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From the Editor

As Japan entered the 1990's from the preceding period of rapid economic growth, the pace of economic growth slowed greatly. Japan is now facing a recession of rare proportions. That is, Japan experienced an economic "bubble" in which the prices of land and stocks soared above a level consistent with the basic conditions of the economy, and then fell suddenly. During this time, many scandals have occurred in financing and securities, and many companies, especially small and medium-sized businesses, have been driven into bankruptcy. Large companies are no exception, and in recent times, many companies have begun to make adjustments in the areas of production and employment.

These unfavorable economic conditions are also exerting a strong influence on the field of informatization. Just into the 1990's, the profitability of hardware, software, and other goods fell, although it had increased steadily in the 1980's. Sales fell in the information services industry, and informatization investment, which had been booming, fell into a depression. These trends have continued up to the present. These circumstances suggest a directional shift in informatization from quantitative expansion, as represented by the introduction of information systems, to qualitative improvement. In companies, there is great interest recently in re-engineering, including the re-engineering of information systems, rather than simple restructuring. It also seems that this change in user needs has produced new approaches for information systems, including downsizing and open systems.

All through the 1980's, Japan took an active strategy in all fields of informatization, and so the demand for informatization personnel increased throughout this period. However, the global recession that appeared with the start of the 1990's, the serious economic recession in Japan, rapid progress in information technologies, and other factors have made changes necessary in business management. More study is needed based on this

situation in regard to the informatization personnel who will be needed in the future. In recent years, informatization has spread widely and deeply not only into industry, but also from society to individual households. This has caused the application of information technology to become more specialized and more diversified. For the informatization personnel who will be needed in the future, it will no longer be simple quantity that is necessary, so much as improvements in quality. For the training of such informatization personnel, it is necessary not only to update the specialized training of information engineers, but to become involved in a wide range of informatization education, including formal education such as primary education.

The Information Industries Committee of Japan's Industrial Structure Council (Chairman: Eiji Kageyama, President of JIPDEC) has been actively conducting investigations for the formation of a sound informatized society in Japan, including the consideration of such issues as the current economic situation, progress in information technology, and changes in the informatization environment. As a result, in December 1992, the Basic Policy Subcommittee made an urgent proposal aimed at structural reform in the information industry, centered around the establishment of a market mechanism for software. The final version of this proposal was issued in June 1993. In December 1992, the Informatization Personnel Policy Subcommittee made another urgent proposal, which included a classification of the new informatization personnel who will be in charge of the sophisticated informatization seen as necessary in the future and a curriculum for their training. The final version was issued in May 1993. In response to these proposals, CAIT of JIPDEC established a committee on a curriculum for the training of informatization personnel (Chairman: Eiji Kageyama, President of JIPDEC). This committee is currently formulating a standard curriculum. The committee plans to complete this project in December 1993 and issue the results at that time.

The current JIQ contains a summary of the policies considered necessary for Japan's informatization in the future, based mainly on the findings of the Information Industries Committee of the Industrial Structure Council through investigations conducted thus far. I would like to take this

opportunity to extend my heartiest thanks to each writer who has contributed to this special feature.

I hope that the special feature in this issue will prove useful to the reader.

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Promotion of New Areas of Social Infrastructure and Environment towards Informatization

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I. Meaning of Informatization in Today's World

1. The Increasing Significance of Intellectual Activities in Japan's Economic Growth and the Improvement of the National Standard of Living

Since the second world war, the Japanese economy has made enormous development centering on production industries, with a background of the world-wide expansion of demand for industrial products and rapid decline of trade barriers. However, the world's economic system and the surrounding environment which predicated Japan's economic growth have greatly changed in the following ways. First, there is a change in the international environment traversing production industries. Corporate business activities have become borderless as a result of reduced international barriers to trade and investment and advances in transportation and communications. In the area of production technology, where Japan has had a comparative advantage to date, it is believed that the level of technology will become uniform internationally, while Japanese companies' production activities will continue to shift overseas as part of the borderless corporate activities under the increase in personnel costs in Japan. Second, there is a change in the value-added structure in the economy. Traditionally, value added was derived from low production cost and high production

technology, with the product and its service being irrelevant. However, it is being shifted to the quality of intellectual such activities as the setting of product concept and its systematization, originality in intellectual services, and exactitude in marketing. Third, there are changes in the external environment surrounding the economy. Amid environmental changes such as global environmental problems, the aging of the population, and increased demands by people for more freedom in terms of time and space, the human race will have to resolve these problems as global challenges by combining its intelligence. At the same time, it has become necessary to construct an efficient economic system as a prerequisite to these.

In the course of such environmental changes, while taking the abovementioned external environment as a prerequisite, the growth of the Japanese economy and the achievement of a more affluent national lifestyle by effectively performing high-level intellectual activities that match Japan's relatively high salary level, have both become possible for the fist time.

2. Progress of Information Technologies to Enable the Enhancement of Intellectual Activities and the Improvement of Productivity

Informatization can now play an extremely important role due to the advance of high-level intellectual activities and rapid productivity improvements that have been made possible by the recent technological progress described below. First is the improvement of the operability of information equipment by enhanced hardware price performance and graphical user interface improvement, as exemplified by "downsizing," which is making it possible for individuals to use hardware and software with high-level functions. Also, I believe that the progress of multi-media technologies in the future will promote the use of multi-media for informatization, along with the development of the communication infrastructure as represented by B-ISDN, will further expand the area of utilization of information technologies. Second is the progress in network related technologies. As a result of open system propagation, LAN/WAN technology progress advances in large scale database technologies, etc., the freedom of individuals has been vastly expanded in terms of time and space. Third is the speeding-up of super-

computers. This speeding-up is expected to bring about a rapid improvement in the level and efficiency of research in cases where experiments must be made for practical problem solutions even though the solutions are theoretically known, or where experiments cannot be performed through simulation, and to be a prime mover in bringing about great breakthroughs in the area of global challenges such as the environment and energy.

3. Necessity of Realizing the Age of "Everywhere Computing"

In the US, the age of "Everywhere Computing" (computing for everyone, everywhere), when computers will be used, in every aspect of intellectual activity, is just around the corner.

Japan's future economic growth not only depends on the enhancement of intellectual activities and improvement of productivity, but such a new stage of informatization made possible as a result of the phenomal advance of information technologies is of life or death significance to the development of Japan as it is to the innovation of production technology. We can position stages in the process of informatization so far, as follows:

① The first stage where centralized information processing of fixed applications was enhanced for speed-up and human resource saving. (Primary Informatization, or Point Informatization),

② The second stage, after the liberalization of communications took place, where network communication was developed within the limited areas of parties who had business relationships. (Secondary Informatization, or Line Informatization), and then the new stage of Informatization following Secondary Informatization which may be called "Tertiary Informatization" (or Surface Informatization). In this new stage of informatization [Tertiary Informatization (or Surface Informatization)], the following will be achieved.

① Propagation of personal computers by downsizing,
② Expansion of information distribution by the use of networks,
③ Advance among the general public by multi-media and the further spread of informatization. Finally the "Age of Everywhere Computing" will become a reality through the various facets mentioned above.

II. Present State of Informatization in Japan

1. Industry

In the area of production, labor saving and automation at plants to meet the needs of small quantity production for a large number of products has greatly progressed. Specifically, in the area of design, labor saving/automation of design work achieved by CAD and CAE, and the joint sharing of design information have made contributions to production enhancement. In the field of manufacturing, structural flexibility of production lines is made possible by CAM and FMS (Flexible Manufacturing System). Furthermore, there have been moves towards making CIM (Computer Integrated Manufacturing) a reality. CIM will centrally control all information relative to all the processes from design to manufacturing, to closing orders, to shipment. In the area of distribution, we have seen the rapid propagation and development of POS systems and EOS (Electronic Ordering System). In the area of finance, the installation of CD/ATM (Automatic Teller Machines) is in progress. While informatization in these field operations departments has made remarkable progress, in the planning and control departments that are the basis for corporate competitive power, informatization for the quality improvement of intellectual activities has not made much progress up to now. The MIS (Management Information System) boom was on towards the end of the 1960s, but those systems were not necessarily at a high perfection level. On the other hand, the concept of SIS (Strategic Information System) has not taken root in Japanese companies because the level of progress in distributed processing and outsourcing is behind that of the United States.

