidoscope of input and output functions and built-in telecommunications capabilities.

Informatization may not be synonymous with computerization. Yet it is undeniable that, to the degree that com-



Information networks are revolutionizing Japanese daily life.

puter systems form the nucleus of an information society, problems accompanying the advent of this new social order are themselves products of computerization. Rendering the problem even more complex is the fact that the spread of computers has been very fast indeed, ranging in past years between 10-20% annually. Moreover, the capabilities of such computer functions as processing speed, memory capacity, integration and transmission capacity have increased more than 10 times in the past five years. It is hardly surprising, then, that human abilities and the social organizations that we have created have proven unable to cope with such rapid change. This critical overload makes the task of finding solutions to the problems created by informatization all the more complex, and, needless to say, difficult to resolve.

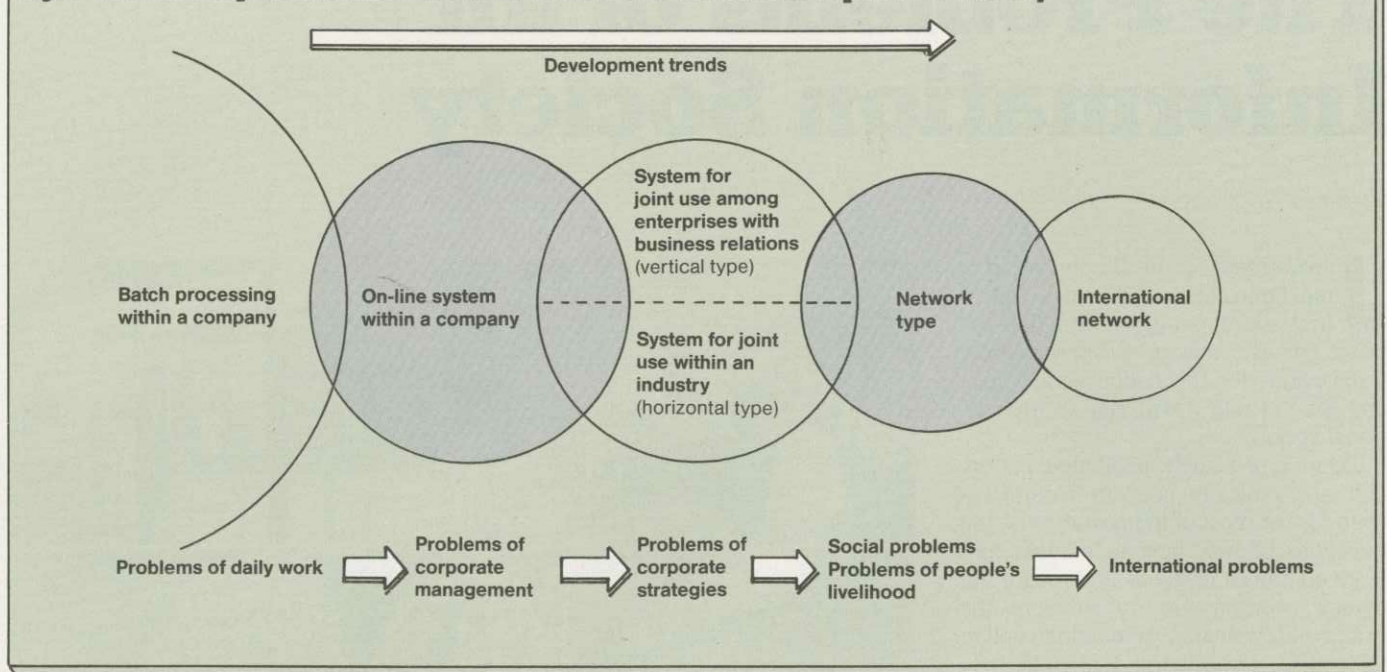
## The growth and evolution of computer systems

Computer use follows two broad patterns. The first approach is to actually

incorporate a computer into a given machine or product in the form of a computer chip, and to use this microcomputer to operate the machine. The use of microcomputers has led to astonishing improvements in the performance of automobiles, cameras, household electric appliances, medical equipment, indeed, the full spectrum of industrial products. This transformation has cost products that lag behind in computerization their competitiveness in international markets, and has become, for better or worse, the driving force propelling industrial society in the direction of information and software dependence.

