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Ubiquitous Networking by "International Symbiosis"

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The moves to develop the ubiquitous network that started at the turn of the century have facilitated the development of the ubiquitous network infrastructure, emergence of clusters of related solutions and the establishment of a safe and secure usage environment. Currently, these moves are steadily penetrating Japan's ICT (information and communications technology) environment. At the same time, "Galapagosization" is emerging as the new issue, which is the phenomenon in which efforts to develop the latest technologies and products/services within the Japanese market are not well reflected in Japan's international competitiveness.

The competitive environment surrounding Japan in the global market is undergoing a major change with the emergence of "MegaGrowth countries." While having large populations of 40 million or more, these countries, such as China, India, Korea and Vietnam, are on the way to achieving high economic growth. While China and India are expected to take the lead as major players in world economy, MegaGrowth countries may grow to become equivalent to Japan, the US and Europe in terms of market size. The "flying geese type" of growth that was seen in the past will disappear and, instead, the "simultaneous and multiple emergence type" of economic growth will occur outside the Japanese market, i.e., mostly in MegaGrowth countries.

In the future world market, the most advanced products will not necessarily become the products earning the largest sales and profits. What is required of Japan's ICT industry under such an environment is that in addition to strengthening the international evolution of the ubiquitous network industry in the high-end market where Japanese industry is likely to become highly competitive, the industry must also exist together with the diversity seen in the middle-tier and low-end markets. To become competitive in the global market, the industry should pursue the improvement of "international symbiosis" by actively utilizing the first-rate management resources available in these countries.

I Ubiquitous Networking Faces New Issues

1 Ubiquitous Networking Has Taken Root in Japan's ICT Environment

Eight years have already passed since Nomura Research Institute (NRI) started to address the theme of the ubiquitous network at the turn of the century. During this period, progress in efforts to achieve ubiquitous networking has been activated among the industries, academia and governments of Japan and Korea. Through these efforts, ubiquitous networking has become firmly rooted in Japan's ICT (information and communications technology) environment.

This paper outlines the recent situation of ubiquitous networking in Japan, which can be expressed as the current level of achievements related to ubiquitous networking in Japan. Following this overview, consideration will be given to the international competitiveness of Japan's ICT industry that is now emerging as new issues based on the studies and deliberations of multiple committees organized by the Ministry of Internal Affairs and Communications of Japan in which the author participated as a member. By considering the drastic changes in such an international competitive environment from the long-term perspective, the concept of "international symbiosis" will be used for further contemplation of the issues.

First, the following sections describe the recent situation of ubiquitous networking from the aspects of three policy directions taken under the "u-Japan Policy:" (1) development of the ubiquitous network infrastructure, (2) ICT utilization to resolve the emerging economic and social problems Japan will face as it moves towards the 2010s and (3) establishment of a safe and secure usage environment.

(1) Development of the ubiquitous network infrastructure

In e-Japan Strategy II (the national IT strategy), the ubiquitous network was defined as a "network that can be connected at any time, anywhere and with anything." As examples that can provide a close image of the ubiquitous network, services such as i-Mode that was developed as a gigantic closed network that connects mobile phones with the Internet were first offered to consumers.

However, the major objectives pursued by the ubiquitous network are to ensure interconnectivity and interoperability to the maximum extent possible among five different types of networks. Specifically, these are (1) wired broadband networks such as ADSL (asymmetric digital subscriber line) and FTTH (fiber to the home), (2) wireless networks such as mobile phone Internet (Internet connections by mobile phones) and wireless LANs, (3) broadcasting networks that have steadily shifted to a digital format, (4) traffic networks such as ETC (electronic toll collection system) and ITS (intelligent transport systems) and (5) real object networks such as RFID (radio frequency identification), sensor networks and network robots.

Currently, in Japan, each of these five different types of networks is steadily being developed.

For wired networks, plans are underway to eliminate broadband zero areas by 2010. For wireless networks, active moves are seen for the development of WiMAX (worldwide interoperability for microwave access; a radio communications system covering a radius of about 50 km) and the next-generation PHS (personal handy-phone system). A detailed road map is being formulated for the digitization of terrestrial waves for broadcasting systems in preparation for the cessation of the use of analog signals by 2011. Traffic systems focus on the connection of car navigation systems to the Internet, the development of multiple ETC functions and the development of an automatic driving system to ensure safety. For real object networks, increased expectations are being given to the practical use of network robots in addition to RFIDs and sensor networks.

Because there are players who are already deeply interested in each of these five types of networks, and policy-making authorities are highly motivated for the development of these networks, steady progress will be made in the development of these five network types in the future.

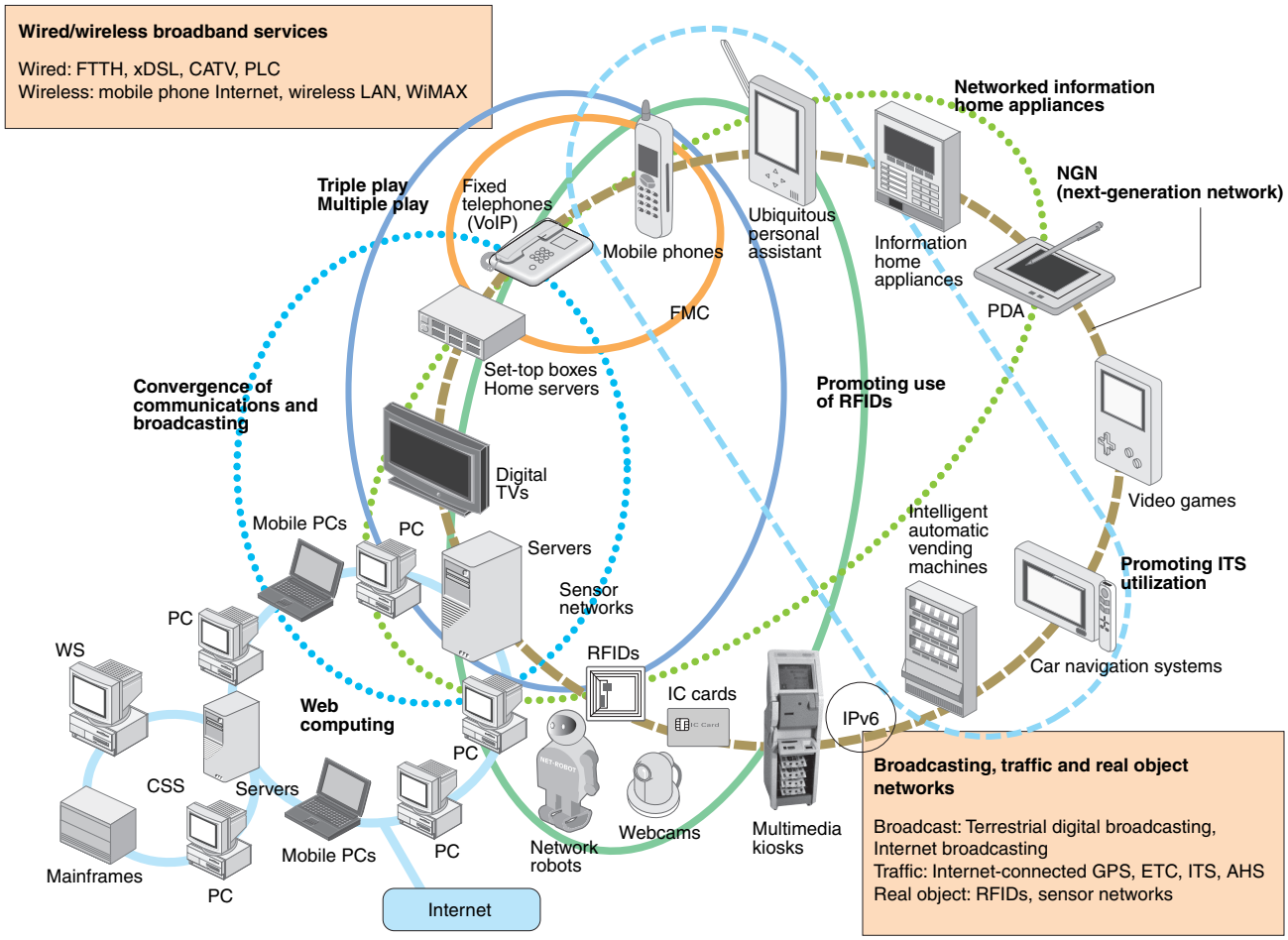
The realization of the ubiquitous network infrastructure requires not only the development of each of these five network types, but also the establishment of interconnectivity and interoperability among them to the maximum extent possible.

In this respect, as described in NRI Papers No. 113 (January 1, 2007), "The Long Tail and Lofty Head of Video Content," new themes of activities aimed at establishing interconnectivity and interoperability among these five types of networks have been emerging one after another in the area of Japan's information and communications policy. These include (1) FMC (fixed-mobile convergence), (2) triple play (the merging of voice, video and data communications via a single line) and multiple play (triple play + mobile phone), (3) convergence of communications and broadcasting, (4) networking of information home appliances, (5) promoting the use of RFIDs, (6) promoting ITS utilization and (7) developing NGN (next-generation networks employing full-digital and full-IP technology) both for wired and wireless networks (Figure 1).

Rather than pursing the comprehensive goal of "ubiquitous networking," the government and the ICT industry have started to achieve these individual specific themes. Nevertheless, steadily promoting the achievement of these specific themes means nothing but promoting ubiquitous networking.

With an increasing number of specific goals being identified and achieved for each theme, the themes pursued

Figure 1. Ubiquitous Networking Pursued under Individual Specific Themes



Notes: AHS = advanced cruise-assist highway system, CSS = client/server system, ETC = electronic toll collection system, FMC = fixed-mobile convergence, FTTH = fiber-to-the-home, IPv6 = Internet Protocol Version 6 (new IP protocol), ITS = intelligent transport systems, LAN = local area network, PC = personal computer, PDA = personal digital assistant, PLC = power line communications, VoIP = voice over Internet Protocol, WiMAX = worldwide interoperability for microwave access (radio communications system covering a radius of 50 km), WS = workstation, xDSL = various digital subscriber lines

under individual programs are becoming more important than the "ubiquitous network" ICT paradigm itself. This situation suggests that we are in the process of achieving maturity where this ICT paradigm will become part of reality. This is mentioned in NRI Papers No. 113 in 2006.

Figure 2 shows this situation in such a way that extends Figure 1 of NRI Papers No. 97 (November 1, 2005), "Japan's National IT Strategy and the Ubiquitous Network." While the frequency of the appearance of the term "ubiquitous" has already reached its peak and has been declining, the frequency of the appearance of the constituents of the ubiquitous network concept such as the convergence of communications and broadcasting and the next-generation network has been increasing. If the appearance of these phrases is added to Figure 1 of NRI Papers No. 97, it becomes clear that Japanese industries still have high interest in the "ubiquitous paradigm," as shown in Figure 2.

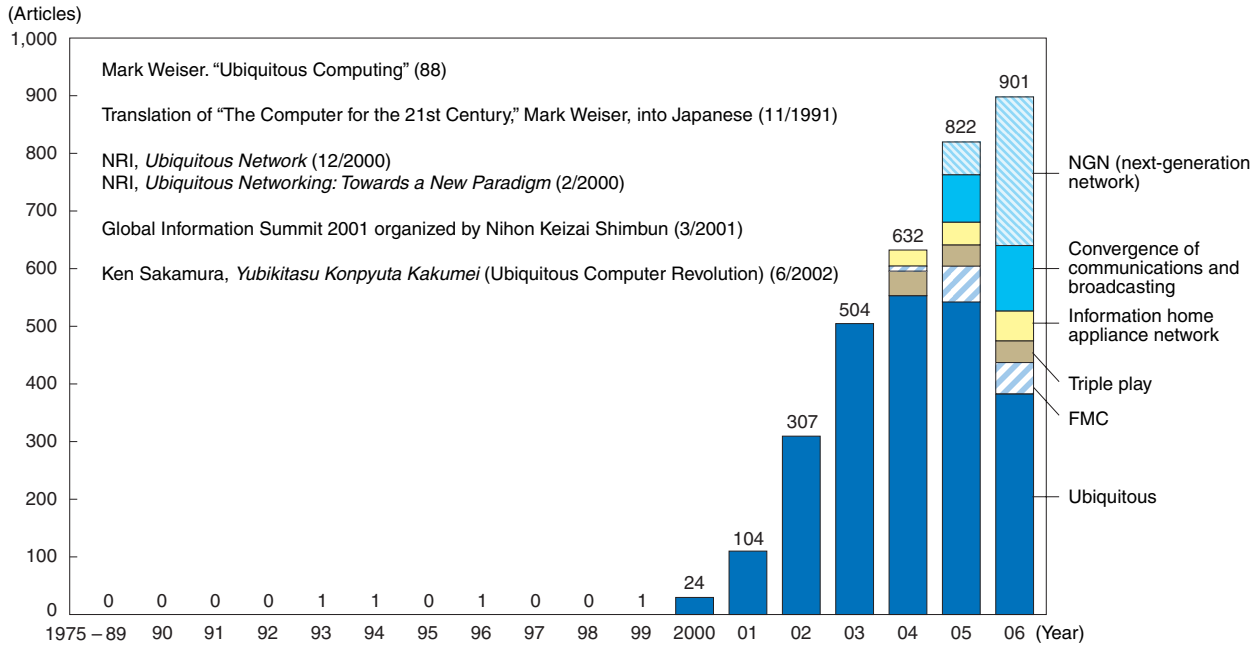
As such, as far as the Japanese network infrastructure is concerned, the ubiquitous network serves as the underlying concept for the development of different types of networks. Currently, steady progress is being made in activities to develop safe and secure networks that can be connected "at any time, anywhere and with anything."