2. Public Sector

(1) Central Government

Japan's central government agencies started using computers in the mid 50s. System development has been made for various administrative duties to date, and in some cases version ups have been made in response to the advance of information technologies.

On the other hand, concerning development of administrative information databases, there is a large amount of information which has not yet been organized as database, though some of the information is electronically

filed. In recent years, informatization in the area of office automation has been in progress. However, there is a large gap in the number of small computers such as personal computers installed per employee. While a small computer is installed for every four employees both in the US federal government and in Japan's private sector, a small computer is installed for every 36 employees in Japan's central government. An apparent lag compared with the US and the private sector is visible. Also, use of networks composed of personal computers is not progressing in the central government.

(2) Local Government

Computer utilization in local government bodies differs greatly with each local government in terms of the state of progress in informatization. The state of installation of small computers per employee is similar to that of the central government. Overall, local governments are behind in informatization. One significant characteristic of the informatization of local governments is that resident information control is carried out by computers. Utilization of information equipment is being promoted from the viewpoint of resident service quality improvement. It is the task of local governments to make further advances in informatization. Another significant characteristic of the informatization of local governments is that there is high probability of system standardization. However, such system standardization has not progressed appreciably up to now and it will be a problem when local governments develop computer networks between themselves and other localities as well as with the central government.

(3) Medical Service

In recent years, use of computers in medical institutions has been propagated in the area of management for efficiency improvement of fixed applications such as teller accounting/ clinic invoice calculation and pharmaceutical product inventory control. However, at present, because systems have been constructed on a custom basis for each medical institution, investigations are under-way into the use of packaged software. In the meantime, informatization of medical treatment record management such as electronic filing of charts in medical consultation areas and PACS (Picture Archiving and Communication System) in the area of medical imaging management is still available at only a limited number of medical

institutions. Furthermore, alliance enhancement and functional specialization between medical institutions through shared use of the electronically filed medical treatment data on an online or offline basis are still being performed by only a limited number of medical institutions.

(4) Education

Japan is far behind Europe and the US with regard to the informatization of education in elementary and junior high schools. While the installation ratio of computers in Europe and the US is 100%, the rate is 50% in Japan's elementary schools and 86% in it's junior high schools. Also, as for educational software, the US has more than 15,000 packages, while Japan has as few as about 2,500. Furthermore, when it comes to teachers who can provide instruction regarding computers, only about 9%, a very insufficient number, of all teachers can do that. Particularly in elementary schools, only slightly less than 4% of the teachers can give computer instruction.

(5) Research

As for the development of research networks, each ministry and other government agency has been executing network installation in accordance with it's own policy. Therefore, closed networks vertically divided by ministry and agency have been constructed and operated in a disorderly manner. Furthermore, the communication line speed of Japanese networks is much slower than that of networks in the United States by several ten to several hundred times. Therefore, the free exchange of information between research institutions is not underway in Japan. Moreover, the development of LANs within research institutions, which form the base of these networks, is also backward. For example, out of the 98 national universities in Japan, only five universities have completed LAN installation. On the other hand, the installation of high-speed computers such as supercomputers has been completed at only eight universities out of the 98 national universities, and Japan is behind in this area as well. This has made it difficult to perform R&D in various innovative scientific technologies. In the US, the significance of research using high-speed computers such as supercomputers was recognized early on, and an environment in which free research can be performed using supercomputers has already been set up.

3. Households

In Japan, we cannot say that computer utilization in the home is widely and generally popularized. At present, Information exchange is chiefly carried out by TV and telephone. In recent years, however, several systems have been put on the market for handling information using a computer at home. In the rest of the world, we see cases where such systems have been propagated on a full-scale basis. Services using such systems are starting in Japan. Videotex is the first such case. In Japan, the CAPTAINS system was put into actual use in 1984. However, the number of users is still at about the 120,000 level at present and the system has come to be centered around business uses. PC communication is the second. As of 1992, there were 1,877 PC network stations in Japan and the number of users was 1.55 million. It is believed that PC communications have an aspect of spreading easily among people who are familiar with the operation of word-processors and PCs, but of being generally difficult to spread beyond these people and into households. From that standpoint, progress is being made on ease-of-operation by utilizing the research results on human interfaces. Multi-media is the third. Up to now, information transmission for multi-media have been carried out using packages such as CD-ROMs. However, we cannot acquire new information from outside the home as we can with a TV. Therefore, although multi-media is a system with extremely diversified possibilities in the future, its propagation into the home has been very limited so far.

III. Policy Tasks for the Promotion of Informatization

1. Government Role for Promotion of Informatization

Government shoulders an important role in informatization. First of all, Government should set up an environment where the private sector can provide information systems under a necessary minimum of clear regulations. In the meantime, in addition to its role in setting such rules, it is one of the most important roles of the Government, as part of setting up an environment, to set proper incentives for investment in informatization and the information industry. Government is also expected to take a positive role in the areas of establishing software prices, promotion of investment in informatization, and enhancement

of databases. Secondly, Government itself should promote investment in its own informatization. Government bears responsibility in important areas of intellectual activity in research, education, and administration. In these areas, Government is expected to receive great benefits from the recent advance of information technologies. Also, informatization in business operations that Government is promoting on its own has the aspect of becoming the basis for the informatization of society as a whole. For example, informatization in the research area will become a hotbed of information technology advances, informatization in the educational area will promote the information literacy of the whole nation, and informatization in the administrative area will become a model to be emulated by the private sector. However, in these areas, the Government is far behind both the US and the private sector. Therefore, the continuing establishment of a new social infrastructure, taking into account the characteristics of informatization, has become a top priority and urgent policy task. The third is the promotion of fundamental technology development. In the area of information technologies the pace of technological progress is fast. Technological development has an especially important significance in the promotion of informatization.

2. Specific Policy Tasks

(1) New Social Infrastructure for Informatization

We must establish the concept of a new social infrastructure in proceeding with informatization for business operations performed by the Government itself. From that standpoint, the comprehensive economic policy package put together on April 13, 1993 to boost the Japanese economy can be highly evaluated in terms of providing the social infrastructure upon which the development of informatization is based. However, it is necessary that informatization investments be demanded continuously.

① Provision of Information Foundation for Research

1) Provision of Research Networks

LANs are the foundation of research networks. The development of LANs for national research institutions (98 national universities, 92 national research laboratories, and many other public research institutions) must be completed at the earliest possible date. In the meantime, the networks to

connect those LANs must be integrated and the line speed must be raised. Eventually, it will be necessary to vigorously pursue gigabit-class computer networks.

2) Installation of High-Speed Computers such as Supercomputers

Supercomputers are currently installed at about 40 locations in Japan's national research institutions. The installation of a further eleven supercomputers has been authorized in the latest comprehensive economic policy package. However, high-speed computers such as supercomputers must be installed at major leading-edge research institutions among the national research institutions at the earliest possible date.

