Chapter 1

Realization of Dynamic Ubiquitous Network Society

Section 1
Revitalization of Regional Economies through ICT

1. Growth of regional economies through ICT

(1) Economic growth of Japan and development of regional economy

As the population ages and the birthrate declines, Japan is expected to become a super-aging society with a declining population. If the population ages and declines at the current rate, the working population engaged in production activities will decline in the mid- to long-term, having a negative impact on the economic growth of the country. In order to maintain economic growth under these circumstances, it will be necessary to utilize diverse ideas from the public and to create new added values. In particular, the development of a regional economy will be of great importance for the future economic growth of Japan.

However, the environment surrounding the regional economy has changed rapidly recent years. The regional economy is faced with various issues; for example, the globalization of economic activities along with the spread of ICT, subsequent competition in an international market, and transition from a growth model of a high-growth era based on public projects, and so on. Local society is locked into a vicious circle, becoming less attractive due to the loss of its traditional crafts and authentic local culture, which induces further population decline. When it becomes difficult to secure the labor force due to the population decline, it is feared companies may flow out of the region, with a resultant decline in tax revenues and deterioration of local government finances. Furthermore, the deterioration of local government finances may lead to the degradation of administrative services, which will escalate the population outflow further, triggering a negative chain reaction.

In order to recover from the negative chain reaction, it is necessary for each local area to activate its own production activities and to achieve its own economic growth under a declining population.

(2) Characteristics of ICT capital and current situation of ubiquitous networks

A. Economic efficiency of networks through ICT capital

ICT is increasingly taking the role of a new infrastructure for production activities and the importance of ICT capital has dramatically increased. When local communities aspire to attain economic growth whatever the circumstances, it is essential to input and utilize ICT capital actively as an opportunity to bring about change in production activities.

In particular, ICT capital, such as computers, has a characteristic whereby the "economic efficiency of networks" takes effect. As ubiquitous networks progress, information and knowledge exchanges are activated through networks of ICT capital, which will enable us to create various innovations and new added values. In other words, it is fair to conclude that the accumulation of ICT capital and progress of ubiquitous networks improve the productivity of the overall economy through the effect of the economic efficiency of networks, and at the same time, contribute to the economic growth of Japan by providing sources for new added values.

B. Developing ubiquitous index for each prefecture

For an analysis of the impact of the progress of ubiquitous networks on regional economic growth, we have developed the "Ubiquitous Index" for each prefecture as an index to indicate the progress of ubiquitous networks (See **Figure 1-1**). From changes to the ubiquitous index it has been found that the index figures are getting larger on a whole and the rate of increase has rapidly accelerated since 2000. When ubiquitous indexes are compared by prefecture, while the figure for Tokyo grew by 7.6 from 2000 to 2005, the figure for Aomori remained as low as a growth of 4.7, showing the dispersion among different prefectures.

(3) Progress of ubiquitous networks and regional economic growth

The following is the analysis of the impact of ICT capital and the progress of ubiquitous networks on the economic growth of each prefecture, using a macro production function model. Here, the effect of the progress of ubiquitous networks on economic growth is examined by using a ubiquitous index developed for this study.