The second pattern is to link computers to communications networks, and to use them as file-oriented systems for calculations and clerical processing in economic and social organizations. There are countless examples of these systems in our everyday lives. The currency exchange, savings, automatic cash dispensing systems and stock transaction systems of banks and other financial institutions, the reservation systems of hotels and airline companies, POS (point of sales) systems in the distribution sector,

Fig. 1 The Development of Advanced Information Networks in Japanese Industry



real-time sales management systems in physical distribution operations, delivery systems in the transportation industry, all exist as enormous networks that are even now playing a pivotal role as the social infrastructure of the economy and modern society.

When computers are first introduced into industry they are primarily employed as stand-alone batch systems (Fig. 1). But as they come into wider and wider use, they are connected to communications circuits, gradually coming to be used for on-line, real-time work processing directly linking headquarters operations, factories and business offices.

The greatest drawback of the batch system is that data have to be collected in the form of written receipts via the mails and messenger services. It can take days to gather and input data, meaning that the simple task of compiling information and maintaining the current status of operations constantly lags behind the user's immediate needs.

In contrast, the on-line business office can directly input new information into a terminal the minute it arises. Information is always up to date. Be it for a trading company's sales and inventory management system, a bank's savings system or an airline's seat reservation system, wherever a batch system finds itself in competition with an on-line system, the on-line system invariably emerges triumphant.

As a result, the more competitive the market, the faster has been the conversion to on-line systems. Moreover, as on-line systems came to be an accepted part

of individual enterprises, they began to be shifted in the direction of joint use through interactive connections over communications lines. No longer is it enough for major corporations to develop production management systems or sales and inventory management systems simply to streamline their own operations. It becomes all but impossible to raise efficiency without connecting their systems to those of their clients and subcontractors. Large companies work to bring others under their umbrellas even while strengthening vertical networks to help them expand their own market shares. And inevitably, smaller companies also move to build jointly operated horizontal networks within their respective industries or regions to keep from being overwhelmed by the on-line systems of big business.

As experience was gained in operating these joint-use systems, they were linked into even larger networks, until terminals were being brought into the offices of even small companies and the home. For instance, it became possible to plug into a telephone network, making seat reservations or even shopping from home with a pushbutton or data telephone. Connected to a television network, vendors can offer video information systems in the form of videotex. Connected to facsimile networks, they can provide information in the form of maps and graphics. The creation of personal computer networks makes possible home banking and the accessing of databases by individual users. Eventually, these systems promise to

transcend national borders, proffering services to users in foreign countries over international communications circuits even as foreign databases and financial systems enter Japan's own market.

In short, the more computer systems have been used, the more new needs have been discovered. Customers have become comfortable with using the systems, and the systems themselves have been renewed in an endless cycle of evolutionary growth.

## T ransforming industrial structure

As they have grown and evolved, computer systems have pervaded every corner of industry. In agriculture, a primary industry, computers assist in cultivating fruit and vegetables by controlling and adjusting the amount of fertilizer, the temperature and even exposure to light. In fish hatcheries, computers control water temperatures and currents, and even automatically deliver food to the hatchlings. Computer control functions have, in fact, led to a growing congruence of primary and secondary industry.

Much the same process is at work in manufacturing, the representative secondary industry. Computers first made it possible to perfect production management systems. Now they are being linked to retail and wholesale networks in response to the growing trend toward small-lot production of increasingly varied lines of products. This has made it

possible to manufacture products in direct response to market needs. And it has also led production management systems in the secondary industry to encroach on distribution, a tertiary industry sector. Even in tertiary industry, the computer systems of banks and securities companies are reaching out into the information industry as they provide corporate and economic information.

The conclusion is obvious. A major transformation is occurring in industrial structure as the growth of computer networks intensifies competition along the borders separating different industries. A securities company, for instance, can break into the domain of banks by offering services with economic functions like funds based on medium-term national bonds (the Japanese equivalent of America's mutual money fund, or MMF). Banks in turn can invade the turf of securities houses with a variety of dealing systems. The credit card systems of department stores and supermarket chains are leading them into financial services, while trucking and other transportation services are advancing into the distribution sector with the direct delivery of products from outlying regions of the country, a service only made possible by their networks for centralized small parcel delivery systems.

Growing interindustry competition does not stop there. Computer systems can easily offer their services abroad over international communications circuits. The provision of services in country B by the banking systems, securities information systems and insurance systems of country A over international phone and data transmission lines means nothing less than the liberalization of the banking, securities and insurance businesses of both countries.