② Informatization of Education

1) Informatization of Education at Elementary Schools and Junior High Schools

a) Installation of Computers for Education
In making education using computers a reality in the truest sense of the word, the ideal is to create an environment where each student is provided with a computer so that they can use computers in various aspects of study in their daily lives.

b) Availability of Software
In order to provide information for the smooth installation of good-quality educational software, we must create libraries on a nationwide basis.

c) R&D on Advanced Education Methods
With regard to the advanced education systems that can effectively utilize the potential capabilities possessed by computers, it will be necessary that the Government take the initiative in performing R&D, verification, and dissemination in the future.

③ Informatization in Administration

1) Central Government

Concerning the informatization of the central government, the Government must from now on, as an entire Government, formulate a 5-year informatization plan for administration together with the public announcement of its principles. The Government must also review the

plan every year. In view of the conditions pervading the central government and the information technology trends in recent years, all the related ministries and agencies must take a look at the following three systems and install the systems at the earliest possible date, while maintaining consistency between ministries and agencies.

The first is the installation of LANs within each ministry and agency and personal computers connected to the LANs at a ratio of one unit per person, and networks between those ministries and agencies. The second is the construction of networks connecting Tokyo and local areas. For example, a TV conference system or the like connecting a head ministry in Tokyo to its regional bureau offices should be constructed in the 5-year plan. The third is informatization of individual services. The central government should actively undertake the project, especially in those cases closely related to the private sector. For example, the online arrangement of statistical research is one such case. This should be fully operational in about five years.

2) Local Government

In the informatization of local government, an automatic resident card issuing system is the only system that has been officially authorized, and its early installation is desired. In the future, the local government will have to examine changes in the system so that automatic issuance can be permitted for other certificates. On the other hand, one characteristic of the informatization of local government bodies is that each government is proceeding with informatization on its own. For this reason, system standardization by joint collaboration of local governments is required.

(2) Development of Environment for Promotion of Informatization with Private Sector Initiative

① Maintenance of Security

As for security measures in the private sector, it is first necessary to propagate general standards for computer system safety measures and also to provide proper incentives such as strategic financial assistance. It is also necessary to promote the propagation of systems auditing by the diffusion of systems auditing standards and the operation of a systems audit corporate ledger system.

② Promotion of Standardization

Regarding standardized EDI in industry, interdisciplinary standards and international standards exist regarding communication procedure and syntax rules (standard syntax rules). At present, we are at a stage where message development is progressing, and the foundation for EDI propagation is being securely put in place. However, interdisciplinary EDI that is linked not only to commercial flow centering around order placement and acceptance, but also physical distribution and monetary flow, has not been fully developed, and the progress of EDI propagation in small and intermediate companies is almost stalled. Therefore, it is necessary to energetically promote dissemination and education activities through the construction of and operational experimenting with interdisciplinary EDI pilot models. On the other hand, as the importance of standardization in the information area increases, the strategic importance of standards has further increased in accordance with the advance of internationalization. Japan is now required to actively participate in setting international standards. The development of standardized technologies generally enables the establishment of general-purpose fundamental technologies that will permit the development of a variety of technologies based on these standardized technologies. The utilization of the financing and loan system for the Fundamental Technology Research Promotion Centers must be reviewed in terms of such joint research and development.

③ Promotion of Communication Line Enhancement and Development of Related Systems

In the future, it will be necessary to develop a communication infrastructure such as B-ISDN for households in general. For the effective utilization of such a high-level communication infrastructure, it will be necessary to provide a variety of diversified communication services and information services on the infrastructure. For that purpose, it is necessary to promote necessary environmental development, including the proper review of various existing regulations, so that there will be no obstacles to the spread of such a variety of services. Also, it is believed that in relation to communication and broadcasting systems as well, the information related industries will have to provide services that are more creative and original than before in response to the needs of people. For this reason, it is important that the spread of diversified services not be hampered.

④ Review of Various Systems in Response to Progress in Informatization

We must promote the enhancement of rational/efficient office work systems using "paperless" methods, in light of preparation work for uniform international rules regarding EDI transactions, etc., that have been carried out in 1993 in the Working Group on EDI of UNCITRAL (United Nations Committee for International TRAnsaction Law). The rules include the definition of EDI transactions, electronic data control of "original documents," and corroborative capabilities. Furthermore, for the smooth progress of informatization into the home, it is necessary to establish systems to protect privacy and preserve morality.

In addition, it is necessary to establish a system to smoothly handle intellectual property rights. This must be reviewed by associations of property rights owners and media related companies.

⑤ Development of Database

In order to make databases widely used, the free originality and vitality of the private sector must be fully utilized under free competition. The development work of databases should be performed by the private sector in principle. In the meantime, there is a large amount of administrative data stored on magnetic tape that is not utilized. It is necessary to enhance both the provision of administrative data to the private sector and the distribution system.

(3) Promotion of Fundamental Technology Development

Due to situational changes in recent years, it has become necessary to tackle several new tasks for the development of fundamental technologies in the future. The first is the shift to basic research. In shifting the content of technological development to basic matters, the method of proceeding with the project must be changed accordingly. First of all, in choosing research themes, it would be more appropriate to change to the "peer review method," wherein individual themes are evaluated and chosen using the opinions of third parties. Selection of research contents will thereby be carried out more flexibly. Meanwhile, as the themes of basic research are becoming globally common, we must enhance international cooperation. In particular, with regard to software products created as a result of research, we must de-

velop an environment wherein it can be freely used by the world's researchers by providing such products free of charge. Secondly, software will become more important. There are no established paradigms concerning the fundamental technological development of software. However, in addition to theoretical structures (such as inference) and the solution of principles (such as recognition and learning), such so-called computing functions as the ability to obtain a solution within a realistic processing time are also important. As corroborative studies, we should also consider including research on software development for the purpose of the verification of these and the collection of related data. Thirdly, the interface between computers and humans has become important. In terms of the development of technologies concerning the interface between computers and humans, our task is to improve computers so that we can operate them with an "everyday" sense, to provide computers with the same capability of recognition and feeling as humans, etc. In such research, the actual senses and capabilities of humans, themselves will become subjects of research. Therefore, we will have to have the perspectives of various areas of research such as psychology, ergonomics, and pedagogy in addition to computer science.

Toward Appropriate Software Trade

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Some time ago, the Information Industries Committee of the Industrial Structure Council, an advisory organ of the Minister of International Trade and Industry, prepared a report presenting the desirable directions for agreements and pricing decisions, which are basic conditions for appropriate software trade.

In that report of December 1992, the Information Industries Committee presented a detailed urgent proposal, "The New Age of Software", to the Ministry of International Trade and Industry. Among the directions indicated for creation of an appropriate business environment for the software market, the problem of rules for trade was given particular attention.

*** Standpoint of the Investigation**

In recent years, along with the rapid advances in information technology, the importance of software has come to be felt strongly as hardware has fallen in price and become less differentiated.

However, in Japan, there has been a low recognition of the value of intellectual creations to begin with, and there are trade practices which discount software as just an accessory of hardware. These factors have hampered trade in software as an independent product, and accordingly, the software market in Japan has failed to mature.

To make the market truly competitive, the establishment of a system to distribute large quantities of high quality, sophisticated software is an urgent issue.

From this standpoint, the Informa-

tion Industries Committee is forming rules for both software venders and users based on the consent of both parties in regard to problems related to trade, specifically agreements and pricing decisions, which are basic conditions for the establishment of fair, transparent, and efficient marketing mechanisms in the software market.

* Establishing Appropriate Agreement Practices

In the development of custom software (software developed under commission), it often happens that the vender is unable to gain a thorough understanding of the user's needs at the time that the order is placed. The vender and the user often have different ideas of the details and scope of the work to be done and of the functions and quality of the software to be supplied. This creates a tendency for a high degree of uncertainty in the business. In a business with such a high degree of uncertainty, use of an agreement containing all necessary items for discussion related to the transaction is necessary to raise the transparency of business dealings as much as possible, reduce the risks associated with business dealings, and increase trust for the business partner.