A. Estimate equation

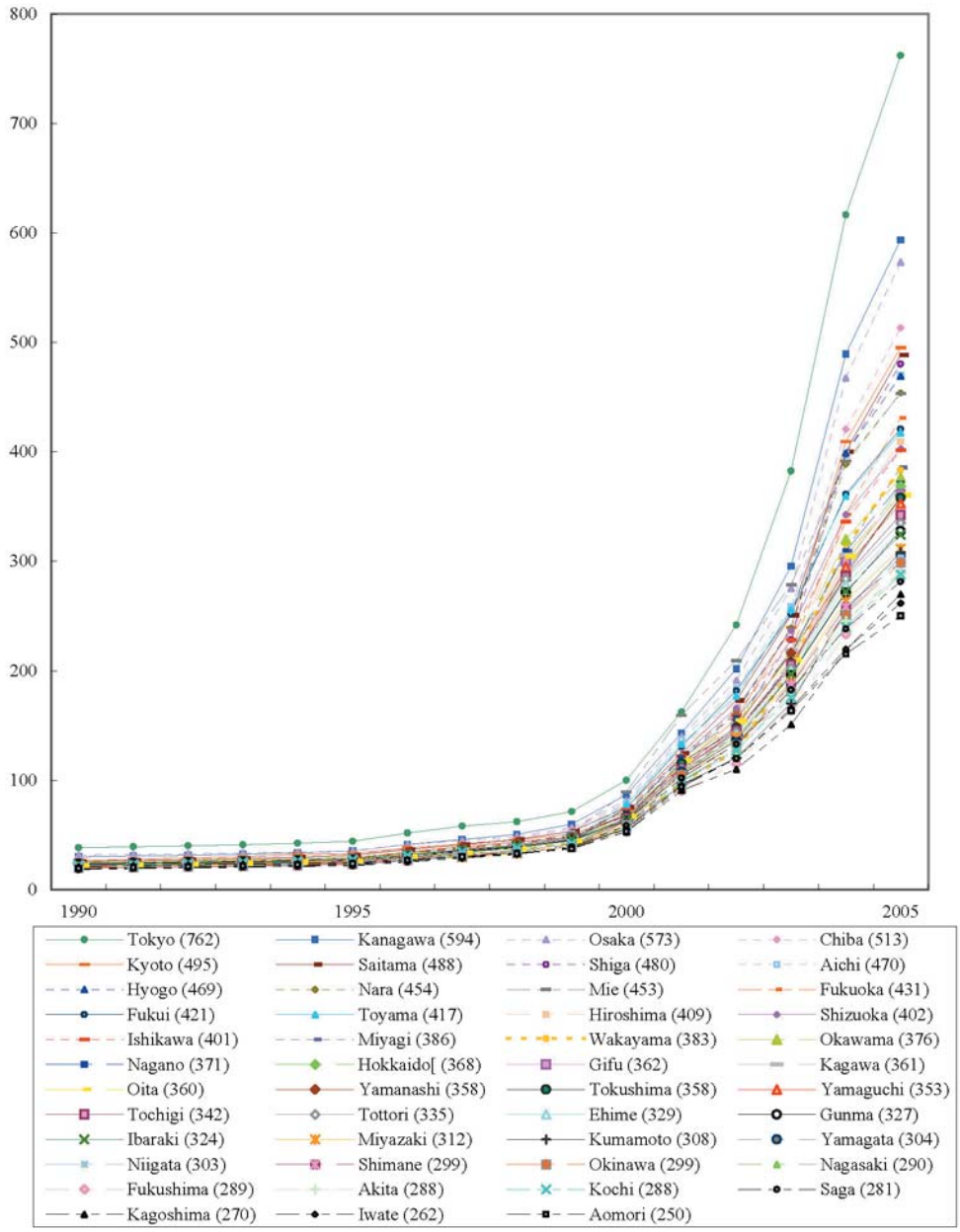
The following is the production function model used for this analysis[1]. In order to better understand the difference between prefectures, the model is assigned with prefecture-specific dummy variables.

$$\ln(Y/L) = \ln A + \alpha' \cdot \ln(K_{all}/L) + \left(\sum_{p=1}^{47} \beta_p \cdot dp_p\right) \cdot \ln(K_i \cdot U)$$

Y:Output, K_{all}: Total Capital, K_i: ICT Capital, L: Labor input, U:Ubiquitous index, dp_p:Prefecture-specific dummy variables

Fig. 1-1 Trends in Ubiquitous Index of each prefecture

(The value in Tokyo in 2000 is defined as 100.)



* Figures in brackets indicate the values of the ubiquitous index of each prefecture as of 2005.

(Source) "Survey on Regional Economic Growth Brought about by the Development of a Ubiquitous Network"

[1] Since the effect of ICT capital on economic growth varies depending on the progress in ubiquitous networks, we have estimated the degree of the contribution of ICT capital stock, obtained by multiplying ICT capital by the ubiquitous index which indicates the progress of the ubiquitous network.