## **A**ccelerating deregulation

In the past few years the telecommunications industries of Japan, the United States and the United Kingdom have been opened to private-sector participation, signaling the liberation of communications circuits to individual users. Since private companies are now free to utilize message switching systems, the impact of this major deregulatory step is quickly rippling out to affect other industrial sectors. The account settlement systems of banks, the dealing systems of securities houses, the ordering systems of distributors and the small parcel delivery systems of trucking companies are all variants on message switching, and the liberation of communications circuits means that it is

now possible, at least technologically, for anyone at all to provide these services.

However, technology is not the only factor at work in the marketplace. In Japan and elsewhere, old laws regulating the activities of different industries remain in place and unchanged, with the result that making seat reservations and purchasing tickets from an airline company via a data telephone constitutes a violation of the travel industry laws, while paying for it with a bank cash card touches on banking laws. When you try to offer doctors' examinations using video information systems you run afoul of laws governing the medical profession, while setting up a security system to automatically detect and report fires puts you in violation of fire prevention codes. In this way, the provision of computer system services is hampered at every turn by the provisions of old laws.

It is not that these laws are bad in and of themselves. They were logical enough in their own time. But no one anticipated the appearance of computer systems when these laws were first being drafted. Now, if we are to successfully adjust to the coming information society, it is essential that deregulation be accelerated in every field.

## **T**he need for new rules

As the continuing progress in informatization leads to the widespread use of electronic transactions, it will be necessary to create new rules to govern activities that have been cut loose from their previous moorings. When consumers are doing business from CRT display terminals in their own homes, it will be necessary to set new guidelines for determining exactly when a contract has been applied for, when it has been approved and at what point it has become irrevocable. When accounts are being settled electronically by computerized banking systems, it will be essential to establish when payments are to be considered completed. Or again, there will have to be detailed rules on compensation for damages when these systems break down, clearly laying out where responsibility lies and setting limits on credit.

The fact is that when accidents occur affecting transactions carried out over computer networks, it is all but impossible for the public, the actual victims, to track down and establish the cause of the problem and prove where responsibility lies. There is a serious need for legal measures to be put into place that will protect the consumer and hold the vendors of such networks responsible for

problems with the services they provide.

Another example of the current vacuum in rules for an information society can be found in the business world. Today many large corporations are leveraging off their enormous managerial resources, assets and technological capabilities to build vertical networks that can enhance their competitiveness in the marketplace. Already there have been many cases where subcontractors and other small business have been forced not only to install terminals themselves, but to bear the expense as well. Clearly this kind of practice raises questions of free trade.

Similarly, moves are afoot to establish joint-use computerized systems in finance, insurance, distribution, transportation and other fields. Here again, there have been cases in Japan of discriminatory practices, ranging from outright refusal to allow companies to join such systems to the imposition of special financial burdens. It is necessary to take these up and investigate their implications under the antimonopoly statutes.

Presently computer system development is a competitive business. Extensive effort has gone into differentiating systems from others in the field, and very little into ensuring compatibility. The result is that compatibility between most such systems has been so badly compromised that it is becoming close to impossible to connect different networks with one another. It is now a common sight to see ranks of noncompatible terminals lined up in the offices of wholesalers, warehousemen and trucking companies. It hardly seems an exaggeration to speak of "terminal pollution."

What is needed today is a concerted effort to standardize corporate and product codes, protocols and even formats for the business forms used by these different systems. Ideally it should be possible to plug into and carry out transactions on any system using a single, standardized office terminal. The International Organization for Standardization (ISO) is presently working to develop what it calls OSI, an acronym for open systems interconnection, as an international standard for computerized systems. It is important that Japan also promote the standardization of business protocols both within industries and across industry borders that are in conformity with this new international standard.

This much is clear: As we move ever closer to a full-fledged information society, it will become ever more essential to pursue both the deregulation of old laws and restrictions, and the creation of rules appropriate for the new social order.

## Achieving security and guaranteeing privacy

Banking systems, seat reservation systems, traffic control systems, small parcel delivery systems, emergency medical information systems. . . the range of computerized systems in existence today seems endless. When these countless systems are joined together into large networks, they function as crucial social infrastructure. To the degree that they make our daily lives easier and more convenient, breakdowns in these systems have the potential of seriously disrupting social activities and the national life. Moreover, as networking has expanded the field of action of computer systems, they have become that much more vulnerable to damage from wind and rain, earthquakes, fire and even sabotage and computer crime. There is not unjustified concern that an information society will also be an extremely fragile society.