However, looking at the actual situation of custom software development in Japan, we see that the venders and users do not have a strong consciousness that the details of the transaction should be clarified at the contract stage. Moreover, no common rules have been formed for items which should be included in a contract, such as procedures for changing specifications, or the assigning of responsibility for defects.

Therefore, contracts are being concluded which can hardly be said to be necessarily appropriate for the development of custom software. These are the insufficient contracts produced by many vender and users based only on their own limited experience, and contracts based on the general concept of "contract" produced by staff in charge of judicial affairs, who have nothing to do with system development. As a result, there is no assurance of transparency in software transactions or of trust between trade partners. This invites various kinds of trouble between the user and the vender, and consequently the user's trust in the vender falls when the functions and performance that the user expected cannot be obtained from the completed system. To deal with this situation, this report indicates the contract text items that should be

made clear at the time of a transaction, along with guidelines for these items. (The major items to be included in contracts were announced in the name of the Minister of International Trade and Industry in an official publication dated July 14, 1993).

Major Items to be Included in Contracts

(1) System for Development Promotion
   1. Unification of windows
   2. Holding conferences regularly
   3. Setting roles
(2) Establishing Specifications
   1. Subject for formation of specifications
   2. Checking and setting of specifications
   3. Procedures for confirming specifications
(3) Changing Specifications
   1. Method for offering specifications
   2. Method for accepting changes
   3. Formation of specifications for changes
   4. Procedures for confirming changed specifications
(4) Checking and Acceptance
   1. Standards for checking and acceptance
   2. Time period for checking and acceptance
(5) Responsibility for Defects
   1. Scope of responsibility for correcting defects
   2. Scope of liability for damages
   3. Time period for responsibility for defects
(6) Intellectual Property Rights
   1. Ownership of rights to the program
   2. Ownership of rights to documents
   3. Ownership of rights to routines, modules, etc.
   4. Ownership of rights to intangible information
(7) Confidential Information

* Introduction of Ordering by RFP (Request for Proposal)

The failure of users in almost all cases to submit a clear RFP (Request for Proposal) at the time of ordering software can be indicated as one factor that obscures the details of contracts. The RFP is to indicate what the user expects from the vender, under what conditions development should be carried out, and so on. In the fields of engineering and construction, ordering by RFP is common practice. This format is also generally used in the software industry in Europe and America.

From now on, it seems necessary in the Japanese software industry as

well to spread the practice in which the user clarifies by RFP the outline, development system, development environment, important guarantee items, and contract items for the system being commissioned, and in which the vender creates specifications based on that RFP.

* Promotion of Value-Based Pricing

To solve the current problem of immaturity in the software market, various actions for environmental construction will be necessary. The circulation of contracts in which the items of discussion which are necessary for the transaction, as mentioned above, are made clear, will contribute to the transparency of transactions. However, although this kind of clarification of contracts is necessary in software trade, it can't be said that this alone is sufficient to functionalize the market mechanisms of the software market. Also, it is difficult to ensure transparency in transactions. To really functionalize the market mechanisms of the software market, ensuring mutual trust between the vender and the user and causing prices that reflect the value of the software to be set are also important tasks.

However, in reality the pricing of custom software is set according to the rule of "cost plus", and this basis for estimation is often made known to the user. However, as this pricing method is based on person-hours, it is a cost-based pricing method. This hinders wholesome growth in the software market, as it tends not to reflect the value, quality, or productivity of software. To eliminate cost-based pricing for the sake of higher value-added pricing on software and creative development in the software industry, all venders must try to provide software with a high level of technology and know-how that satisfies the users' demands. This software must be high in productivity and in value-added pricing, but low in cost. Competition, based on the price and quality of software, is necessary for the market.

Nevertheless, venders who are currently trying to introduce pricing method based on the value of software find it difficult to effect an immediate escape from the old method. Therefore, the "cost plus" method may be used in some cases as a gradual means, but even in those cases, for the establishment of the market mechanisms, the users' trust must not be lost while software pricing is made to reflect its value.

For example, an intermediate stance during the process of enacting value-based pricing could be to indicate only the costs incurred at each stage of software construction when asked by the user for an estimate.

On the other hand, if the user insists on knowing the person-hours, the vender could enable the user to place a suitable value on the skills of the engineer involved by including information on the engineer's rank, in order to indicate indirectly to the user the value of the software, the vender's productivity, and so on. Through such means, correct information can be supplied to the user, who at present is hardly given any data at all for decisions on the value and pricing of software. It is necessary to ensure that the ranking of engineers used for estimates supplied to users is adjusted according to the ranking used within the company for calculating costs. Of course, it isn't necessary that the engineer ranking presented to the users be absolutely identical to the engineer ranking used internally for cost calculation. However, as these are based on a common standard, they should have some degree of correspondence.

It is thought that the supplying of correct information to the user, achieved by adjusting the engineer ranking used for estimates for users according to the engineer ranking used within the company for cost calculations, can strengthen the relationship of trust between the vender and the user.

Many venders currently ranking engineers take the engineers' years of experience, past achievements, qualifications, or some combination of these factors as the basis for that ranking. However, these ranking factors are obscure to the user, and as the factors used vary according to the company, this information is not helpful to the user. A clear standard must be established for ranking engineers, and moreover, a common standard must be established among venders. Only when such a standard is established will transparency be ensured in transactions, and only then will users be able to compare the prices, productivity, and so on of various venders.

In the case that such a standard for ranking is established, however, it will not be necessary for the venders to standardize the number of ranks. The important thing is to establish a clear, common standard for ranking. Each vender could create its own ranking system based on that common standard, and still the user

should be able to conduct comparisons among venders.

Still, there is the fear that uniform rank-based evaluation of engineers could hamper the development of creative software engineers. The ranking should be made to reflect the various skills that engineers have, because ranking which includes estimation of the degree to which an engineer's abilities and knowledge are invested in the process of software production is an important factor.

In considering the standard for this sort of ranking, it is possible to make use of the new pattern for informatization personnel, and the new divisions in the test for information processing engineers based on that new pattern, suggested by the Informatization Personnel Policy Subcommittee of the Information Industries Committee of the Industrial Structure Council. These could be used as a common standard for evaluating engineers. That is, when ranking engineers in the future, under the premise of enactment of an ability-based salary system, it seems that it would be effective to use this personnel pattern as the basis. Because it is necessary to fully exploit the merits of engineers with various kinds of skills in high value addition for software, it seems that study should be made for realistic standards based on the past experiences and achievements of engineers in each category, keeping the pattern of informatization personnel in mind.

*** Making Cost Calculation More Strict**

At present, almost all of the expenses of software development are calculated as manufacturing cost or general operating expenses, but in cost calculation, venders vary as to whether the cost of research and development, the cost of in-house education, the cost of correcting defects, and costs related to maintenance after delivery are included in manufacturing cost or in general operating expenses. There is no standardized rule for cost calculation, and as a result, users do not place much faith in the prices that venders indicate.

To deal with expenses in such a way that the variance is evident, it seems that the software industry should become standardized to some extent. The cost of research and development and the cost of in-house education could be divided, depending on the goal or subject, into general items (unrelated to the project,

necessary for the whole company) and items necessary for individual projects. Because the cost-effectiveness of general research and development and in-house education is not limited to individual projects but extends to the whole company, it would seem that this should be treated as general operating expenses as a rule. Items which are necessary for individual projects also benefit the company internally, but from the standpoint that they were only necessary in the first place because of that project, as a rule, it would seem that these should be treated as part of manufacturing cost.

The possibility and time period of defect occurrence and the expenses needed for correcting said defects can not be predicted accurately, but because conclusion of a contract means taking responsibility for the completion of the software involved, it is desirable that such expenses be added to production costs in the contract.