(2) Emergence of Clusters of Solutions Related to the Ubiquitous Network

The next question relates to the second aspect of the u-Japan Policy: Is progress steadily being made in "ICT utilization to resolve the emerging economic and social problems that Japan will face as it moves toward the 2010s?"

In 2006, the Ministry of Internal Affairs and Communications began awarding the "u-Japan Best Practice Grand Prize" with the aim of promoting the creation of solutions that make use of the ubiquitous network. While the ubiquitous network is still on the way toward development, the ministry invites solutions using the existing ICT environment to resolve various socioeconomic problems, evaluates them based on prescribed standards and awards prizes to the selected solutions as the best practices at a ceremony on June 1

Figure 2. Frequency of Appearance of Ubiquitous-Related Articles in Three Economic Newspapers



Notes: (1) The three economic newspapers are *Nihon Keizai Shimbun, Nikkei Business Daily* and *Nikkan Kogyo Shimbun*. Keywords include similar terms and phrases. (2) Figures indicate the total number of articles carrying the indicated terms and/or phrases.

every year during Information and Communications Month. This event provides a good opportunity to see what ubiquitous-network-related solutions are being developed.

The u-Japan Best Practice Grand Prize in 2006 was awarded to the "Street Corner Monitoring Sensor System to Protect Commuting School Children" developed by Matsushita Electric Industrial Co. (Figure 3).

This system works as follows. Active and passive RFIDs are attached to backpacks carried by elementary school children. As the children pass the school gates, where an RFID reader is installed, to attend or leave the school, this information is sent to the PCs and/or mobile phones of parents and teachers via the center.

In addition, the RFID readers are also installed on top of automatic vending machines (where electric power is available) that are installed almost everywhere on city streets. Each time a school child passes one of these vending machines, the time and a video image are stored in the center. Parents and teachers who have the correct ID (authentication number) can access this information on the Web.

From 2004 to 2005, violent crimes involving school children attending or leaving school often occurred in Japan. Concerned about this situation, the Japanese government convened an inter-ministry committee in December 2005 to develop measures to prevent such violent crimes involving children.

In anticipation of the utilization of the ubiquitous network to help prevent such crimes, the Ministry of Internal Affairs and Communications conducted surveys on how many solutions making use of the ICT of the ubiquitous network, such as those developed by Matsushita Electric Industrial Co., were available throughout the country. The ministry reported the survey results, which revealed that 192 solutions had already been devised throughout the country as of March 2006.

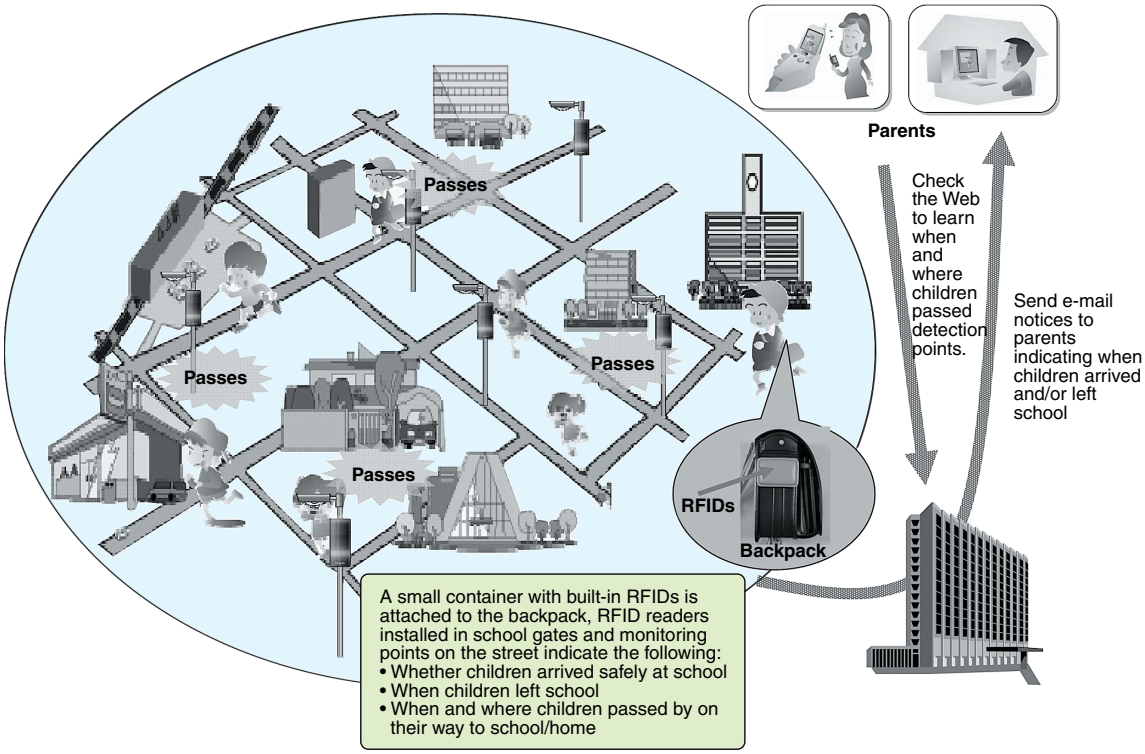
Once the utilization environment of the ubiquitous network where mobile terminals, RFID, webcams and the like are freely connected via wired and wireless broadband networks has been established, clusters of new solutions can emerge whenever a serious social need, such as protecting the safety of school children when they attend and leave school, becomes apparent.

In addition to Matsushita's solutions, the u-Japan Best Practice Grand Prize 2006 was also awarded to the following systems: the component receipt/shipment management system developed by Fujitsu that uses RFID tags between a component factory and a product assembly plant, which could reduce component inventory by half; the small-amount payment system via a network that uses NTT DoCoMo mobile phones; and the video distribution system developed by SHE KNOWS JOURNAL (SKJ) that enables anyone to easily and quickly distribute video and voice information via the Internet at low cost.

The u-Japan Best Practice Grand Prize 2007 was awarded to the "hospital bedside safety control system using RFIDs" developed by the Akita University Hospital (Figure 4). This system uses RFIDs attached to injection medications and patient wristbands and links them with electronic medical records on a real-time basis via wireless LAN. The hospital is achieving the intended effect of preventing medical malpractice during daily medical service.

Figure 3. u-Japan Best Practice Grand Prize 2006

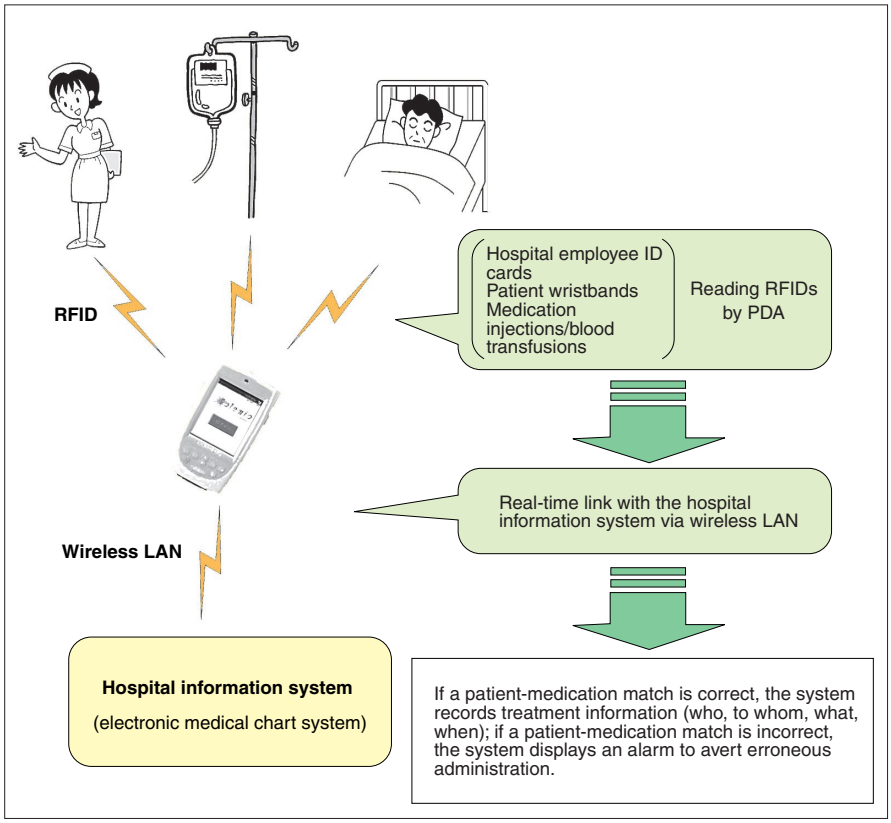
Street Corner Monitoring Sensor System (Matsushita Electric Industrial Co.)



Source: The Ministry of Internal Affairs and Communications, "u-Japan Best Practices 2006," June 2006, http://www.soumu.go.jp/s-news/2006/pdf/060601_1_01.pdf

Figure 4. u-Japan Best Practice Grand Prize 2007

Bedside Safety Control System Using RFID Tags (Akita University Hospital)



Features of This System

Seamless connection of RFIDs, wireless LANs, PDAs and the hospital information system enables:

- Use of the system at bedsides throughout the hospital
- Easy reading of data by anybody
- Quick reading while doctors and nurses are busy working
- For the first time in Japan, the latest technology (RFIDs) was applied to bedside treatment to help resolve some problems facing hospitals

Effects of This System

Improving medical safety

- Decreasing the number of incidents
- Helping to prevent mistakes from occurring
- Fostering peace of mind among hospital staff members

Improving work efficiency

- Easing of identification (distorted bands and drips, soiled tags)
- Cutting work time (about half that of a bar code system)
- Reliable treatment records (developed through both a medication check and a treatment record)

Source: The Ministry of Internal Affairs and Communications, "u-Japan Best Practices 2007," June 2007, http://www.soumu.go.jp/s-news/2007/pdf/070601_2_01.pdf

In the medical field, the remote medical system developed by NTT Resonant won a prize in 2006. This system transmits high-definition microscope images and enables a doctor conducting a surgical operation in a hospital located in a different location to receive advice from a specialist in pathology (the number of such specialists is still limited in Japan) based on the transmitted images.

A somewhat interesting system developed by NTT DoCoMo that won a prize in 2007 was the alcohol check system using videophones for truck drivers. The system uses the videophone function of the third-generation mobile phone to talk face-to-face with a driver located in a remote location on a real-time basis and automatically sends the data measured by an alcohol sensor connected to the phone. The system enables a manager at the trucking company office to immediately check whether a driver has drunk alcohol. This solution aims to address a social problem of frequently occurring traffic accidents resulting in injury or death caused by drunk drivers.

Recently, in addition to activities at the national level and those by companies, in Europe and the US we see moves to encourage individuals to participate in efforts to promote measures against global warming. In the third session of the Digital Civilizations Forum (Ci'Num[1]), which was held in October 2007 in Bordeaux, France, and in which the author participated, discussions were held on the concept of "Ecogotchi," an ecological version of Tamagotchi, which is a personal calculator that measures carbon dioxide emissions by individuals, and that of "Eco-Footprint," which records a history of carbon dioxide emissions by individuals. While these tools remain at the conceptual level, we can easily imagine Ecogotchi and Eco-Footprint as specific solutions in the near future as extensions of the videophone alcohol check system mentioned above.