In light of these concerns, it is necessary to act to reinforce and expand systematic security measures for computer systems. On the technological front this means building redundancies into such systems, codifying signals and taking other steps to reduce their vulnerability. At the same time, the criminal code should be revised to include measures to prevent computer crime, and there should be further improvements in information systems audits and insurance systems.

Virtually all computer networks have provisions for the journaling of all transactions on the system by the network center. Typically, this is done by having the terminals installed in companies or homes send ID codes to the center when accessing the network, or having users identify themselves with a password.

As a result, real-time sales management systems in the distribution industry now leave detailed journals of who in which enterprise sold what for how much to which other company. This journal in turn becomes made-to-order information on which products are selling well and which are proving a drag on the market. Shopping systems record in detail who has purchased what and for how much. Banking systems record who has transferred how much money to whom and for what purpose.

The journals that on-line systems accumulate minute by minute, day by day are vital corporate secrets to a commercial enterprise, and to an individual constitute part of his or her privacy. Provisions must be made in the criminal code and

in the statutes for the protection of privacy that will legally clarify whether leaks of these journals, or even their outright sale to outsiders, are violations of the privacy of communications, or leaks of company secrets or even invasions of individual privacy.

Nor should we forget that the application programs controlling these networks and the accumulated information in their databases can be rapidly transferred to magnetic tape at the network centers. It is therefore equally important to bolster the protection of the intellectual property rights to this software and information.

On the other hand, though, we must recognize that computer networks are fast becoming indispensable infrastructure for modern society. Should rights be over-protected, interface connections concealed from the public, and high copyright fees levied on the use of information, the diffusion of these systems will come to a rapid halt. There is also the danger that the holders of intellectual property rights in these networks will gain an unassailable advantage over their competitors that will compromise the guarantee of fair trade. All these concerns represent entirely new problems unique to an information society. The search for solutions demands research and debate at the international level.

## Education for a new age

The number of mainframe computers in use in Japan today exceeds 200,000. There are more than 4,000,000 personal computers, and easily as many word processors. A good 70% of the companies listed on the first section of the Tokyo Stock Exchange are already on-line; more than 20% are participants in inter-company computer networks. The problems of informatization are the shared problems of all Japanese industry. And without question, the greatest problem of all is education.

Education, of course, comes in many forms. First there is the basic task of alerting the vast majority of people to the simple fact that informatization is a reality, and that its progress is triggering immense changes in industrial structure, the economy and society itself.

Second, there is the inescapable fact that the development of software is tending to widen rather than narrow gaps in people's abilities. When a company creates new software, it increases its advantage over other firms. When a nation develops new software it enhances its national economic power and competitiveness. Education must play a vital role in

eliminating these widening differentials.

Third, progress in informatization is overturning the traditional labor market. It has been estimated that the information industry and its impact on other sectors will generate six million new job opportunities in Japan by the year 2000. Yet it cannot be denied that this will be accompanied by the loss of millions of jobs in old occupational areas. An increasingly important issue in education will be the enrichment of the educational system to allow for the reeducation and reassignment of displaced workers.

Fourth, and closely related to the third point, is the challenge thrown down by predictions that there will be a shortfall of at least 600,000 in the ranks of systems engineers trained and qualified to guide the informatization revolution. The development of software for new network systems is becoming more and more difficult. What are needed now are creative human resources rich in a wide range of experience cutting across industrial, academic and international boundaries. The old education system is unable to deal adequately with these new needs, and must be retuned if it is to continue to perform its duties in a new age.

The last great problem that we must touch on is the likely appearance of a host of international systems in the years ahead. Accelerating informatization will tend inexorably to accelerate the free exchange of information across national borders. International social infrastructure systems jointly funded and operated by all participating countries are already entering operation, as can be seen in such systems as the Society for Worldwide Interbank Financial Telecommunications (SWIFT), Société Internationale de Télécommunications Aéronautiques (SITA) and World Weather Watch (WWW). These networks can only continue to grow in scope, complexity and importance.

The spread of international networks is going to change the very concept of national borders. We are rapidly entering an age of international competition using networks created through international coordination and cooperation, and predicated on the free exchange of information, equality and mutual respect for national sovereignty. This, no less than all the other facets of informatization discussed, will indelibly alter our view of the world in which we live and work. Our ability to skillfully manage the tides of change will determine whether or not the coming information society will make the world a better place, or only create new problems for us all. ●