[2] The 2007 White Paper, Information and Communications in Japan, confirmed that economic efficiency of networks becomes effective for ICT capital while the returns are kept constant with regard to the size of corporate production activities, which causes the generation of increasing returns for the whole economy. It also confirmed that in addition to the economic efficiency of a network of ICT capital, the effect of the usage aspect of ubiquitous networks, such as "expansion of spread" and "increased use", causes the generation of increasing returns for the whole economy, while keeping the returns constant with regard to the size of corporate production activities, etc.

B. Effect of progress of ubiquitous networks on economic growth

According to the result of the estimation, the variables obtained by multiplying ICT capital by the ubiquitous index are significantly positive in all prefectures, proving that the effect in terms of economic efficiency and the use of ubiquitous networks through ICT capital make a positive contribution to the improvement of labor productivity[2] (**Figure 1-2**).

This indicates that local economies with low growth have the potential to grow dramatically, if the ubiquitous networks make progress and the economic efficiency of networks takes effect in all sectors, creating new innovations and added values.

C. Contribution of the progress of ubiquitous networks to the growth of real prefectural product

Based on the estimates analyzed in the previous section the contribution of the progress of ubiquitous networks of ICT capital to the economic growth of each prefecture is examined. The result shows that the contribution ratio in terms of economic efficiency and use of networks through ICT capital to the average growth rate of real gross prefectural product from 2001 to 2005 lies in between 0.35% and 1.71%, with the contribution rate exceeding 50% in 35 prefectures,

Fig. 1-2 Estimates of a model using prefectural panel data

	Parameter	Coefficient	t-value
Capital share	α'	0.394	20.530
Hokkaiso	β 1	0.020	12.300
Aomori	β 2	0.013	6.980
Iwate	β 3	0.013	7.930
Miyagi	β 4	0.018	10.350
Akita	β 5	0.014	7.030
Yamagata	β 6	0.013	7.410
Fukushima	β 7	0.017	9.180
Ibaraki	β 8	0.021	12.170
Tochigi	β 9	0.019	10.970
Gunma	β 10	0.017	9.630
Saitama	β 11	0.024	15.420
Chiba	β 12	0.024	14.140
Tokyo	β 13	0.028	16.840
Kanagawa	β 14	0.023	13.190
Niigata	β 15	0.018	10.040
Toyama	β 16	0.016	7.450

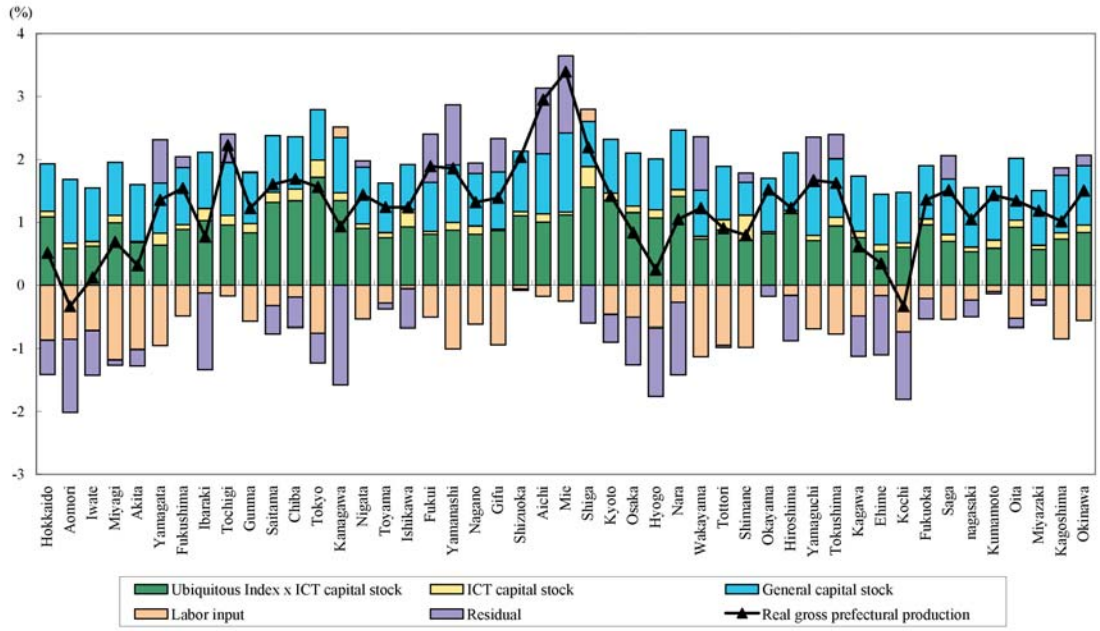
	Parameter	Coefficient	t-value
Ishikawa	β 17	0.019	11.150
Fukui	β 18	0.016	7.310
Yamanashi	β 19	0.018	9.450
Nagano	β 20	0.016	9.020
Gifu	β 21	0.018	9.220
Shizuoka	β 22	0.021	11.900
Aichi	β 23	0.019	10.390
Mie	β 24	0.023	11.500
Shiga	β 25	0.027	15.130
Kyoto	β 26	0.023	13.030
Osaka	β 27	0.020	11.220
Hyogo	β 28	0.019	9.340
Nara	β 29	0.026	14.060
Wakayama	β 30	0.013	6.100
Tottori	β 31	0.018	10.570
Shimane	β 32	0.015	8.680
Okayama	β 33	0.016	7.610