As such, serious social issues and needs are recognized and shared extensively by industry, the government, public organizations, municipalities and local communities. In the order of their seriousness, a wide variety of solutions have been proposed and developed by diverse players such as universities, communities and medical institutions in addition to ICT companies. The more promising the solutions, the higher the priority that is given to their dissemination throughout the country. This is the precise process that is the aim of the u-Japan policy. At the same time, these solutions suggest that the fundamental constituents of achieving the ubiquitous network society have steadily been taking root in Japanese society.

In addition to social problems, responses to economic issues have also been actively proposed and developed. When the concept of ubiquitous networking started to be discussed, industry first paid attention to the use of RFIDs in retailing.

In the US, a campaign against the use of RFIDs was raised by a consumer group at such an early stage as verification testing of the devices. The point at issue was that even if RFIDs could be used for the process from factories to store warehouses, it might take considerable time for products with RFIDs to arrive at stores.

At the study committee on the advanced utilization of RFIDs organized by the Ministry of Internal Affairs and Communications in 2003, the author noted that it is meaningful to introduce RFIDs only when traceability can be established for an entire life cycle of products from the procurement of raw material to the disposal of the product, and pointed out three barriers that had to be overcome in order to establish such traceability. These are the barrier encountered when a product is delivered from a warehouse to a store, the barrier of whether consumers bring products to their homes or elsewhere and the barrier of whether RFIDs are utilized until the product is finally disposed of.

After these discussions, industry, academia and government have all been conducting focused activities to promote the utilization of RFIDs. Figure 5 indicates the latest situation monitored by NRI regarding the extent to which progress is being made in verification tests and actual application of RFIDs.

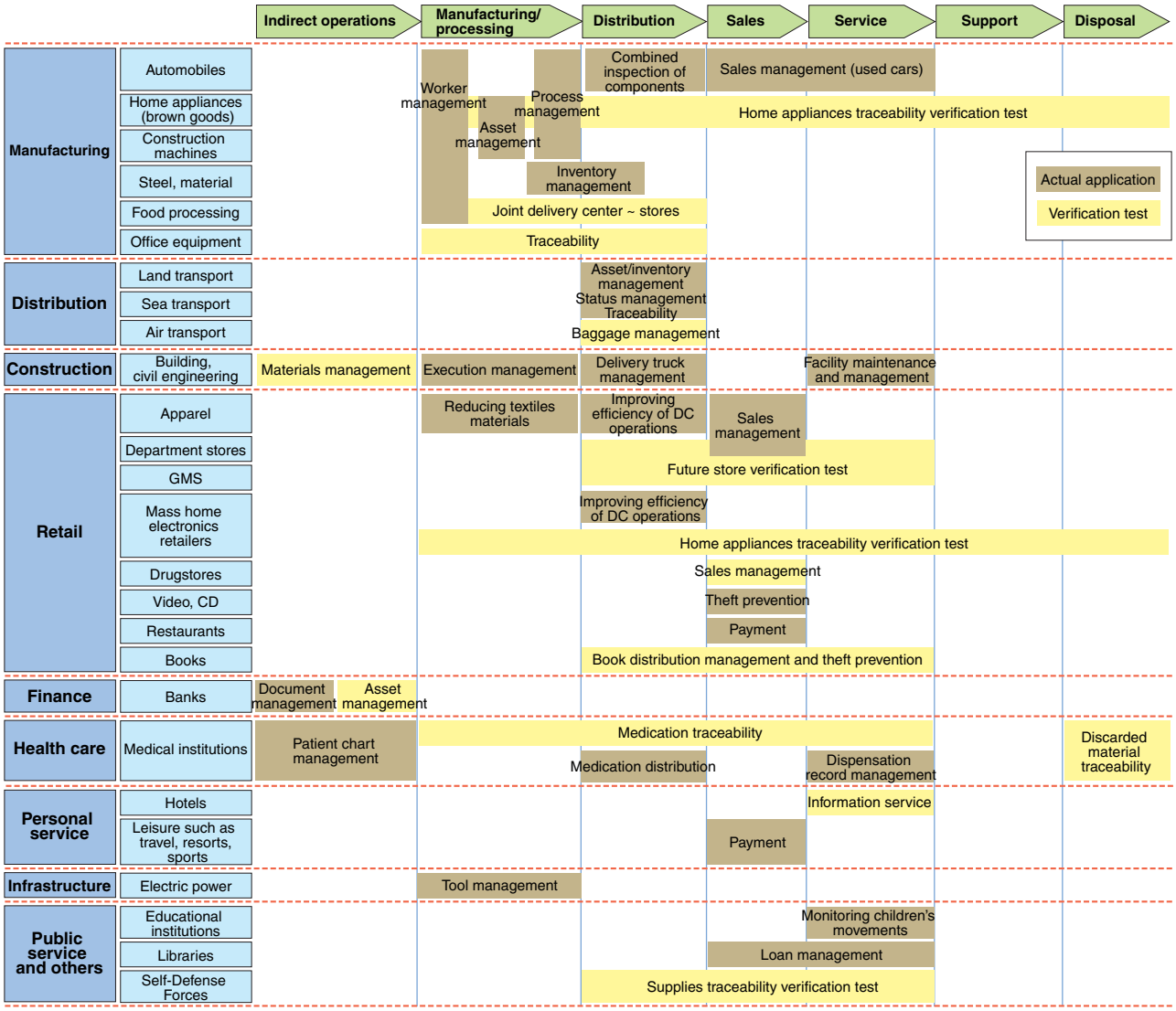
While RFIDs were first intended for application in the retail and distribution fields, the application fields have quickly been expanded to include manufacturing, logistics, construction, finance, health care, personal service and public service fields. In Japan, RFIDs are being used in such a way as meeting the initially anticipated expectation that RFIDs have a substantial potential as social solutions not merely as distribution solutions.

With respect to the place of use in each field, the three barriers were overcome one after another, and RFIDs are used not only for distribution but also for sales. Furthermore, cases have emerged where RFIDs are used for service, support and other functions up to the disposal stage. In addition, we also see the use of RFIDs in the manufacturing and processing stages prior to distribution as well as for indirect business operations. Thus, RFIDs are being utilized in every aspect of business activities.

While some solutions are still at the verification test level, a shift from verification testing to actual application has been seen in many fields. In light of this situation, as progress is made in technological innovations in the field of RFIDs and social recognition expands in the future, a shift from verification testing to actual application will occur in many different fields. Through these processes, the use of RFIDs will surely and resolutely be rooted in industry and society in Japan.

As such, ubiquitous network solutions will be proposed and developed for social and industrial problems in the order of their seriousness. These solutions will be verified and tested and demonstration projects will be implemented. Emergent processes from these testing stages to major moves towards actual application will steadily continue in the future.

Figure 5. Verification Testing and Actual Application of RFIDs



Note: DC = distribution center, GMS = general merchandise store, brown goods = household electrical entertainment appliances such as audio and video players

Source: Additions and modifications made by the author to "Kiro ni tatsu nihon no IC tagu (Japan's IC Tags at the Crossroads)," *Chiteki Shisan Sozo* (Knowledge Creation and Integration), November 2006.

(3) Towards establishment of a safe and secure usage environment

The third pillar of the u-Japan Policy consists of activities towards the establishment of a safe and secure usage environment. As indicated above, the ubiquitous network brings users ultimate network convenience, and at the same time, ultimate network vulnerability[2].

During the discussions at the u-Japan Policy Roundtable, we took a stance that it is appropriate to disclose comprehensively the vulnerable aspects that the ubiquitous network has from the initial stage of its introduction without hiding them. Accordingly, in addition to the shadow issues that currently exist, we tried to identify vulnerable aspects that might emerge when the ubiquitous network is firmly rooted in society in the future.

In studying such vulnerabilities, we selected ten categories that include privacy, information security, illegal/harmful content, measures for intellectual property rights, information literacy, the geographical divide and ecological considerations. For each category, the issues we currently face as well as the issues that are likely to emerge in the future were examined. With ten issues assigned to each category, a total of 100 "shadow issues" of the ubiquitous network were consequently identified.[3]

While this identification was conducted at the u-Japan Policy Roundtable in 2004, the Ministry of Internal Affairs and Communications reviewed the 100 issues in 2006 under the recognition that these shadow issues change from moment to moment with changes in the times and technological innovations.

During this review process, the following four issues were added to the 100 issues that were initially identified: (1) ensuring security in mobile terminals, (2) response to anonymity of information senders, (3) providing useful legal information and (4) utilization of

guidelines: a mechanism to inspect consistency and positioning among guidelines that will newly emerge.

How extensive and how difficult to respond to these 104 issues can be easily grasped by the fact that just five well-known issues, i.e., computer viruses, spam mail, unauthorized access, protection of juveniles from unlawful content and privacy issues relative to finance/settlement, are serious enough to ensure the safety and security of the network. Furthermore, in addition to these five issues, we have 99 additional difficult issues to overcome.

These problems have extremely diverse aspects: (1) those for which the government should take the initiative in establishing a framework and system such as the development of electronic governments and the issue of the digital divide (gaps in utilizing digital technology), (2) those for which voluntary activities chiefly by companies are important such as considerations to privacy and the environment, (3) those for which rules for new industrial activities must be widely accepted such as for intellectual property rights and electronic commerce, (4) those that will be developed through the improvement of users' awareness of their responsibilities such as information literacy and manners of use and (5) those that require responses to malicious users such as security and elimination of illegal/harmful content.

Table 2 lists these problems from the user perspective, and classifies them into five levels depending on the degree of severity. In a network society or a ubiquitous network society where a major change in social systems takes place, ignorance and indifference are significant "user problems." To help eliminate mistakes, user education and training are necessary measures. The most critical "user problems" for which a legal system must be established are those caused by unlawful users and/or malicious users who intend to do harm.

Currently, studies are being actively pursued by the Study Group on the Comprehensive Legal System for Communications and Broadcasting organized by the Ministry of Internal Affairs and Communications, of which the author is a member, with respect to responses to illegal and/or harmful content that falls under Levels 4 and 5, which has been brought about through the popularization of the Internet.

These studies are an extension of those made at the Roundtable for Studying Communications-Broadcasting Convergence organized under the initiative of then Minister for Internal Affairs and Communications Heizo Takenaka in 2006. The purpose of these studies is to change the current legal system that regulates communications and broadcasting by vertical classifications into nine laws, i.e., the Radio Law (wireless), the Wire Telecommunications Law (wired), the Telecommunications Business Law, the Broadcast Law, the Cable Sound Broadcast Law, the Cable Television Broadcast Law, the Law Concerning Broadcast on Telecommunications Services, the Wire Broadcast Telephone Law and the NTT Company Law, to a system consisting of the following layers: transmission infrastructure, platforms and content. These laws are then to be combined into a single law provisionally named the "Information and Communications Law."

The Study Group issued an interim report in June and published its final report on December 6, 2007. After specific studies are made under the extensive framework that is being developed, efforts will be made to submit a bill to an ordinary session of the Diet in 2010.

The basic purpose of these activities is to change the legal system to a layered structure to respond to the structural changes occurring in the information and communications industry, which is rapidly making progress in digitization and IP utilization. This will enable free and diversified business integration and linkages that transcend the layer borders, while promoting fair competition and user protection. For this purpose, studies are underway on regulating transmission infrastructure as a business consisting of transmission facilities and transmission services without distinction between communications and broadcasting, providing a new framework called a platform and establishing regulations to ensure the openness of such platform (Figure 6).