The expense of maintenance of software after delivery should not be added to the cost of software development, but the costs of preservation should be treated as preservation costs, based on a preservation contract concluded with separate compensation.

In the case of reuse of routines, modules or intangible property, currently the fees for usage by a third party and expenses for later adjustments are added to the cost, but in the case in which the vender owns the intellectual property rights of these routines and so on, only the expenses needed for later adjustments are added. To add routines, modules, and intangible property to the cost, under the current taxation laws, these expenses must be capitalized (redemption period: five years), but as technology becomes obsolete quickly these days, there is almost nothing that can be applied for a full five years. This makes it difficult to calculate routines, modules, and intangible property as cost.

However, because reuse of routines, modules and intangible property is the application of property which the vender has accumulated, in cost calculation, it is appropriate to treat this as an increase in the profit margin, dealing with it in transactions with the user as payment to one's company for technology, and so on.

*** Promoting the Openness of Information**

In the current software market, many kinds of information which are necessary for business dealings are accumulated internally by the vender. Such information is rarely made available to the user. These kinds of information, which are useful for business, are not generally distributed through any media, either. As a result, the users are forced to make decisions on software purchases based only on limited information. As long as this situation continues, it will be difficult to increase the transparency of the software business or to establish market mechanisms in the software market. Therefore, various kinds of information related to the software business should be distributed in the market, and usability of information by users should be raised significantly.

For example, in the construction industry, information on unit personnel expenses, unit material expenses, and so on is regularly published in organs of the industry, so that this information can be utilized by users. As a result, the users apply this information in making their own decisions about actions to take in the market.

The current state of the software market, in which information that users can utilize is limited, contrasts with the situation in the construction industry. To put market mechanisms to work in this market, venders should increase the transparency of the business, making as much helpful information available as users can utilize by providing large quantities of information in various forms.

Because information on the price and quality of software and information on venders' technological strength and so on would seem especially helpful to users, as much information as possible of types such as those listed below should be made available through organizations in the industry, organs of a third party, and organs of the industry. It is urgently necessary that a consensus be reached on this.

Information Regarding Vender

* Software developed by each vender in the past (type, price, functions, etc.)
* Fields of specialization of vender, or fields of vender's accomplishments (by industry type handled, etc.)
* Overall technological strength of vender (number of engineers with certain qualifications, etc.)

* Business conditions of vender
* Degree of satisfaction toward each vender among users, etc.

Information Regarding Software

* Scales of programs necessary to realize various functions
* Excellent software developed in the past, etc.

To ensure the transparency of business dealings, along with promotion of the opening of information to users by venders, it is also necessary to promote the opening of information to venders by users. At present, venders have to deal with the problem of insufficient understanding of users' needs and the consequent inability to create specifications in a complete form; this causes many instances of trouble related to transactions. For that reason, at the time of software development, users should first present an RFP (Request for Proposal), in which the major items are presented in as much detail as possible. By making this a common and thoroughgoing practice, as much information as possible should be made available to venders about the details of business and so on.

Training New Informatization Personnel

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Chapter 1: A New Stage of Informatization

1. Advance of the New Information Revolution

Throughout the 1970's and 1980's, Japan accomplished economic growth while overcoming major changes in the economic environment, including the two oil crises and the rapid rise of the yen. Informatization made a large contribution to this economic growth by providing rationalization, labor-saving, and so on. From now on as well, for stable economic growth under various structural restrictions, and to make the life of the nation's citizens more comfortable, informatization must be made even more sophisticated. However, with the background of the revolution in information technology, the specific form which informatization will take from now on will both cause great qualitative changes in the role of information systems and raise the social position of information systems significantly. Also, the very information that is collected, processed, and distributed by information systems will become the source of new economic and cultural values. This kind of change which will be brought about by further progress in informatization could well be called a "new information revolution".

The revolution in information technology is seen especially clearly in the following areas.

① Sophistication of functions of information systems

Downsizing is continuing to advance, as illustrated for example by the appearance of the RISC chip,

which has allowed workstations to realize processing speeds that matched existing general-use computers. It is becoming possible for various kinds of information, including images and sounds as in multi-media, to be processed. As a result, means are being supplied widely for the realization of sophisticated information processing which was not possible in the past.

② Sophistication of environment for usage of information systems

Because of the development of computer network technology, information systems are developing toward a distributed usage model. Also, graphic user interfaces are providing a user-friendly operating environment. From now on, the application of multi-media systems and knowledge information processing should contribute to the construction of a user environment that is significantly closer to human patterns of intuition and cognition.

③ Sophistication of technology for construction of information systems

As CASE tools, repositories, and other functions become more sophisticated and object-oriented technology is put to practical use, a comprehensive environment will develop even further for efficient software development through such means as automatization of various processes of program development and re-use of programs.

Also, with the background of the revolution in technology, the roles played by information systems will increase in sophistication in the following ways.

① Fusion of information systems and creative intellectual activities

The main goals of information systems have so far been to save simple mental labor and to increase speed. In addition, information systems will become the basis for social and industrial intellectual creative activities such as decision making, problem solving, and creation.

② Closeness of information systems to the end user

As environments become easier for the end user to utilize because of the increasing variety and sophistication in user interfaces, it will become possible for the end user to develop simple information systems directly by making use of 4GL

and so on.

③ Infrastructuring of information systems

As connections by computer networks become generalized, and the surface expansion of information systems advances by leaps and bounds, the result is that the role information systems play in the infrastructure for economic and social activities and for people's lives becomes stronger and stronger.

2. Changes in the Role of the Information Service Industry and the Role of Users in the New Information Revolution

In the economy and society, as this new information revolution progresses, the role that should be played by the information service industry (including information service sections of computer makers, as well as information service companies), as well as the role that users should play, will experience major changes. The details of these changes are as follows.

(1) The role that the information service industry should play

The information service industry, with its base of advanced technological ability, must enable the user to enjoy the benefits of information technology to the fullest extent possible, supplying specialized and sophisticated services including the construction, operation, application, and so on of information systems. Among these activities, the following five points can be said especially to be roles which will become increasingly important in the future.

① Support for new value-creating activities

When carrying out planning and designing in advanced stages of the process of constructing information systems, supplying systems that are appropriate to the needs and business of the user has so far been the main object, but from now on, information systems will be expected to fulfill the function of supporting the user's activities for formation of new economic and cultural values by becoming integrated with the user's business and organization in the most suitable way.

② Configuration of the most suitable information systems

In the design and development of

software, integration functions that form high quality information systems should be supplied by the combination of hardware and software.

③ Support for the use of information systems

User support has so far concentrated on education of the user, but user support should grow to include functions allowing full exploitation of the effectiveness of information systems, including support for the improvement of the user's business.

④ Operations of information systems

So far, operations have concentrated on the operation and maintenance of hardware owned by the user, but this is expected to shift from now on to take the form of systems operation, the management of the user's information system as a whole. This will require integrated functions for operating information systems safely and efficiently, including choice of the most appropriate hardware, emergency response for the handling and solving of various sorts of trouble, confidentiality, and advance crime prevention.

⑤ Supplying high-quality package software

Because package software will become even more important than before amid the rapid advance of downsizing, system integration, and so on, along with the development and supplying of high quality package software, from now on, functions will become necessary to effect a transfer to the user of the business processing know-how that has been obtained through such development.

(2) The role that the users should play

① Acquisition of basic skills for information system construction and application

End user computing is continuing to advance. In order to become able to enjoy the benefits of information systems to the fullest, users must themselves gain the ability to construct and apply simple information systems that are appropriate to their own needs.

② Cultivation of ability to use and apply information ("information literacy")

End users must cultivate informa-

tion literacy. That is, they must develop the ability to exploit the functions of increasingly sophisticated information systems to the fullest, and to put the information gained to practical use.