	Parameter	Coefficient	t-value
Hiroshima	β 34	0.021	11.170
Yamaguchi	β 35	0.014	6.690
Tokushima	β 36	0.020	10.920
Kagawa	β 37	0.016	8.160
Ehime	β 38	0.011	6.220
Kochi	β 39	0.013	7.040
Fukuoka	β 40	0.017	9.570
Saga	β 41	0.015	8.360
Nagasaki	β 42	0.011	6.040
Kumato	β 43	0.011	6.420
Oita	β 44	0.018	9.290
Miyazaki	β 45	0.012	6.480
Kagoshima	β 46	0.015	8.760
Okinawa	β 47	0.018	11.050
Constant term	lnA	1.613	28.000

Sample	376
Log likelihood	1054.76

(Source) "Survey on Regional Economic Growth Brought about by the Development of a Ubiquitous Network"

Fig. 1-3 Decomposition of the average growth rate of real gross prefectural product (2001-2005)



(Source) "Survey on Regional Economic Growth Brought about by the Development of a Ubiquitous Network"

which suggests that the effect of economic efficiency and use of networks through ICT capital is significant in underpinning economic growth (**Figure 1-3**).

D. Outlook of regional economic growth

The growth rate of real gross prefectural product for 2011 was projected based on the estimates of the previous sections B and C to find out how much the effect of economic efficiency and use of networks through ICT capital contributes to economic growth[3], and the result shows that the contribution rate of economic efficiency and use of networks through ICT capital to the growth rate of real gross prefectural product lies in between 0.90% to 2.53%, exhibiting an increase from the contribution ratio obtained in section C (the average real growth rate of real gross prefectural product from 2001 to 2005). This suggests the possibility of attaining further economic growth in all prefectures if ICT capital is accumulated and a ubiquitous society makes progress smoothly. (**Figure 1-4**).

(4) Impact of capital allocation among regions on the overall economy

Under the assumptions of (3)-D, it has been suggested that the smooth accumulation of ICT capital and progress of ubiquitous networks could possibly further drive up economic growth in 2011. From this result, it is conceivable that measures for the further improvement of the contribution of ICT capital and ubiquitous networks could enhance the growth of the overall economy.