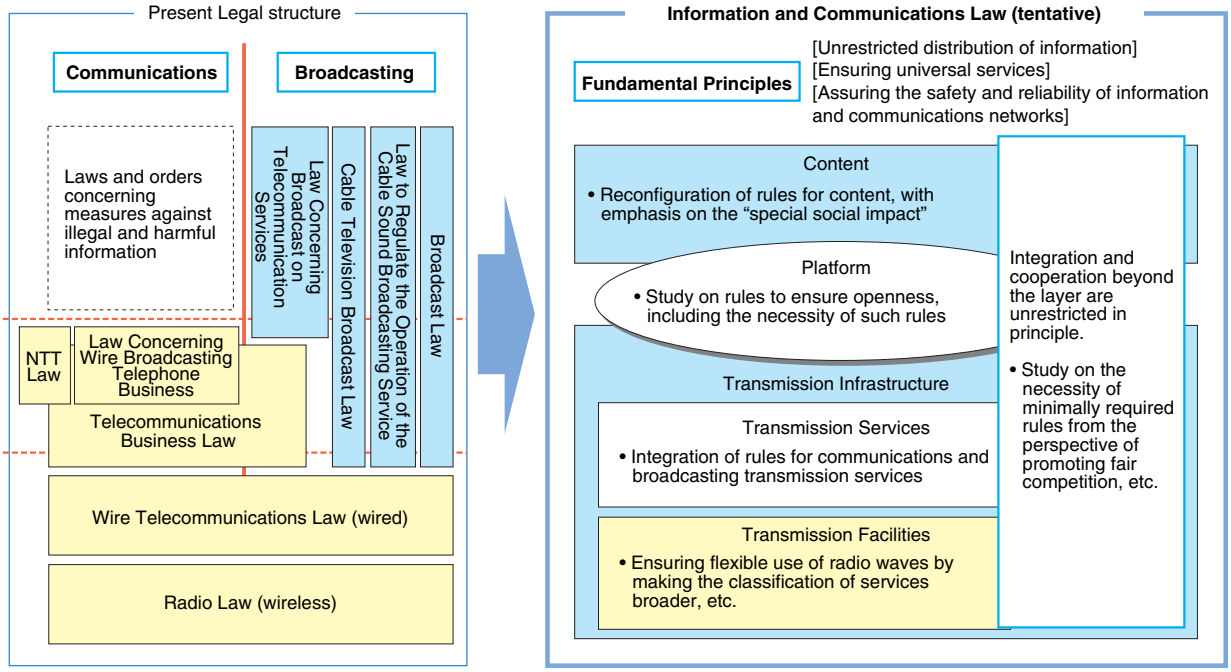
These activities eventually require studies on what sort of legal system is required for content, which will consequently contribute to the "establishment of a safe and secure ICT usage environment" that is the third aspect of the u-Japan Policy.

In the process of studying this Information and Communications Law (provisional name), the Study Group has introduced a plan to classify the content layer, which is the third layer, into three categories: (1) media service, (2) open communications and (3) personal communica-

Table 1. Five Levels of User Problems Causing "Shadow Issues" in Network Society

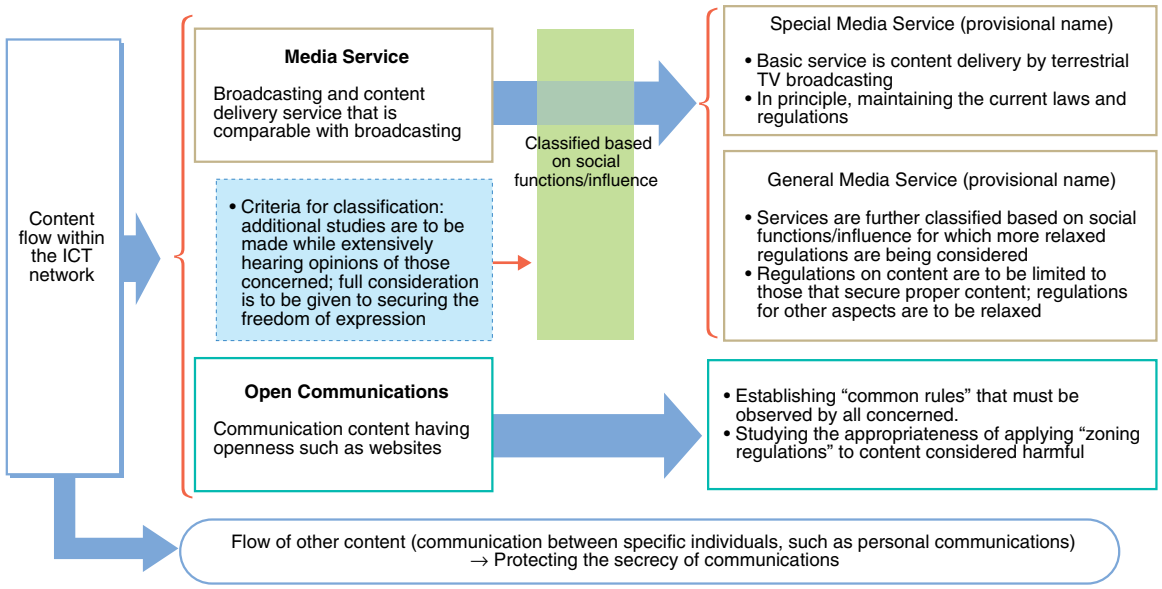
Level 1	Ignorance	While not intentional, this act consequently puts oneself at a disadvantage
Level 2	Indifference	Regardless of whether intentional, nothing is done
Level 3	Mistake	While the act is not intentional, the result is harmful
Level 4	Willful	An intentionally harmful act is done
Level 5	Malicious	An intentionally malicious act is done

Figure 6. Fundamental Restructuring of Legal Structure for Communications and Broadcasting



Source: The Ministry of Internal Affairs and Communications, "Interim Report of the Study Group on the Comprehensive Legal System for Communications and Broadcasting," June 2007

Figure 7. Future Legal System for Content



Source: The Ministry of Internal Affairs and Communications, "Interim Report of the Study Group on the Comprehensive Legal System for Communications and Broadcasting," June 2007

tions. Media service is to be further divided into "special media service" and "general media service."

"Media service" corresponds to conventional "broadcasting" and "personal communications" corresponds to conventional "communications." While it is evidently a form of communications, content on the Internet has not been properly positioned in the existing legal system because it was not regarded as so-called "communications" that is strictly protected within a network based on the principle of protecting the secrecy of communications, and its openness was taken for granted. Efforts are ongoing to appropriately position such content within the legal system (Figure 7).

The Study Group considers it appropriate to establish the minimum necessary regulations for content of open communications from the perspective of ensuring both the freedom of expression and public welfare. Specifically, the government should establish a basic portion of "common rules" that must be observed by all people concerned as the minimum requirements to preclude the distribution of illegal and harmful content. This basic portion should serve as the legal bases for the co-regulation

by the government and private sectors when Internet service providers (ISPs) and industrial associations prepare response measures and policies such as setting standards for deleting and rating individual communications.

The Study Group also proposed that the introduction of the so-called "zoning regulations" should be considered. With reference to the techniques of the Harmful Book Prevention Ordinance, etc., these regulate specific actions for only a certain range and certain usage methods.

While there is no predicting what will actually happen as the result of these studies, the issues that can be directed towards solutions through these proposals are only part of the "responses to illegal and harmful content" that correspond to about 10 percent of the 104 issues explained above.

Originally, these studies are designed to address a shift to the digital/IP format, which can be described as the eve of ubiquitous networking. Accordingly, it is apparent that responses that are one level above are necessary for the legal system to properly deal with ubiquitous networking.

Nevertheless, it is extremely significant that laws and regulations be established as social consensus for the following principles: (1) establishing an independent category for open communications by distinguishing them from communications and broadcasting content, (2) applying certain minimum rules and regulations to this category and (3) seeing that such rules and regulations ensure both freedom of expression and public welfare.

While these measures may directly address less than 10 percent of the total of 104 issues, these measures are extremely important in that they can establish a basic stance for resolving nearly 100 percent of the issues. These long, far-reaching activities should not be postponed or shelved due to political factors or industrial pride. In any case, it is certain that a framework for resolving the 104 issues to be brought about by ubiquitous networking is to be secured.

As described above, activities towards ubiquitous networking that started eight years ago have become deeply rooted in the basic portion of Japan's ICT policy in each aspect of the three pillars of the u-Japan Policy, which provides the momentum in steady progress as we move towards the 2010s.

2 New Issues: Response to "Galapagosization" of the Japanese ICT Industry[4]

As a result of the progress in ubiquitous networking over the past eight years, many companies in the Japanese ICT industry have furnished the world's latest information and communication infrastructure.

The benefits that are enjoyed by ordinary users as a result of such progress include the use of: a network infrastructure where nearly 10 million individual users enjoy optical fiber connections at 100 megabits per second; a GPS (global positioning system) that would have been limited to industrial use or special-purpose activities; mobile phones that are equipped with a myriad of functions such as electronic money and fingerprint authentication technology; digital home appliances centered on flat-screen TVs, based on which digital video recorders, digital video cameras and PCs are all connected to freely exchange high-definition images; and digital high-definition TV broadcasting that has been steadily gaining in popularity in preparation for the cessation of the analog format in 2011.

However, with the development of the ICT utilization environment for the ubiquitous network in Japan, the industry has been facing new issues. These issues relate to the international deployment of the ubiquitous network by the ICT industry as a whole.

When we turn our eyes away from the Japanese market and look at the world's latest products and services that were produced as fruits of ubiquitous networking from the perspective of whether such products and services have international competitiveness that is appropriate for their state-of-the-art attributes in the global market, we will see a completely different story.

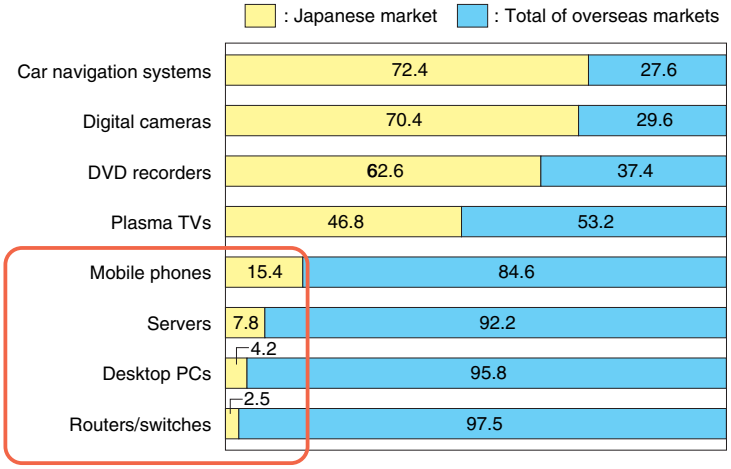
Figure 8 shows the share of various electronics products in the world market. The share of Japanese companies is very high at around 50 to 70 percent for products that are not connected to networks such as car navigation systems, digital cameras, DVD recorders and plasma TVs. However, the share is low for products that are connected to networks such as mobile phones, servers, PCs and routers/switches. For example, the share of mobile phones is 15.4 percent, and that of servers and desktop PCs is less than 10 percent.

This difference is more striking when we see the share of individual companies. While the total sales of eight major Japanese mobile phone manufacturers in the world market including Japan is about ¥2 trillion, this figure is far less than the ¥2.6 trillion earned by a single company, Nokia. The figure is close to the respective sales of Motorola and Samsung. Furthermore, the total combined sales volume of seven Japanese PC manufacturers (¥3 trillion) is far less than the sales of Dell alone, or ¥4.7 trillion. Hewlett-Packard (HP), which ranked second, alone recorded ¥2.9 trillion (Figure 9).

Another similar example is digital high-definition television broadcasting (HDTV). HDTV, which has been gaining in popularity in Japan, has been providing spectacular high-quality images to Japanese consumers. Its future is promising as the new television broadcasting technology whose coverage has been expanding steadily throughout Japan. When we turn to the status of its international deployment, however, we must recognize that delays have occurred in its penetration overseas in spite of the fact that it is the latest technology in the world.