Chapter 2: Informatization Personnel Required as Supporters of the New Information Revolution

1. The Need for Increasingly Specialized and Advanced Engineers—Personnel who will carry the new information revolution

As described in Chapter 1, the information industry is expected to play an extremely large role for the steady development of the new information revolution, and the necessary technologies will become more advanced. For the information service industry to play such an advanced and varied role, it would seem difficult to continue to rely on one single type of personnel, the system engineer, for such sophisticated and varied functions. Outstanding personnel are needed who have abundant experience in specialized fields and advanced specialized knowledge and skills. Also, for the end user to fully enjoy the benefits of the closeness of information systems to the end user, personnel are needed who will lead end user computing, while end users also improve their own ability to utilize information.

2. Detailed Personnel Profiles —Types of specialized engineers

The need for personnel with advanced skills and knowledge, specialized in various fields, will be concentrated on the profiles listed below.

I. Personnel related to the planning, designing, development, application, and evaluation of information systems

(1) System Analyst (System Consultant and System Inspector)

Constructs plans, evaluating business, organization, and information system as an integrated system.

As a System Analyst, is responsible for comprehensive planning regarding the configuration and usage of information systems, the business situation, and the situation of the organization, from the point of view of problem-solving. Also, playing the role of System

Inspector, comprehensively inspects and evaluates the reliability, safety, and efficiency of information systems as a neutral third party, and provides advice and guidance to the parties concerned.

(2) Project Manager

Manages projects. Constructs plans for system development. To promote system development, keeping the budget, delivery deadline, and quality in mind, makes use of skills for basic project planning, project management, and estimation.

(3) Application Engineer

Possesses business knowledge related to organization adopting the information system, and software development skills including integrated development environments, such as CASE, and prototyping skills; evaluative ability for package software and so on, and skills necessary for construction of information systems, such as integration skills. Analyzing and modeling the adopting organization's business, structures appropriate information systems.

(4) Production Engineer

Has the ability to develop good programs, using various methods and tools for software engineering, and giving consideration to quality and maintenance. Also responsible for programming process for program examination, maintenance, customizing, integration, and so on.

(5) Technical Specialist

Has high-level skills and knowledge in specific areas of technology, such as basic software, networks, and databases, and practical business experience. Provides technical support in system development to System Analysts and Application Engineers.

(6) System Operation Management Engineer

In charge not only of system operation management centered on the host computer, but also of operation management of a distributed system suitable to the downsizing trend, as well as professional system operation management in the aspects of managing trouble, security, and structuring.

II. Personnel related to education of engineers and users

(7) Education Engineer

Conducts specialized education for information processing engineers, and helps information system users to acquire methods for information system usage. For this purpose, has specialized skills such as information processing skills, instruction skills, the ability to develop educational materials, and the ability to explain the use of information systems. Conducts education and personnel training with these skills.

III. Personnel related to development of system software and microcomputer application systems

(8) Development Engineer

Possesses advanced skills related to hardware, basic software, and so on. Conducts development of system software, represented by basic software and middle software which uses the latest information technologies, and microcomputer application products, which are used in electric appliances, various control mechanisms and so on.

IV. Personnel to lead informatization among users

(9) System Administrator

Possesses a certain degree of knowledge and skills related to hardware and software, and abundant business knowledge related to the organization adopting the information system. Takes the viewpoint of the end user with regard to details of use of the information system after introduction. Plays the role of leader in informatization, participating in development of simple systems along with planning by the provider for the most appropriate system for problem-solving in his/her own section, and after introduction of the system, works for construction of a usage environment for the information system, including collection and organization of information needed in own section.

V. Personnel for promotion of research and development for information technology

Based on creative thinking and original ideas, researches and develops production technologies and so forth for new system architecture and software.

Chapter 3: Setting a Standard Curriculum for the Establishment of Training Systems for Informatization Personnel

In order to train advanced, specialized information processing engineers, as described in Chapter 2, it is necessary to establish a personnel training system that is consistent from education through to evaluation, using examinations based on the curriculum. This requires setting a standard curriculum to enable high quality education and conducting suitable education with cooperation by companies and educational institutions. Planning of the standard curriculum should be conducted in line with the following considerations.

1. Standardized Curriculum System

Until the engineers reach the actual ability level of advanced information processing engineers, as basic knowledge acquired by specialized education is deepened according to their individual career paths, they need to acquire firm business abilities by a certain amount of actual business experience, including participation in the planning of actual development projects. Therefore the standardized curriculum, which will become the basis of the education of informatization personnel, should be formed as a system with steps, consisting of specialized curricula for each type of advanced information processing engineer, and as a preceding step, a common curriculum making clear the common basic knowledge and skills which new staff are expected to acquire within five years of entering the company. The common curriculum should be adapted in form to the actual development and training of engineers. It should include two levels, a second common curriculum (for approximately the first three years after entering the company) and a first common curriculum (for approximately the third to the fifth year after entering the company).

The curriculum for training system administrators is for the purpose of training information system engineers on the user side; therefore it differs from the common curriculum for engineers in the quality and quantity of knowledge and skills that are necessary. Two levels, beginning and advanced, should be established in a curriculum with a separate system. (See the chart for an outline of the curriculum as a whole.)

2. Points for Consideration in the Standardized Curriculum

(1) Emphasis on both the aspect of acquisition of basic knowledge and the aspect of training for practical ability

The structure of the common curriculum must include consideration for enabling appropriate choices from among the fields related to the advanced information processing engineering positions which each person has taken as his/her goal. The second common curriculum, which corresponds to the beginning level for engineers, should be centered around basic business abilities and acquisition of the wide range of basic knowledge that will be necessary in their future careers as information processing engineers.

It is necessary in each curriculum to emphasize not only the acquisition of required knowledge, but also the development of ability to apply that knowledge. Therefore, while providing sufficient practice and exercise of practical content, consideration should be given to planning ability, expression techniques, and communication ability. In addition, some degree of practical ability should be developed for specialized skills.

(2) Developing and supplying textbooks and training Materials

To support study based on the curriculum, the Information-Technology Promotion Agency, Japan (IPA) and the Central Academy of Information Technology (CAIT) should develop and supply texts to make individual study possible of the content indicated for each curriculum. These texts should include explanations, examples and self-study questions. Training materials that could be used in lectures in actual study should also be developed and supplied.

(3) The need for development of teaching materials and educational methods for the training of practical ability

The training of planning ability, consulting ability, and management ability requires long time periods of actual practice. However, for efficient learning to take place within the limited time period for training and through instruction by a fixed number of instructors, it is thought that teaching materials such as simulation-

type computer assisted instruction (CAI) systems and practical project exercises would be effective.

Chapter 4: Reviewing Examination System for Formation of a Consistent Training System

To construct a consistent personnel training system from instruction through to evaluation, a national examination system must be established in conformity with the standardized curriculum to enable the objective evaluation of those abilities. For this purpose, the present examination system for information processing engineers should be revised with the following points in mind.

1. Examination Divisions and Examination Periods that Correspond to the Classification of Engineers

(1) Examination divisions

① For the time being, the examination divisions will be the eleven listed below, out of consideration for continuity with existing examination divisions, practical restrictions, and so on.

② Other divisions will be added in quick succession as their addition becomes possible, based on ascertainment of the contents of the curriculum to be formed and ascertainment of the establishment of education based on those contents.