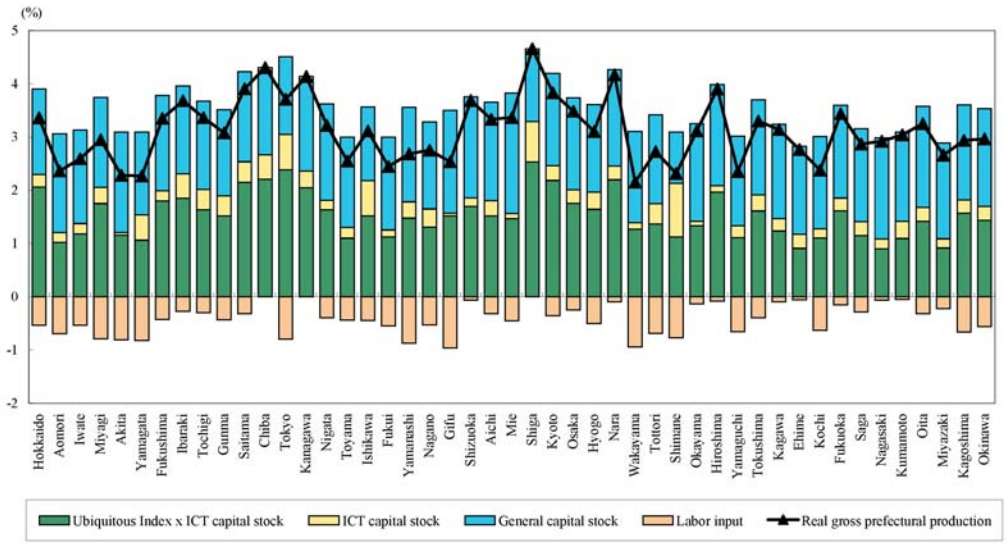
A possible measure for improving the contribution of ICT capital and ubiquitous networks is to promote the accumulation of ICT capital, the basis for a ubiquitous network. We have created a scenario where accumulated ICT capital facilitates the progress of ubiquitous networks and promotes economic growth, and conducted a simulation of economic growth in accordance with this scenario.

With regard to an accumulation of ICT capital, it is assumed that 1% of accumulated ICT capital in a given year increases every year, on top of the increment in ICT capital in the years between 2008 and 2011 used in the forecast in (3)-D in the previous section. Using the difference in the allocation method of the 1% growth in ICT capital, we have analyzed the impact on the growth of the overall economy (**Figure 1-5**).

A. Simulation

The ICT capital-labor-ratio (ICT capital stock per employed worker) is taken into consideration when setting up a method for allocating the increment of ICT capital. In the case where, in addition, a fixed amount of ICT capital is increased, the limited effect seems to be larger if such ICT capital is added when ICT capital stock per employed worker is small. However, this effect has not been taken into account in

Fig. 1-4 Decomposition of the growth rate of real gross prefectural product (2011)



(Source) "Survey on Regional Economic Growth Brought about by the Development of a Ubiquitous Network"

[3] The future outlook of individual data was estimated under the following assumptions: labor hours and number of employees are extrapolated with the average growth rate from 2000 to 2006, and general capital stock, ICT capital stock and facility operation ratio are extrapolated with the average growth rate from 2002 through 2005. The ubiquitous index was calculated with the extension of an estimate of the penetration curve for each piece of data.

the allocation method that simply focuses on the size of ICT capital stock. Thus, when we set up an allocation method, we focused on the ICT capital-labor-ratio, rather than the ICT capital itself.