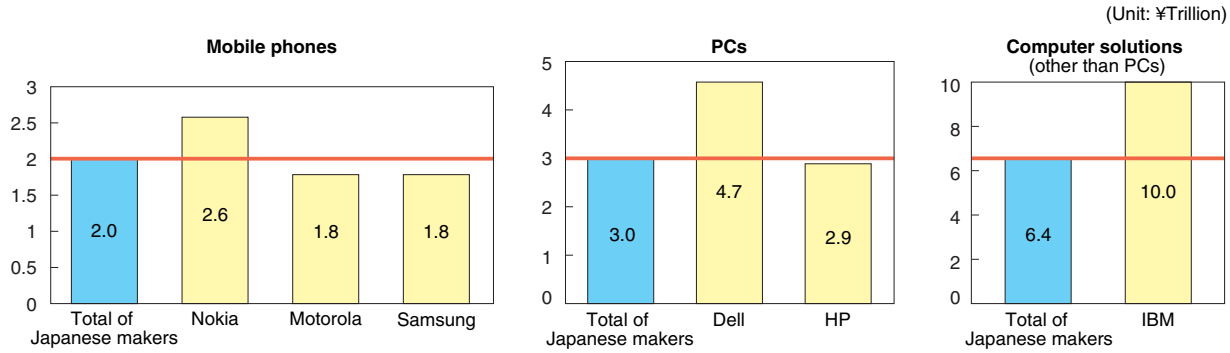
For terrestrial digital broadcasting systems, three systems have been standardized by the International

Figure 8. Share of Japanese ICT Products in the World Market is in No Way High



Note: ICT = information and communications technology
Source: Compiled based on "2006 White Paper on Information and Communications," the Ministry of Internal Affairs and Communications

Figure 9. Comparison of Sales with Major Overseas Manufacturers

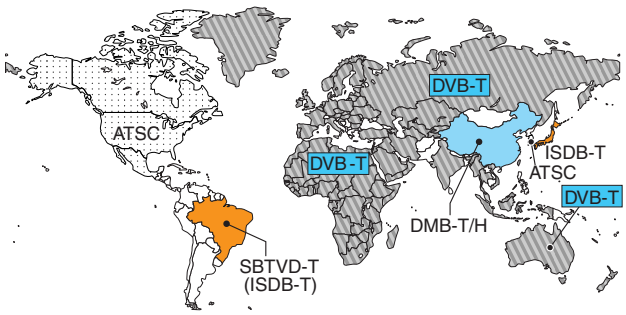


Note: HP = Hewlett-Packard
Source: The Ministry of Internal Affairs and Communications, "Final Report of the Roundtable for Strengthening International Competitiveness of ICT," April 2007

Telecommunication Union (ITU). They are the ATSC (Advanced Television Systems Committee) system in the US, the DVB-T (Digital Video Broadcasting-Terrestrial) system in Europe and the ISDB-T (Integrated Services Digital Broadcasting-Terrestrial) system in Japan. The system that is enjoying the most extensive popularity is DVB-T in Europe. DVB-T has been rapidly adopted not only in each European country but also in Africa, the Middle East, India, South East Asia and Oceania. In 2006, China announced that it would adopt its own independent system called DMB-T/H (Digital Multimedia Broadcast-Terrestrial/Handheld). As of now, the only country that has adopted the ISDB-T system, which is used in Japan, is Brazil (Figure 10).

From October 2006 to April 2007, the Roundtable for Strengthening International Competitiveness of ICT organized under the auspices of the Minister for Internal Affairs and Communications was held. At this roundtable, several dozen people consisting mostly of management executives of the leading Japanese companies in the ICT industry and experts vigorously discussed the need to strengthen the international competitiveness of Japan's information and communications industry.

Figure 10. Worldwide Use of Digital Broadcasting ISDB-T System



Source: The Ministry of Internal Affairs and Communications, "Report of the Roundtable for Strengthening International Competitiveness of ICT," May 2007 (Original source: DVB Project)

At this roundtable, the phenomenon dubbed the "Galapagosization phenomenon" (with a slight trace of masochism) was discussed. In this phenomenon, the world's latest products and services that have been developed in the Japanese market and have been tailored to the highly sophisticated preferences of Japanese consumers, such as mobile phones, PCs and the digital high-definition

television broadcasting system, have not gained in popularity in the world market. Mobile phones and PCs are representative examples.

In another committee organized by the Ministry of Economy, Trade and Industry to discuss globalization of content in which the author also participated, opinions were expressed that, in a sense, excessive adaptation to the Japanese market that is somewhat large is also a problem and that this phenomenon should be dubbed the "Madagascarization phenomenon," rather than using the small Galapagos Islands as the referent.

In either case, the phenomenon has been seen in which corporate moves aiming to achieve the world's latest technology for the Japanese market do not necessarily strengthen international competitiveness. How to link these moves to strong international competitiveness is no doubt an extremely essential issue in considering the future of Japanese industry.

II Changing World Market and Conversion of Growth Mechanism

1 Changing World Market: Rise of MegaGrowth Countries

(1) Japan's ICT industry has shifted its focus to the domestic market

During the 1980s, for Japan's electronics industry, launching new products in the domestic market meant launching the same products in the world market almost simultaneously.

Intense competition in which many companies have aggressively engaged in the domestic market has similarly taken place in the European and US markets, which was internationally criticized as being faced with "torrent-like exports." Individual companies have always had the incentive for expanding market size in order to generate profits by keeping the learning curve descending (the more products are manufactured, the more production cost declines). In these business operations, it is fair to assume that there was totally no leeway for allowing corporate activities to center on the domestic market.

However, when we faced a restructuring boom as a result of the bursting of the bubble in Japan during the 1990s, the international activities of many Japanese companies were subjected to restructuring. The effect on companies that decided to take the approach of continuing international business operations without restructuring such activities and those that decided to select international operations as their target for restructuring has now become apparent. Many companies in Japan's ICT industry chose the latter option.

All of the new product groups that emerged with the progress in ubiquitous networking are directly connected to the network environment of each country, and must face the fact that enormous costs are required to overcome differences in standards and systems. This factor cannot be ignored behind corporate actions that shifted the focus to the domestic market where such costs are negligible.

In any case, a Galapagosized industry that focuses on the domestic market can no longer find sanctuary in a domestic market that is experiencing a shrinking tendency due to a declining birth rate and improved longevity. Furthermore, intense competition in the domestic market has been shortening the life cycles of products and directing the products towards early maturation. In order to find some way out of this situation, it is undoubtedly necessary for Japanese companies to look at overseas markets that have sizes many times greater than the Japanese market.

(2) Economic growth achieved by countries having large populations

When companies enter the world market, however, they must pay attention to the fact that the competitive environment surrounding Japan in the world market has seen major changes at the end of the 20th century.

First, Korean companies that survived the IMF (International Monetary Fund) crisis in 1997 have rapidly come to the fore in the world market with their agile decision-making abilities and capabilities for executing bold strategies. China, which joined the WTO (World Trade Organization) and has been equipped with incomparable price competitiveness and business promotion ability that cannot be ignored, has made its appearance in the world market as an important player. In service fields including information technology service, India has been about to demonstrate overwhelmingly strong competitiveness by using the global network infrastructure.

The progress of these countries, especially China and India, has shown factors that are different from the conventional wisdom in world economy.

Over the period from the end of the 1980s into the 1990s, after Japan had achieved high economic growth, countries that have the potential of achieving similar growth have emerged. They are the so-called NIEs (newly industrializing economies) such as Singapore, Korea, Taiwan and Hong Kong.

The common characteristic among these countries that were expected to achieve high growth was that they have a high degree of mobility with small populations. These countries have mostly achieved the anticipated growth and produced companies that have been actively participating in the world market. Nevertheless, these countries have not come to have a vital impact on world economy partly because of their small populations. If we were to select a country that has had such an impact, it would be Korea, which has a relatively large population among the NIEs or about 48 million people. While global companies such as Samsung and Hyundai in Korea have come to exert major

influence as individual companies, this does not mean that the Korean economy of the entire nation has been playing an important role in the world market.

In any case, the new phenomenon of the world economy that emerged at the end of the 20th century is that countries that have overwhelmingly large populations on the scale of a billion people and vast land areas have started to achieve high economic growth of around 10 percent.

Brazil and Russia, which are part of the BRICs that have recently been attracting extensive attention, also have large populations of 190 million and 140 million, respectively. Furthermore, China's GDP (gross domestic product) has already reached half that of Japan. The total GDP of BRICs has already exceeded that of Japan. When these countries with large populations start to achieve substantial economic growth, the impact they will have on world economy will be widely different from that of NIEs.

The fact that China and India have started to achieve growth rates of around 10 percent suggests that conditions are being set even for countries other than those with small populations to be able to achieve high economic growth.

(3) Rise of "MegaGrowth Countries"

Advanced knowledge and information always serve as important engines for economic growth. Until the middle of the 1990s, economic growth by NIEs was chiefly achieved by city-state countries with small populations, such as Singapore and Hong Kong where such advanced knowledge and information tend to be easily disseminated throughout the country. As we entered the 21st century, however, countries with large populations such as India and China began to achieve high growth. What is the major factor that distinguishes the period before the middle of the 1990s from the period thereafter?

The factor is the development of digital information networks and popularity of the Internet. With the development of digital information networks, advanced knowledge and information that are important engines for high growth began to be able to be instantly and easily spread throughout the country and shared by many people. It is assumed that because of this factor, a country's large population and vast land area no longer hinders growth.

Of course, behind the economic growth of these countries, there might have been changes in the capital aspect that were brought about by a policy to actively invite foreign capital and vitalized activities of global companies and funds in response to such a policy. In addition, a factor in the labor aspect could also have contributed to such growth. Personnel in developing countries have also participated in global education and training system projects developed by the governments of developing and developed countries. An increasing number of these individuals have contributed to economic growth after returning to their home countries. Nevertheless, the author considers that the most important factor effective to TFP (total factor productivity) is the extensive sharing of advanced knowledge and information as enabled by the development of digital information networks.

A hypothesis derived from these considerations is the rise of "MegaGrowth countries."

MegaGrowth (abbreviated expression of Mega-population and high Growth) countries are striving to achieve a high rate of economic growth even though they have a large population of around 40 million or more. It can easily be imagined that MegaGrowth countries that are expected to appear on the main stage of world economy with progress in the spread of digital information networks will have an extremely large impact on the size and structure of the future world market because they have large populations. Such an impact will be especially significant for products where one person purchases several units, if affordable, such as mobile phones and PCs.

With the current digital information networks further developing into the ubiquitous network, advanced knowledge and information will be communicated more easily and intensely, which will accelerate the growth process. In this sense, the growth of MegaGrowth countries is not unrelated to the ubiquitous network. Rather, the growth of these countries will promote ubiquitous networking, which is most effective for spreading the advanced knowledge and information that constitute the lifeline of such growth.

(4) Market size of MegaGrowth countries

In the 21st century, changes in the world economy will center on the growth (or slump) of the MegaGrowth countries. By focusing on such changes in the MegaGrowth countries, the author has attempted to make some "virtual calculations" to consider long-term structural changes in the future world market. Let me reiterate that these are "virtual calculations" to facilitate an understanding of the nature and magnitude of the problems, and these calculations do not fall under the category of estimates or projections.

In order to make these calculations, the top 30 countries in terms of population in 2005 were selected. Table 2 lists these countries with China at the top with the largest population and Argentina at 30th with a population of about 39 million. If advanced countries are excluded from this list, 23 countries remain. When we see the economic growth rate of these countries with large populations, the rate exceeds the world average of 3.5 percent with some exceptions. In this situation, we cannot justify the conventional thinking that countries with large populations cannot achieve high economic growth.

Of these countries, three countries with a per-capita GDP of less than $600 and a GDP of less than $30 billion, which are expected to have no major impact no matter how high their growth, are excluded. They are

Table 2. MegaGrowth Countries (MegaGrowth 20)

Country (Region)	Population (1,000 people)	GDP ($ Billion)	GDP Real Growth Rate (%)	Per-capita GDP ($)
Year	2005	2005	2005	2005
World Total	6,464,750	44,645	3.50	6,906
1 China	1,323,345	2,234	10.20	1,688
2 India	1,103,371	806	9.20	730
3 US	298,213	12,417	3.20	41,636
4 Indonesia	222,781	287	5.60	1,289
5 Brazil	186,405	796	2.30	4,271
6 Pakistan	157,935	111	7.80	701
7 Russia	143,202	764	6.40	5,333
8 Bangladesh	141,822	60	6.00	423
9 Nigeria	131,530	99	6.90	752
10 Japan	128,085	4,534	2.60	35,398
11 Mexico	107,029	768	3.00	7,180
12 Vietnam	84,238	52	8.40	622
13 Philippines	83,054	99	5.00	1,192
14 Germany	82,689	2,795	1.00	33,800
15 Ethiopia	77,431	11	8.70	144
16 Egypt	74,033	89	4.90	1,207
17 Turkey	73,193	363	7.40	4,953
18 Iran	69,515	190	4.40	2,730
19 Thailand	64,233	177	4.50	2,750
20 France	60,496	2,127	1.20	35,153
21 UK	59,668	2,199	1.80	36,850
22 Italy	58,093	1,763	0.00	30,340
23 Congo	57,549	7	6.50	123
24 Myanmar	50,519	27	5.00	532
25 Korea	47,817	788	4.00	16,472
26 South Africa	47,432	240	4.90	5,050
27 Ukraine	46,481	83	2.60	1,783
28 Columbia	45,600	122	5.10	2,682
29 Spain	43,064	1,125	3.40	26,116
30 Argentina	38,747	183	9.20	4,728
Reference The EU[2]	459,387	13,458	1.30	29,296

Notes: (1) These 30 countries are those ranked within the top 30 in the world in terms of population in 2005; the underlined countries are MegaGrowth countries. (2) As of 2005, the EU consisted of 25 member countries. The real growth rate, however, is the EMU (Economic and Monetary Union) value. (3) Figures for GDP and GDP real growth rate are based on data from the World Bank. However, the GDP for Myanmar is the IMF estimate (base year = 2003), which is converted into dollars. (4) Figures for GDP real growth rate are based on data from the World Bank. However, the figure for the EU is the EMU value.
Source: Compiled based on statistics published by the World Bank, the United Nations and IMF (International Monetary Fund).