(a) Examination divisions to be executed for the time being:
Systems Analyst Examination
Systems Auditor Examination
Project Manager Examination
Application Engineer Examination
Production Engineer Examination
Systems Operation Management Engineer Examination
Technical Specialist Examination (Database)
Technical Specialist Examination (Network)
Senior Programmer Examination
Programmer Examination
Systems Administrator Examination (Beginning)

(b) Examination divisions to be considered for execution in the future:
Technical Specialist Examination (Hardware / Basic Software)
Technical Specialist Examination (Software Production

Engineer)
Development Engineer Examination (System Software)
Development Engineer Examination (Microcomputer-based Systems)
Systems Administrator Examination (Advanced)
Education Engineer Examination
(All examination names are tentative.)

(2) Execution time period

Considering the work needed for setting standardized curricula and forming examination questions, the following schedule is appropriate for the transition to the new examinations.

① Execution time period: Transition to begin in autumn of 1994.
② Divisions for execution: For the time being, execution of the eleven divisions will divided into two periods each year, one in spring and one in autumn.

Divisions for Execution in Autumn:

Systems Analyst Examination
Systems Auditor Examination
Application Engineer Examination
Technical Specialist Examination (Network)
Programmer Examination
Systems Administrator Examination (Beginning)

Divisions for Execution in Spring:

Project Manager Examination
Systems Operation Management Engineer Examination
Production Engineer Examination
Technical Specialist Examination (Database)
Senior Programmer Examination
Programmer Examination

(3) Correspondence relationship with existing examination system

Considering such factors as the fact that the existing examination system is used as part of companies' personnel evaluation systems and the fact that the examination system influences the study curriculum used in in-house education, in order to prevent confusion when the new system is introduced, the correspondence relationship of the new examination system with the existing system must be made clear. After the transition to the new examination system, in regard to standards and so on in businesses' internal qualification systems

and in official systems, it is desirable that those who have already been recognized as having passed under the existing examination divisions be treated on a level with those who pass under the corresponding new examination divisions. The correspondences are shown in Table 1.

2. Improvement of Examination Contents and Examination Methodology

(1) Linkage to standardized curricula

Contents of the examinations should of course be based on the standardized curricula. Moreover, based on analysis of the results of the examinations, appropriate feedback on the contents of the curricula should be provided to strengthen the linkage between the curricula and the examinations and to systematically promote the training of information processing engineers.

(2) Improvement of examination methodology for evaluation of practical business abilities

In order to attain the proper balance between the two aspects of acquisition of systematic, specialized knowledge and skills and development of practical business ability, the relative weight given to essay questions and description questions in the examinations should be increased, and in examinations for advanced information processing engineers, when grading the answers, reference should be made as necessary to the contents and so on of practical business experience, based on data on the examinee's history of practical business experience.

Table 1. Correspondence Relationships of the Existing Examination Divisions with the New Examination Divisions

Existing Examination Divisions	New Examination Divisions
Programmer Examination	Programmer Examination
Senior Programmer Examination	Senior Programmer Examination
Online Systems Engineer Examination	Technical Specialist Examination (Network)
Systems Engineer Examination	Application Engineer Examination
Systems Auditor Examination	Systems Auditor Examination

3. Introduction of System for Partial Exemption from Examination

(1) The concept of partial exemption

When it has been objectively recognized that the examinee has acquired a certain scope of the standardized curriculum through various kinds of education, a system should be established for partial exemption from examination, as follows.

① Scope of subjects for partial exemption

The scope of subjects for partial exemption should be basically the knowledge and skills included in the curriculum whose acquisition is possible through classroom study, exercises, and practice.

② Candidates for partial exemption

Candidates for partial exemption should be those who are recommended by their respective educational institutions from among the learners who have completed study, based on certain standards, when these institutions are recognized as carrying out appropriate education of engineers based on training courses that conform to the standardized curriculum.

(2) Schedule for introduction of the partial exemption system

For the time being, partial exemption from the "Senior Programmer Examination" should be carried out with regard to the Central Academy of Information Technology (CAIT) and local software centers.

Chapter 5: Educational Roles of Educational Institutions and Policies for Improvement

For the construction of a comprehensive personnel training system, businesses, schools, official personnel training institutions, and so on must each fulfill their respective roles correctly, promoting the training of engineers in organic linkage. Therefore, each educational institution must promote the construction of a training system, based on the following points regarding policies for the roles of each institution conducting personnel training and policies for the improvement of those roles.

1. In-house Education

* Personnel training that matches the company's strategies

Setting and executing strategic personnel training directions
Construction of an in-house education system, case studies of its effectiveness, propagation of its achievements

* Establishment of an objective and clear ranking of engineers
Ensuring linkage of career paths and so on with treatment system
Establishment of an ability evaluation system based on objective evaluation standards

2. University Education

* Training creative personnel
Conducting education that values practical information
Support for realization and propagation of prototypes as research seeds

* Conducting information processing education in basic education
Improving general information processing education as a basic course

* Response to life-long education
Improving open lectures and promoting continuing education

3. Professional Schools

* Raising level of education
Establishment of course completion recognition system linked to Class 2 Common Curricula and so on (2-year program, 3-year program)

* Continuing education of staff employed at companies
Improvement of training courses with technology conversion education of a company's engineers

* Providing environment for advanced education
Making entrance to universities and recognition of course credits easier for graduates of professional schools

4. Vocational Schools

* Engineer education that includes basic and practical education in specialized (major) courses
Promotion of the establishment of specialized (major) courses for specialized education
Instructor training activities to improve instruction

* Training engineers for informatization promotion among user departments
Improving contents of education in information-related departments in response to the progress of informatization

(Training system administrators)

5. Central Academy of Information Technology (CAIT)

* Planning and enactment of standardized, leading education to supplement companies' in-house education and private education, and educational support
  Production and distribution of standardized curricula, texts, and instructional materials
  Enactment of training methods and practical training exercise models for the training of advanced information processing engineers
  Construction of a system to provide data and so on related to the training of informatization personnel
  Establishment of a recognition and registration system for introduction and mediation for education engineers

6. Local Software Centers

* Supplementation of in-house education of companies and private education in the community
  Review of curriculum formation in conformity with standardized curriculum, and expansion of national system for promotion of corresponding training
  Train educational personnel through instructor training

* Enactment of plans for training actual business ability
  Mediation and strengthening of system development business with the cooperation of local public groups

* Base for distribution of various kinds of information in the community
  Functional strengthening as a base for distribution of information on technological trends that use networks, research trends and business information

7. Elementary and Middle Schools

* Cultivation of information literacy
  Establishment of information courses and inclusion of information as a subject in entrance exams
  Improvement of information literacy education in teacher training universities and teaching profession process

8. Linkage between Businesses and Educational Institutions

* Efficient personnel training through linkage with educational

institutions
(Establishment of a site for linkage of educational institutions, businesses, groups, and related administrative organs)

- ☆ Setting guidelines for industrial / educational linkage
- ☆ Strengthening industrial / educational linkage for the enactment of practical business education
- ☆ Making practical experience in businesses easier
- ☆ Efficient use of school educational institutions

Chapter 6: Dealing with Internationalization in Training Information Processing Engineers

1. Contribution to Developing Countries

From the standpoint of the promotion of informatization in developing countries and the international division of labor in the information service industry, Japan must also become involved in and, through measures such as the following, contribute actively to the establishment and improvement of training and evaluation methods for information processing personnel.

(1) Acceptance of trainees from abroad and training in companies

The engineers from China, Southeast Asian countries, and other countries who receive training in Japanese businesses are increasing. From now on, for the purposes not only of simple exchange of engineers but also for development toward the progress of international division of labor in the information service market, it is desired that Japan fulfill the function of an information education center for the region of Asia. To this end, it is necessary that educational institutions and professional schools accept engineers from abroad and enable them to receive training smoothly.

(2) Support for the execution of information processing engineer examinations abroad

In recent years, there has been an increasing tendency toward informatization in Asian nations. Along with this tendency, there is discussion of enacting a national examination for the recognition of information processing engineers. It is desired that Japan make use of its experience in executing and managing this kind of national examination to offer suitable cooperation and contributions as necessary.