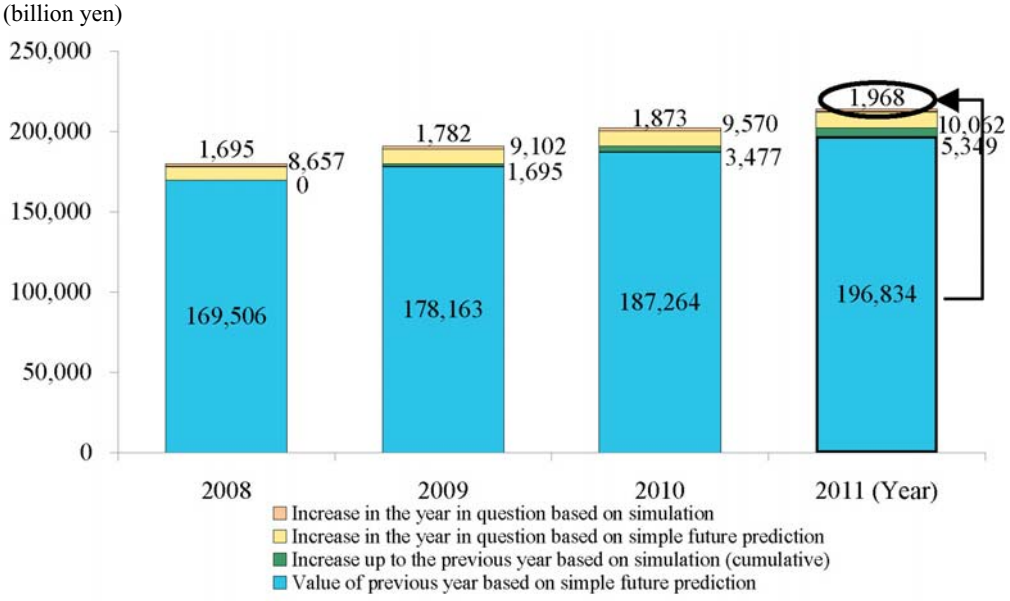
Figure 1-6 shows a comparison between ICT capital-labor-ratios in 2005 by prefecture. Analyses made below show the impact of the different allocation methods on the real GDP of the overall economy in the cases when the growth of ICT capital was allocated to (1) the top 10, (2) top 20, (3) all 47, (4) bottom 20 and (5) bottom 10 prefectures, respectively, with a focus on ICT capital-labor-ratio.

B. Simulation result

Under the scenario where increased ICT capital is allocated in the five patterns mentioned above, we compared each case with real GDP in Japan in 2011 projected from the future outlook of the growth rate of real gross prefectural product obtained in (3)-D. When observing how much Japan's real GDP increases, it is estimated that the GDP growth is largest in the case where the increased capital is allocated to the bottom 10 prefectures of the ICT capital-labor-ratio, and is smallest in the case where the increased capital is allocated to the top 10 prefectures of the ICT capital-labor-ratio, with a difference in real GDP of one trillion yen between the two cases **(Figure 1-7)**.

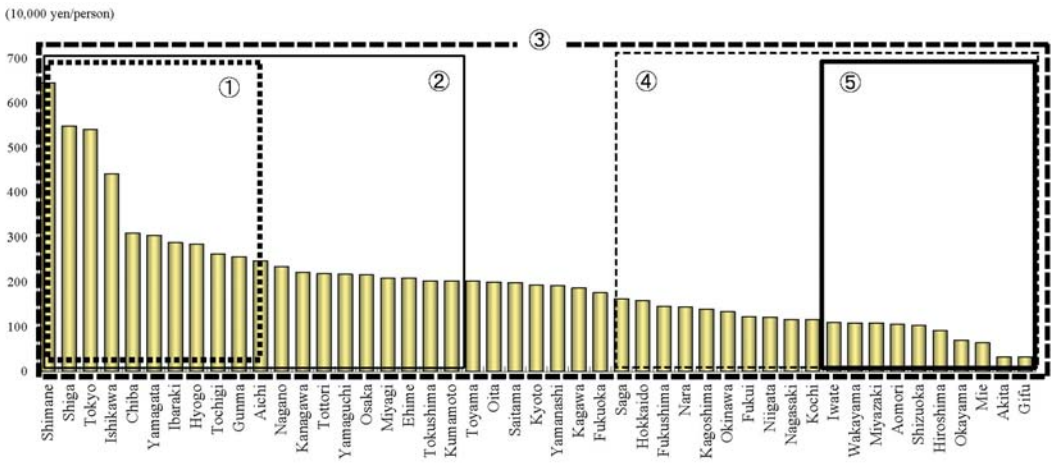
From the comparison of the results of five simulated cases, it has been found that the effect of an increase in real gross prefectural product is larger if