Ethiopia, Congo and Myanmar. Incidentally, these three countries have also been achieving a growth rate of 5 percent or more, which exceeds the world average. The remaining 20 countries are considered MegaGrowth countries (MegaGrowth 20).

By adding Japan, the US and European countries to these MegaGrowth countries, they are classified into four categories, namely, "Japan, US and Europe," "four BRICs countries: Brazil, Russia, India, China," "11 countries neighboring BRICs: Indonesia, Pakistan, Bangladesh, Mexico, Vietnam, the Philippines, Thailand, Korea, Ukraine, Columbia and Argentina" and "five new middle-tier countries: Nigeria, Egypt, Turkey, Iran and South Africa."

(5) Trend growth case

Table 3 indicates the results of virtual GDP calculations every ten years on the assumption that the GDPs of Japan, the US and Europe and the MegaGrowth countries will grow at the same rate from 2005 to 2035 as in 2005.

For 2035, the per-capita GDP was also calculated by using the population projections published by the United Nations. In order to examine the effects of digital information networks, it would be meaningless to trace the trends too many years in the past. Accordingly, the real GDP growth rate in 2005 was adopted as the figure that shows the current strength of the MegaGrowth countries.

Table 3. Virtual Calculations of Economic Growth of Japan/US/Europe and MegaGrowth Countries (Trend Growth Case)

(Unit: $, 2005)

Country/Region	GDP ($ Billion)				Per-capita GDP ($)
Year	2005	2015e	2025e	2035e	2035e
US	12,417	17,014	23,313	31,944	86,170
EU[1]	13,458	15,314	17,425	19,827	42,945
Europe and US	**25,875**	**32,327**	**40,738**	**51,772**	**62,195**
Japan	4,534	5,861	7,576	9,793	81,510
Japan/US/Europe	**30,409**	**38,188**	**48,313**	**61,564**	**64,631**
Germany	2,795	3,087	3,410	3,767	46,575
France	2,127	2,396	2,700	3,042	47,637
UK	2,199	2,628	3,142	3,755	57,355
Italy	1,763	1,763	1,763	1,763	32,350
Spain	1,125	1,571	2,195	3,066	70,016
China	2,234	5,901	15,587	41,171	28,348
India	806	1,943	4,684	11,294	7,558
Russia	764	1,420	2,641	4,911	40,362
Brazil	796	999	1,254	1,575	6,515
BRICs (4)	**4,600**	**10,264**	**24,167**	**58,951**	**17,810**
Ukraine	83	107	138	179	5,456
Pakistan	111	235	497	1,054	4,013
Bangladesh	60	108	193	345	1,591
Korea	788	1,166	1,726	2,555	52,726
Philippines	99	161	263	428	3,621
Vietnam	52	117	263	589	5,294
Indonesia	287	495	854	1,473	5,320
Thailand	177	274	426	662	8,867
Mexico	768	1,033	1,388	1,865	13,697
Columbia	122	201	331	544	8,752
Argentina	183	442	1,065	2,568	52,701
BRICs neighboring countries (11)	**2,730**	**4,339**	**7,144**	**12,261**	**8,830**
Iran	190	292	449	691	7,255
Turkey	363	740	1,511	3,086	31,958
Egypt	89	144	233	375	3,331
Nigeria	99	193	376	732	3,353
South Africa	240	386	624	1,006	20,775
New middle-tier countries (5)	**980**	**1,756**	**3,193**	**5,891**	**10,311**
MegaGrowth countries (20)	**8,310**	**16,358**	**34,503**	**77,103**	**14,631**

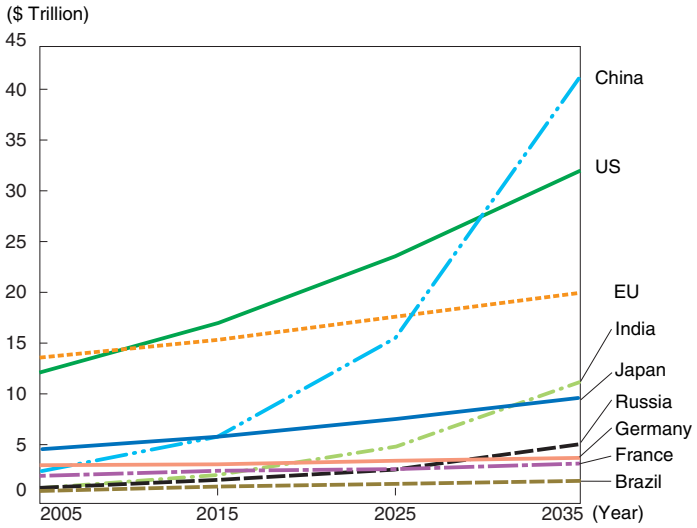
Notes: (1) As of 2005, the EU consisted of 25 countries. (2) Figures for 2010 and after were calculated on the assumption that the real growth rate of 2005 continues every year. (3) Figures for the GDP and GDO real growth rate are based on World Bank information. However, the EMU growth rate is used for the EU. (4) Population projections for 2035 are based on the 2005 projections by the United Nations.
Source: Compiled based on statistics published by the World Bank and the United Nations.

Compared to the growth rate in the past five years, the growth rate of 2005 for Brazil and Russia is slightly lower, and that for India and China is slightly higher. Nevertheless, the order of growth rates of the countries remains almost the same. In consideration of the characteristics of information networks that bring about accumulated effects, the growth rate for 2005 that is not very far back was intentionally adopted.

1) China ranks 1st and India ranks 4th

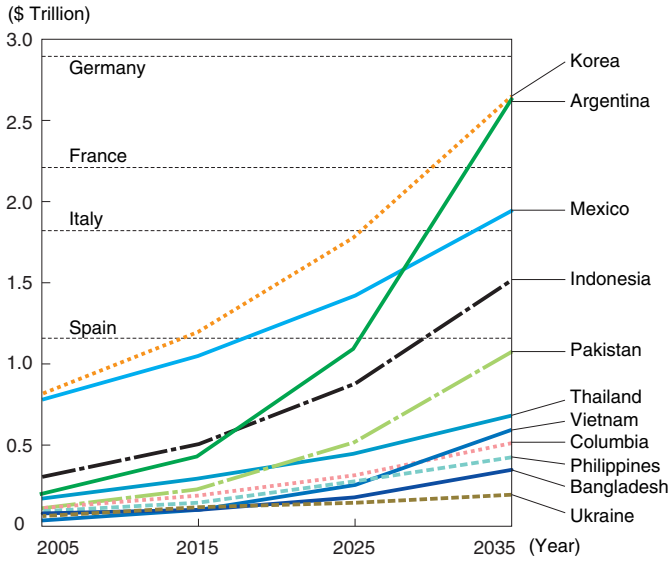
While the calculations were quite simple, the results obtained are quite interesting. Figure 11 shows the changes in the GDPs of Japan, the US and Europe and BRICs under this trend growth case every ten years until 2035. The most noteworthy is the rapid growth of China, the champion of the MegaGrowth countries. While China's economic scale is already currently greater than that of most EU countries, China will surpass Germany and, by 2015, will outstrip Japan. At some point between 2025 to 2035, China will exceed the EU, and then, eventually outpace the US. As a result, according to these virtual calculations, China will become the world's largest economic power by 2035.

Figure 11. Changes in Economic Scale in Japan, US and Europe and BRICs (Trend Growth Case)



Note: The above calculations were made on the assumption that the growth rate in 2005 continues every year. As of 2005, the EU consisted of 25 countries; the EMU value is used for the growth rate.
Source: Compiled based on material published by the World Bank and the United Nations.

Figure 12. Economic Growth of 11 BRICs Neighboring Countries and Economic Scale of EU Countries in 2005 (Trend Growth Case)



Notes: The above indicates the size of the GDP. For the 11 BRICs neighboring countries, it is assumed that the average growth rate of the target countries in 2005 continues every year. For Germany, France, Italy and Spain, the base year for the GDP is 2005.
Source: Compiled based on material published by the World Bank and the United Nations.

Although India has a large population, the economic scale is small with its per-capita GDP amounting to $730. Therefore, even if the country would achieve rapid growth for around the next ten years, India will not be able to show a major presence. Nevertheless, for the ten years from 2015 to 2025, India will outstrip most European countries at a single spurt and, by 2035, the country will ultimately exceed Japan.

Consequently, Japan will be ranked fourth in terms of economic scale next to China, the US and India on an individual country basis. If the EU is regarded as a single block, Japan's rank will drop to fifth. Compared to the current status of the world's second largest economic power, the international positioning of Japan will decline substantially.

If the current growth rate continues, European countries including Germany will even be surpassed by Russia by 2035, not to speak of China and India.

2) Economic growth of BRICs neighboring countries

Figure 12 examines the economic size that could emerge as a result of the economic growth of the 11 countries that neighbor BRICs. In 2015, ten years after 2005, Korea and Mexico will each have an economic size equivalent to the current size of Spain. In 2035, Argentina, Indonesia and Pakistan will also have economic sizes equivalent to or

exceeding the current size of Spain. Among these countries, Korea and Argentina will each have a size equivalent to the current size of Germany.

3) Partial reversal seen in terms of the income level of Japan/US/Europe and MegaGrowth countries

Because economic size alone cannot express the affluence of individuals, each country was plotted on the chart with the horizontal axis representing population and the vertical axis representing per-capita GDP. Under such parameters, Figure 13 compares 2005 with 2035. The chart for 2005 reveals that, except for Korea, the group of Japan, the US and Europe and the group of MegaGrowth countries belong to totally different categories. In 2035, these two categories are mixed, and partial reversion is seen in per-capita GDPs.

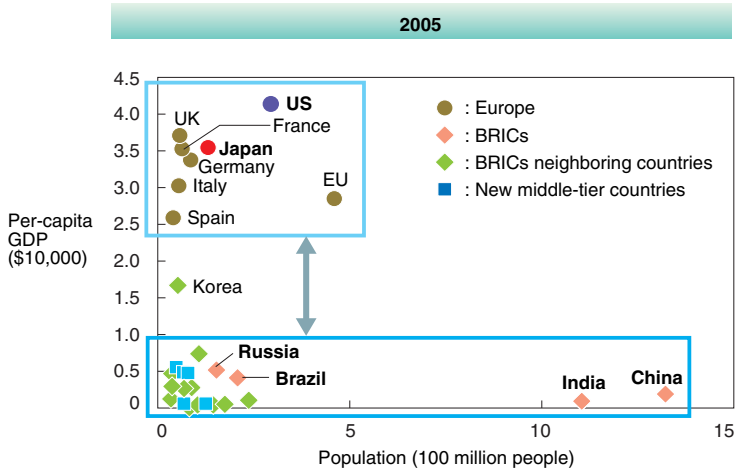
4) China not attaining the income level of Japan/US/Europe

Another important point is that even though China will have the largest economic size in 2035, its per-capita GDP is expected to be $28,348, which is far less than that of the US and Europe. The US, which is currently the world's largest economic power, also has the world's most prominent income level even though it is not the world's highest. However, the world's greatest economic power in 2035 under the trend growth case will not be a country with a high-income level, but will almost certainly be a country with a middle-income level. If companies pursue economic size, they must focus on the segment of consumers having medium-sized affluence, rather than on the most highly affluent consumers.

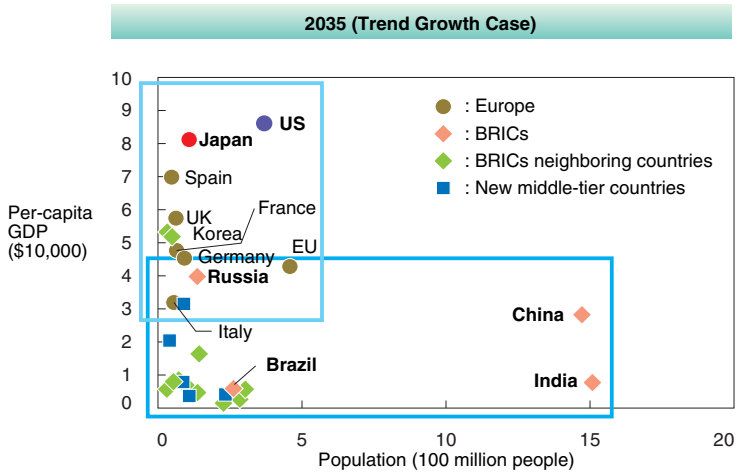
5) MegaGrowth economy becoming enormous

As a result of these changes, in 2035, BRICs will constitute a large economic bloc that is greater than the US or EU, not to speak of Japan. MegaGrowth countries as a whole will become greater than the current economic bloc comprised of advanced countries (Japan, the US and Europe). The same can be said of the economic bloc consisting of BRICs and the 11 countries neighboring BRICs. Accordingly, if economic size alone is taken into account, economic activities targeting BRICs and BRICs

Figure 13. Per-Capita GDP in 2005 and in 2035 (Trend Growth Case)



Note: As of 2005, the EU consisted of 25 countries.
Source: Compiled based on material published by the World Bank and the United Nations.