(3) Support for educational and training facilities abroad

Government cooperation is already being conducted for the establishment of information processing engineer education and training facilities in some Southeast Asian countries. Also, through the Information-Technology Promotion Agency, Japan cooperative development projects are being conducted for intellectual CAI systems for training information processing engineers locally. Equipping and improving the training system in developing countries for information processing engineers is extremely important for development of the information service market in all Asian countries and promotion of appropriate international division of labor. Continued active involvement in this area is needed.

2. Contributions to International Harmonization of Qualification and Examination Systems for Engineers

In regard to international harmonization of each country's unique training methods for information processing engineers, divisions of personnel profile patterns, and evaluation methods, at present in international conferences, the possibility of coordination and mutual recognition is under investigation in regard to the categories of information processing engineers, the contents of the educational curricula, and the examination systems of different countries. To mention some of the major discussions, first, plans are underway for the establishment of a special conference for discussion of "Regarding International Comparison and Recognition of Qualifications and Authorizations of Information Processing Engineers", put out by the International Federation for Information Processing (IFIP). Also, discussions are being conducted in a special group of the South East Asia Regional Computer Confederation (SEARCC) regarding the classification of information processing engineers and the standardization of the examination system. It is desired that Japan also make efforts from now on to make the national examination system internationally open, and that Japan participate actively in such discussions in cooperation with the Center of the International Cooperation for Computerization (CICC) and Japan Information-Technology Engineers Examination Center (JITEC), and other organizations, and cooperate, for example, in the dispatching of appropriate professionals.

Current News

* Fujitsu Leaves Path of IBM Compatibility

Fujitsu has relinquished its right to receive the 1993 information regarding the operating system of IBM's large general-purpose computers. This means that Fujitsu has turned from the path of IBM compatibility to a path of independence.

IBM had raised a dispute with Fujitsu regarding the operating system of general-purpose computers. In 1985, IBM appealed to the AAA (American Arbitration Association), claiming that Fujitsu had infringed on IBM's rights regarding a software copyright concluded in 1983. The decision of the AAA, which was issued in 1987, gave Fujitsu the right to purchase information on the interface, which is the nucleus of the operating system, every year until 1997. Fujitsu continued with IBM compatibility until 1992. However, downsizing is advancing in the computer market, and the proportion of general-purpose computers is decreasing. Demand has also fallen for the large IBM-compatible computers that Fujitsu had been selling.

Fujitsu explains that it decided not to purchase the technical information for 1993 because the demand of its customers for IBM-compatible computers had dropped sharply. Annual sales of Fujitsu's general-purpose computers amount to approximately 700 billion yen, or 45% of the whole of the company's computer section. Still, it is predicted that sales of small machines such as workstations and personal computers will grow from now on, and no further expansion of the market for general-purpose computers, including IBM-compatible computers, is foreseen. Fujitsu seems to have decided that for these reasons, there is no need to continue to pay high license fees for further new development of IBM-compatible computers.

The path of compatibility with IBM

was originally taken in order to catch up with the American and European computer industries. This change in strategy by Fujitsu, which had been representative of that trend, suggests a major change in the direction of Japan's computer industry as a whole.

* Mitsui & Co. Applies U.S.-Japan Joint Credit Extension Program in Export of U.S.-Made Computers

Utilizing a U.S.-Japan public credit extension program, Mitsui & Co. has completed arrangements for the export of large American made computers to the Czech Republic. A-16, a super large general-purpose computer made by Unisys, a business partner of Mitsui & Co., is to be exported along with peripheral devices and a complete set of software for the financial business. A local bank is planning the introduction of a computer system to modernize the management of savings deposits. The contract amount is 12 million dollars; 7.5 million dollars of that amount will be financed by Japanese financial institutions with the backing of the Export-Import Bank of the United States. The remaining 4.5 million dollars will be financed by Mitsui & Co. through its local European corporations, and Japan's Ministry of International Trade and Industry will apply foreign investment insurance to a certain portion of this amount.

In the U.S.-Japan Joint Credit Extension Program, when American and Japanese businesses jointly export to a third country, the Export-Import Bank of the United States provides financing or financial backing, while the Ministry of International Trade and Industry applies insurance. This program aims to help correct the trade imbalance by promoting exports by American businesses, while promoting the flow of finances from America and Japan to developing countries, and so on. The program was begun in spring of 1992 by a 1991 agreement of the governments of both countries. So far, the program has dealt mainly in electrical power facilities, chemical plants, and the like for Southeast Asia and South America. This will be the first case of joint credit extension to an Eastern European country.

* KDD Links to French and German PTTs in Telecommunications Services for Multinational Corporations

KDD will form a tie-up in the field of telecommunications services for multinational corporations with two common carriers, Deutsche Bundespost Telecom (DBPT) and France Telecom (FT). This will provide an

international telecommunications services in specifications common to the three common carriers. The joint service will accept unified orders for communications operations from companies with a number of bases in Japan and Europe, linking Japan with all of Europe. KDD will be in charge of user expansion in Japan, user management, after sale service, and so on. DBPT and FT had already begun a coalition, and asked for KDD's cooperation in a plan to develop a telecommunications services for multinational corporations in all of Europe at the beginning of 1994.

The joint venture will secure circuits especially for communications between Japan and Europe and provide voice communications services, ISDNs, packet switching data communications, and other communications services to meet the needs of any company.

DBPT and FT have begun preliminary talks with American common carriers regarding a further tie-up to expand the service area to include Europe, Japan, and the U.S. In communications services for multinational corporations, in order to gain the advantages of obtaining large scale users, more and more coalitions between common carriers are being formed.

* NEC to Supply Notebook-size PCs with Color Display to NCR on OEM Base

NEC will supply notebook-size PCs with color display on an OEM base to NCR, a computer maker under the AT&T umbrella.

The supply period on the OEM base is one year. A TFT (thin film transistor) type color liquid crystal display will be used in this high-performance notebook-size personal computer. It is predicted that more than 20,000 will be shipped annually. NEC also plans to sell 100,000 of the same products annually under its own brand name. NCR will sell the PCs directly to corporate users under the brand name of "Safari 3180." AT&T, the parent company, also plans the introduction of these products.

TFT liquid crystals, a main component, are only manufactured in Japan, so for the time being, these will be exported from Japan. However, in view of the high yen, studies are proceeding on methods for local manufacture of the computer body with the export of TFT liquid crystals only and also on the local manufacture of TFT liquid crystals.

NEC and AT&T are in partnership for the areas of telecommunications

and semiconductors, but they will also cooperate in the computer field. As global price competition intensifies in the personal computer world, OEM coalitions among large makers have become popular measures to reduce the costs of development and production.

* IBM Japan Develops International VAN Business with Communications Authority of Thailand

Jointly with CAT, the Communications Authority of Thailand, IBM Japan will connect a domestic VAN in Thailand with the IBM Group's international VAN, which links many countries of the world. Service begins in October 1993.

The business nucleus will be formed by CAT and IBM Japan Services Business Company (SBC), a subsidiary of IBM Japan, which will be in charge of computer-related services and software. Communications control equipment will be located in the Bangkok office of CAT, connecting it with the international VAN base of IBM Singapore, which is already linked with 90 countries. CAT will be in charge of business activities within Thailand, while SBC will be in charge of system construction and operation services for local user companies.

About 2,000 Japanese companies have entered Thailand, where the rate of economic growth is high, but the communications network is comparatively undeveloped for such reasons as legal regulations regarding the telecommunications business. In 1992, an agreement was reached by Japan's Ministry of Posts and Telecommunications and the Thai government regarding a VAN project, making the development of this international VAN project possible.

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