Note: Calculations were made on the assumption that the growth rate in 2005 continues every year. As of 2005, the EU consisted of 25 countries. However, the EMU value was used for the growth rate.
Source: Compiled based on material published by the World Bank and the United Nations.

neighboring countries will become greater than those targeting the markets of today's advanced countries.

(6) Contracted Equilibrium Case

While such trend growth case brings about tremendous unimaginable changes in world economy, can such changes actually occur?

Currently, partly influenced by *An Inconvenient Truth* by Al Gore, strong interest in the global environment is growing, in particular, the issue of global warming, not only among advanced nations but also throughout the world. The global environmental issues that were invisible in the past are now becoming increasingly visible such as frequently occurring abnormal weather, the retreat of glaciers and accelerated desertification. The fact that it is difficult for all nations including MegaGrowth countries to continue their current levels of consumption of resources and energy constitutes international common sense.

In the future, heated discussions will take place about the issue of global warming between advanced countries and developing countries, especially MegaGrowth countries.

Table 4. Virtual Calculations of Economic Growth of Japan/US/Europe and MegaGrowth Countries (Contracted Equilibrium Case)

(Unit: $, 2005)

Country/Region	GDP ($ Billion)				Per-capita GDP ($)
Year	2005	2015e	2025e	2035e	2035e
US	12,417	17,014	19,940	21,594	58,251
EU[1]	13,458	15,314	16,339	16,877	36,555
Europe and US	**25,875**	**32,327**	**36,279**	**38,472**	**46,218**
Japan	4,534	5,861	6,669	7,115	59,224
Japan/US/Europe	**30,409**	**38,188**	**42,948**	**45,587**	**47,858**
Germany	2,795	3,087	3,245	3,327	41,136
France	2,127	2,396	2,544	2,621	41,051
UK	2,199	2,628	2,875	3,007	45,922
Italy	1,763	1,763	1,763	1,763	32,350
Spain	1,125	1,571	1,860	2,024	46,212
China	2,234	5,901	9,705	12,484	8,596
India	806	1,943	3,046	3,824	2,559
Russia	764	1,420	1,946	2,281	18,744
Brazil	796	999	1,120	1,186	4,908
BRICs (4)	**4,600**	**10,264**	**15,817**	**19,775**	**5,974**
Ukraine	83	107	122	130	3,965
Pakistan	111	235	344	417	1,589
Bangladesh	60	108	144	168	774
Korea	788	1,166	1,421	1,570	32,402
Philippines	99	161	206	234	1,978
Vietnam	52	117	177	218	1,959
Indonesia	287	495	653	750	2,710
Thailand	177	274	343	383	5,136
Mexico	768	1,033	1,199	1,291	9,484
Columbia	122	201	259	294	4,726
Argentina	183	442	693	869	17,842
BRICs neighboring countries (11)	**2,730**	**4,339**	**5,561**	**6,325**	**4,555**
Iran	190	292	363	405	4,252
Turkey	363	740	1,064	1,279	13,240
Egypt	89	144	184	207	1,841
Nigeria	99	193	271	321	1,470
South Africa	240	386	492	556	11,482
New middle-tier countries (5)	**980**	**1,756**	**2,374**	**2,768**	**4,845**
MegaGrowth countries (20)	**8,310**	**16,358**	**23,752**	**28,868**	**5,478**

Notes: (1) As of 2005, the EU[2] consisted of 25 countries. (2) Figures for 2010 and after were calculated on the assumption that the growth rate of 2005 continues for the first decade, then is reduced to half for the next decade and is further reduced to one-fourth for the third decade. (3) Figures for GDP and GDP real growth rate are based on statistics published by the World Bank. However, the EMU growth rate is used for the EU.
(4) Population projections for 2035 are based on the 2005 projections of the United Nations.
Source: Compiled based on statistics published by the World Bank and the United Nations.

In any event, we can hardly believe that the current pace of resource and energy consumption can be permitted to continue.

Furthermore, most MegaGrowth countries are plagued with many problems such as securing water resources, domestic political issues, ethnic conflicts, income gaps and regional gaps and even the issues of a declining birth rate and improved longevity. It is extremely unreasonable to assume that the current relatively high economic growth rate can continue for another 30 years.

Accordingly, with reference to the pattern of post-war economic growth achieved in Japan, Table 4 shows similar virtual calculations up to 2035 on the assumption that the current growth rate continues for the first decade, then is reduced to half for the next decade and further reduced to one-fourth for the third decade.

1) China surpassing Japan

This contracted equilibrium case also reveals interesting results. When we see the growth of the individual countries of Japan, the US and Europe and BRICs, the phenomenon that China surpasses the US and the EU will not occur as many may expect. However, China does outstrip Japan in 2015 (Figure 14). In either the trend growth case or the contracted equilibrium case, China surpasses Japan in terms of economic scale. Even if stricter assumptions are applied, there is almost no doubt that China will outstrip Japan some time in the future unless there is some extraordinary reason.

Similar to American people 40 years ago who saw the chart[5] created by Herman Kahn suggesting that "Japan will surpass the US in the future in terms of per-capita GNP (Gross National Product)," currently, most Japanese people will be unable to accept the reality of such a future even though they can understand it theoretically.

If reversal actually occurs, this will have an extremely extensive socioeconomic and political effect. Such effect will begin to be felt when reversal becomes almost certain. If we are to take any actions to minimize such impact or to conversely generate new opportunities, we don't have much time left.

For European countries, the result that all countries including Germany will be surpassed by India under this contracted equilibrium case as well as under the trend growth case may have a greater effect. In particular, this will have a major political and social effect in the UK, which is a state that formerly asserted and maintained supremacy over other states.

2) Shrinking income gaps between Japan/US/Europe and MegaGrowth countries

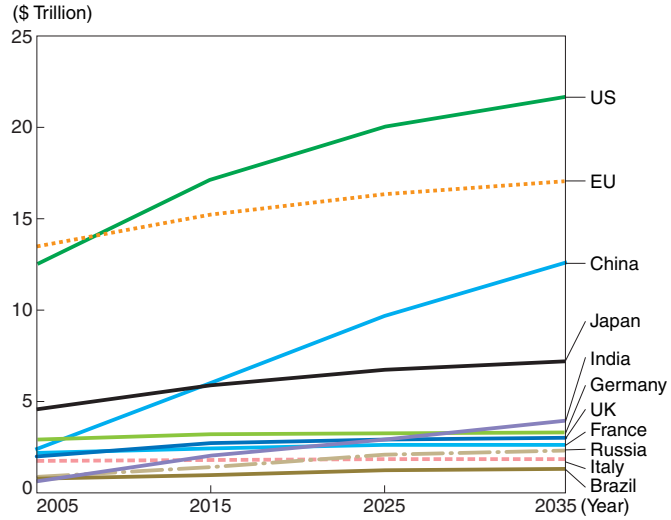
Figure 15 shows the per-capita GDP in 2035 under the contracted equilibrium case. The comparison between this graph and the upper chart in Figure 13 for 2005 reveals substantially narrowed gaps between Japan/US/Europe and MegaGrowth countries.

3) Expanding MegaGrowth economy

Under the contracted equilibrium case as well, the economic size of BRICs (four countries) will become greater than that of the 27 EU countries (this calculation was made for 25 countries), and will be equivalent to that of the US. This means that around 2035, marketing in the US market will have the same meaning as marketing in the BRICs market. Naturally, the market of the MegaGrowth countries will become greater than that of Japan, the EU or the US.

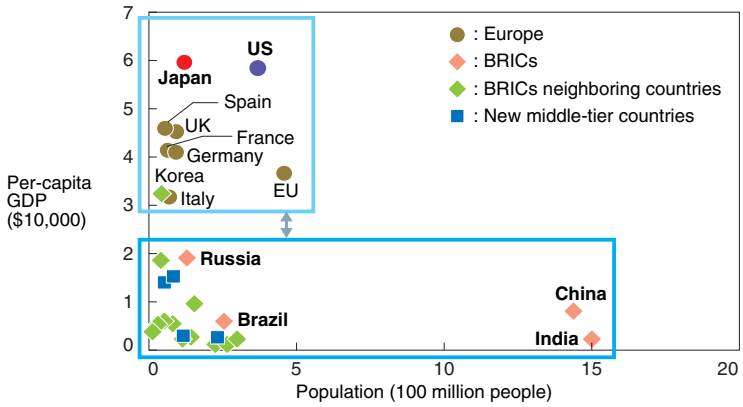
Under both cases, the results of these virtual calculations reveal that in the future companies must establish a strategy by not only assuming the US and European markets but also regarding those of the MegaGrowth

Figure 14. Changes in Economic Scale of Japan, US, Europe and BRICs (Contracted Equilibrium Case)



Note: The above figures are the GDP of each country. Calculations were made on the assumption that the growth rate of 2005 continues for the first decade, then is reduced to half for the second decade and is further reduced to one-fourth for the third decade. As of 2005, the EU consisted of 25 countries. For the EU growth rate, the EMU values are used.
Source: Compiled based on material published by the World Bank and the United Nations.

Figure 15. Per-Capita GDP in 2035 (Contracted Equilibrium Case)



Note: Calculations were made on the assumption that the growth rate of 2005 continues for the first decade, then is reduced to half for the second decade and is further reduced to one-fourth for the third decade. As of 2005, the EU consisted of 25 countries. For the growth rate of the EU, the EMU values are used.
Source: Compiled based on material published by the World Bank and the United Nations.

countries as important targets, and that otherwise they will lose a major part of the world market.

2 Shift from "Flying Geese Type" Growth to "Simultaneous and Multiple Emergence Type" Growth

Such a rise of the MegaGrowth countries will completely change the image of "Japan that started as a developing country, caught up with developed countries, and is now the only country that can equally compete in the US and European markets."

Until the 1980s, Japan was the only country that could compete on an equal footing in the world market with the US and Europe by being ranked among the top economic powers. The term NIEs, meaning "newly industrializing economies," was first officially used at the Toronto Summit in 1988. From the end of the 1980s into the 1990s, NIEs countries such as Korea and Singapore have appeared as new challenger candidates.

Even with the emergence of these countries, the concept of the basic pattern of growth of the world economy was the "flying geese" format with Japan taking the lead, followed by NIEs, which were followed by the ASEAN countries. Behind the ASEAN countries, there were countries with large populations such as China and India. These countries were regarded as remaining in an orderly manner just as a flock of geese soaring in the sky.

However, in future world economy, the country that will aim to equally compete in the advanced markets will not only be Japan. Even with slight time differences, Korea, China and India almost simultaneously began to fiercely compete to catch up with more advanced countries. No matter what has been pursued, Japan will soon become sandwiched between the US and Europe, which are still taking the lead, and Korea, China and India. If we take a more extensive view of the world market, Japan may be confronted by BRICs (Brazil, Russia, China and India) and further by BRICs neighboring countries.

When we consider a rise of the MegaGrowth countries, we can easily imagine that among these countries, countries/companies that have world-class competitiveness in diverse fields may emerge. These include countries with outstanding human resources in science and technology, countries with those who excel in design, countries blessed with natural resources and countries enjoying sufficient human resources. From these, countries/companies that will play important roles in the world market as backed by the expanding domestic market ought to emerge. The best practices for growth as demonstrated by such countries/companies will instantly spread throughout the world via digital information networks.

In the future, growth will not be achieved in an orderly manner by mimicking the pattern of flying geese. Rather, growth will be achieved simultaneously at multiple locations by taking on diversified shapes and routes. These changes will be accelerated by global companies, global funds, highly global education/training systems and so on.

In a world where advanced knowledge and information can be instantly shared, activities to challenge one promising business opportunity will be undertaken all over the world. It cannot be denied that among these activities, an unforeseen country might achieve unexpected success by combining surprising management resources. Digital information networks will make it much easier to discover and procure management resources necessary for such success than in the past. Ubiquitous networking will further improve the quality of the entire processes and accelerate these activities.

Japan, together with European countries and some Asian countries, will be exposed to severe situations such as facing a declining birth rate and improved longevity, which will gradually diminish any hopes for long-term economic growth. However, sustainable economic

growth can be expected of BRICs, which account for more than 40 percent of the world's population. As explained previously, the growth potential of BRICs neighboring countries such as Vietnam, Indonesia, Pakistan and Argentina is also high. Behind them, there are new middle-tier countries.

What is important for Japanese companies is that, in the future, high levels of growth will be attained simultaneously in multiple locations for substantially long times by MegaGrowth countries that are outside the Japanese market. A strategy designed to catch up with only the US and Europe will not be sufficient to deal with major changes occurring in the future in the world market, specifically a rise of the MegaGrowth countries. If Japanese companies are to find consolation in Madagascarization, it is quite doubtful that they can attain growth. Rather, in addition to global companies and funds of existing advanced countries, BRICs and BRICs neighboring countries that will become highly competitive by simultaneously attaining growth in multiple locations will quickly sweep over the entire world market.

III International Competitiveness and "International Symbiosis"

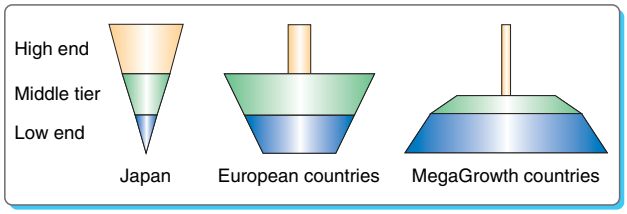
1 Concept of "International Symbiosis"

Under these circumstances, what is necessary for Japanese companies to do is to foster "international symbiosis."[6]

In attempting to catch up with competitors, Japanese companies have been solely devoted to improving technological level and quality as well as price competitiveness to successfully compete in the domestic market and to develop the world's most advanced products and services. As a result, however, with respect to products that are developed by making full use of Japanese management resources and by targeting the Japanese market, the more advanced and sophisticated such products are, the more such products are Galapagosized at the initial stage, resulting in a situation where they are not widely accepted in other markets.

Accordingly, such efforts are as indispensable as are those to quickly develop a brand based on advanced technology and to facilitate prompt acceptance of such a brand in markets having similar characteristics. However, attention must be paid to the fact that even if products are accepted in high-end markets such as the US and EU, these products might not be able to meet the needs of MegaGrowth countries, which are to become the growth center of future world economy. This means that the most advanced products cannot necessarily become the most profitable products or products achieving the largest sales figures in the future world market (Figure 16).

Figure 16. Galapagosization and MegaGrowth Countries



Factors giving rise to Galapagosization

- Progress in broadband services, ubiquitous networking
- Isolation in terms of international standards
- Strong focus on the domestic market
- Moderately large domestic market
- Sophisticated and discriminating consumers
- Industrial structure with initiative taken by communications carriers
- Delays in creating modules and platforms for devices and services

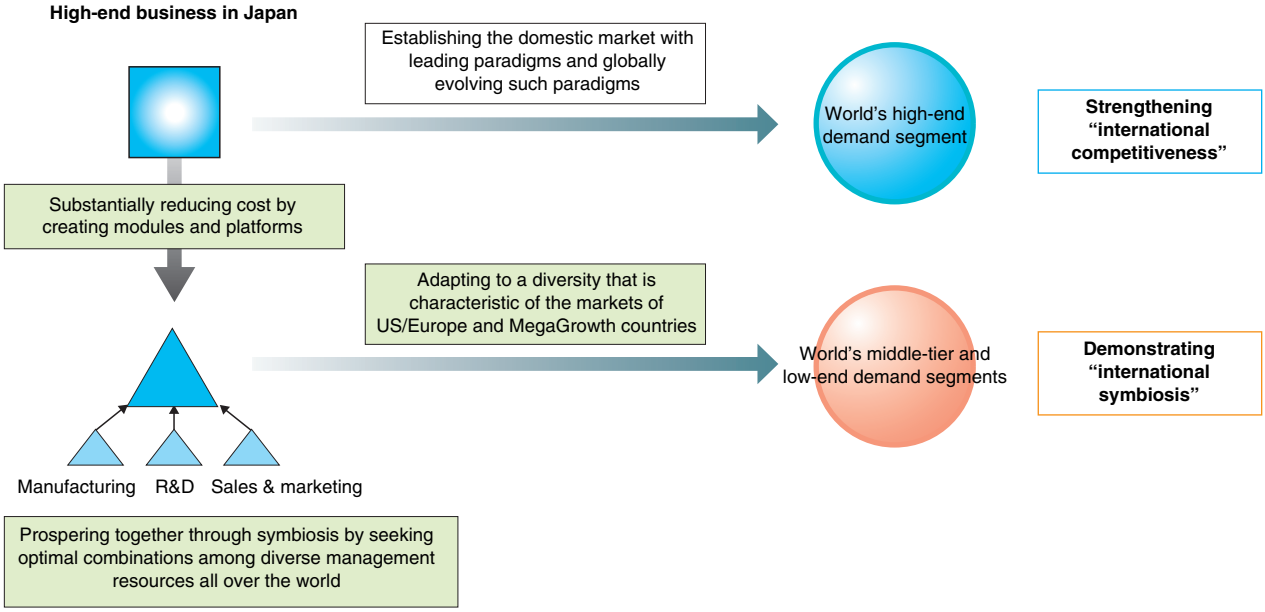
One of the characteristics of the future world market where many countries will grow simultaneously will be unprecedented diversity. In the past, countries with small per-capita GDPs were, with very few exceptions, those with small GDPs. As described in Chapter II, however, countries will emerge that have small per-capita GDPs but will outstrip most European countries in terms of GDP. Far into the future, China and India will surpass Japan in terms of GDP, and might even surpass the US. Countries that have large-sized markets and attain high growth will not necessarily be limited to countries with high per-capita GDPs.

Mass products that will be accepted in the growth centers of the future will probably be those equipped with robust basic functions, rather than with the latest technology/design or sophistication, and those offering reasonable quality that can justify prices, rather than high quality. Before anything else, these products must offer price competitiveness that can compete with China and Taiwan.

The ability required for international activities in these markets is not necessarily the ability to produce state-of-the-art products but is the ability to provide products and services that can be adapted to specific markets by meeting diversified development stages, diverse degrees of sophistication of consumers and differences in cultural backgrounds. To increase sales, companies must be able to target not only high-end markets, but also middle-tier and low-end markets at least for a single product category. The ability to meet a wide variety of needs in the world market will become vitally important.

In other words, in addition to the ability to develop and supply products that can meet high-end markets, success or failure in competition will be determined by the ability to develop product groups that are tailored to middle-tier and low-end markets. This can only be accomplished by making maximum use of intellectual assets such as design, brand, intellectual goods and product concept that can meet high-end markets, and by

Figure 17. International Competitiveness and "International Symbiosis"



modifying them to suit the middle-tier and low-end market according to a variety of needs such as quality, material or function. This ability is called "international symbiosis" (Figure 17).

International symbiosis is important not only for sales but also for profits. At least from the perspective of policy, the improvement of international competitiveness of Japanese companies in the past meant solely improving the following abilities of Japanese companies to those of the world's most advanced. The abilities included technological development, product development, design, marketing, ability to develop an efficient supply chain and mobilize various production process skills and expertise. The era is long past in which the only way Japan could challenge the US and European markets in a situation where it had few countries to rely on was to enhance the quality of its own management resources.

In addition to China and Vietnam, which are unrivaled in terms of manufacturing products at low cost, Russia, which has high research and development abilities, and India, which is excellent in software development, other BRICs countries and BRICs neighboring countries will emerge as reliable partners offering incomparably renowned ability.

The ability to realize remarkably high productivity by combining these superior, yet competitive costs of management resources scattered all over the world and by comprehensively linking such resources without any breaks in practical terms is international symbiosis on the supply side.

This optimal combination of management resources will constantly change in a world where growth is achieved simultaneously in many places. Companies must keep their eyes wide open to such changes occurring throughout the world and implement simulations for a portfolio of management resources. Personal relationships must be established on a daily basis at the level of management executives and at the working level with companies having superior management resources. Based on these activities, management resources to be combined must be changed to better ones at appropriate timing, which will constitute a source of profits.

To this end, the more advanced products and/or services are, the more quickly they must be separated into modules and/or platforms. It becomes important to establish a mechanism in which such products/services are manufactured at the lowest possible cost and are sold extensively at reasonable prices by utilizing diverse management resources available all over the world. The ability to make full use of such dynamism of diverse management resources is international symbiosis on the supply side.

2 Improvement of International Competitiveness and "International Symbiosis"

In the past, the theory of international management and the theory of multinational corporations have also pointed out the importance of a combination of management resources through international division of labor to some extent. However, the forms of international symbiosis that have recently been achieved by Nokia and Samsung are very different in scale.

With their small domestic markets, Finland and Korea have been forced to adopt a corporate behavior of vigorously looking for partners all over the world and taking over markets that they can capture one after another because they do not find Madagascarization acceptable. The continuation of these activities has given rise to the overwhelming performance that they currently enjoy. Among Japanese companies, Toyota and Canon are

strong in international symbiosis to a greater or lesser degree.

The current business administration generally consists of two major theories, one dealing with business strategy and the other with management resources. What was discussed so far is that from the perspective of business strategy, Japanese companies must promote international symbiosis in addition to strengthening international competitiveness.

However, what is correct from the perspective of business strategy is not necessarily correct from the perspective of management resources. While it is probably correct that Japanese companies should promote international symbiosis, these same Japanese companies may be those that are most unsuitable for international symbiosis from the perspective of management resources. To bridge this gap, government policy must play a major role in fields such as the development of human resources capable of international symbiosis, the accumulation of evaluation information of management resources of each country, which are constantly changing, and the development of regulatory infrastructure. Such a role of government might be greater and more important than the government policies designed to improve international competitiveness.

To this point, I have explained how the improvement of international symbiosis is important for the Japanese ICT industry. However, it does not mean that activities to further improve the technological competitive edge in the ICT field in pursuit of becoming the most advanced country in the world should be neglected.

Under the circumstances where an increasing trend towards passing Japan has been discussed, any efforts to aim at constantly being ahead of other countries in the ICT field are of great significance. This is true not only in terms of technology but also from the perspective of increasing interest in both Japanese society and Japanese economy. However, we must note that in addition to the efforts to develop the world's leading environment of ICT utilization in Japan, equivalent efforts must also be made to promote and share such an ICT utilization environment among many countries in the world.

While the ubiquitous network paradigm has already become well known in Japan and Korea, more efforts are necessary to share this paradigm among neighboring Asian countries and other countries or regions. It is understood that unless these activities are conducted in concert with industry, government and academia, such activities will not be successful in contributing to strengthening the international competitiveness of ICT.

Notes

(1) Ci'Num (Les Entretiens des Civilisations Numeriques, Digital Civilization Forum); for three years from 2005, about 30 persons who are "designers of the future" and decision-makers have gathered yearly in Bordeaux, France to discuss the future of digital civilization; it plans to publish a manifesto entitled "The Digital Civilization Forum—Taking up their challenges!" in 2008 after three years of discussions.

(2) Teruyasu Murakami, "Ubiquitous Networking: Business Opportunities and Strategic Issues," NRI Papers, No. 79, August 1, 2004.

(3) Ministry of Internal Affairs and Communications, "Report on Systems of Ubiquitous Network Society (September 2006)," the Policy Roundtable for Realizing a Ubiquitous Network Society.

(4) Discussions about the international competitiveness and international symbiosis in the ICT industry are expanded in this paper based on the author's paper published in *Shukan Economist* (Weekly Economist) entitled "Kokusai kyosoryoku kara kokusai kyoseiryoku no jidai he—Sekai de ureru shohin wo tsukuru tameniha "kokusai kyoseiryoku" ga hitsuyo da (Shifting from the Era of International Competitiveness to the Era of International Symbiosis—To Manufacture Products that Sell in the World, "International Symbiosis" is Necessary), Teruyasu Murakami, August 28, 2007. These considerations largely depend on the discussions at the Roundtable for Strengthening the International Competitiveness of ICT, the Ministry of Internal Affairs and Communications. I would like to express my appreciation for the valuable observations and opinions expressed at this roundtable.

(5) Herman Kahn and Anthony J. Wiener, *The Year 2000*, 1968

(6) See Note 4.

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