Fig. 1-5 Accumulation of ICT capital assumed in a simulation



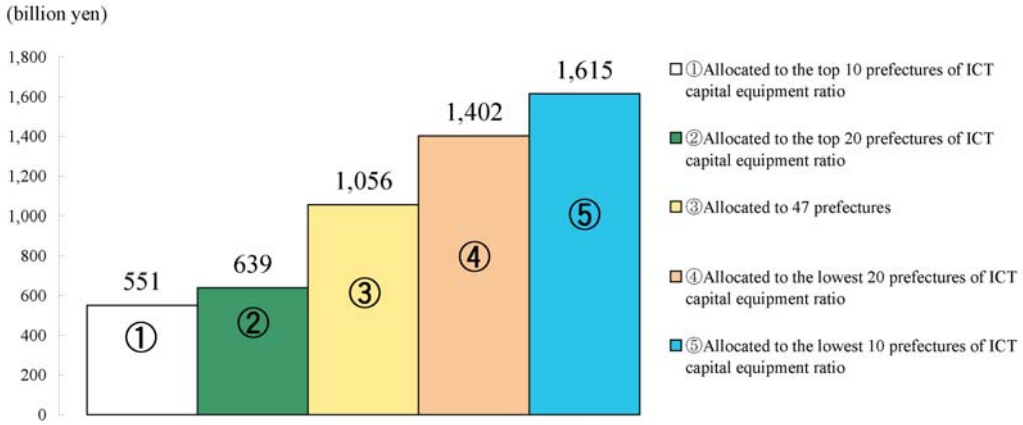
(Source) "Survey on Regional Economic Growth Brought about by the Development of a Ubiquitous Network"

Fig. 1-6 ICT capital-labor-ratio in 2005



(Source) "Survey on Regional Economic Growth Brought about by the Development of a Ubiquitous Network"

Fig. 1-7 Increments from Japan's real GDP forecast values of 2011



(Source) "Survey on Regional Economic Growth Brought about by the Development of a Ubiquitous Network"

the allocation of ICT capital is concentrated in the prefectures with low ICT capital-labor-ratios.

Many prefectures with low ICT capital-labor-ratios have either small ICT capital stock or the number of employees is large. Assuming the volume of allocated ICT capital is constant, the smaller the ICT stock is, the larger the growth rate of ICT capital. Prefectures with a large number of employees tend to have a large real gross prefectural product. Thus, the effect of concentrated allocation seems stronger, being influenced by a small ICT capital stock in the case of the former and being influenced by a large real gross prefectural product in the case of the latter.

The result of this simulation suggests that the correction of regional information discrepancies through the deepening of capital in prefectures with low ICT capital-labor-ratios (increase in the capital equipment ratio) will lead to an effective boost of the real GDP of the overall economy.

2. Diminution of digital divide between regions

(1) Use of ICT in households and regional divide

The use of ICT in households at the end of 2007 is examined to find out about the regional divide in 11 regional groups in the country. For example, the broadband usage rate is highest in the Hokuriku region at 73.4% and lowest in the Tohoku region at 32.8%, with a remarkable difference of 40.6 points **(Figure 1-8)**. IP phone usage rate is highest in the Kinki region at 29.2% and lowest in the Chugoku region at 11.3%, with a difference of 17.9 points.

When taking a look at the installation and usage of ICT devices in households by region at two time points (end of 2007 and 2004) and the regional gap shown therein, it is observed that the diffusion rate increased for almost all items while the regional gap narrowed (Figure 1-9). However, while the diffusion rates for IP phones and broadband increased from three years earlier, the coefficient of variances is virtually unchanged, exhibiting a persistent regional gap. In households, although there is almost no regional gap in the possession of ICT devices, such as mobile phones and PCs, and in the fundamental aspects of ICT usage, such as use of the Internet, the coefficient of variances has not narrowed for the use of broadband and IP phones, indicting a persistent regional gap. Therefore, it is necessary to eliminate the regional digital divide further, focusing on usage aspects in households.

(2) Use of ICT in corporations and regional divide

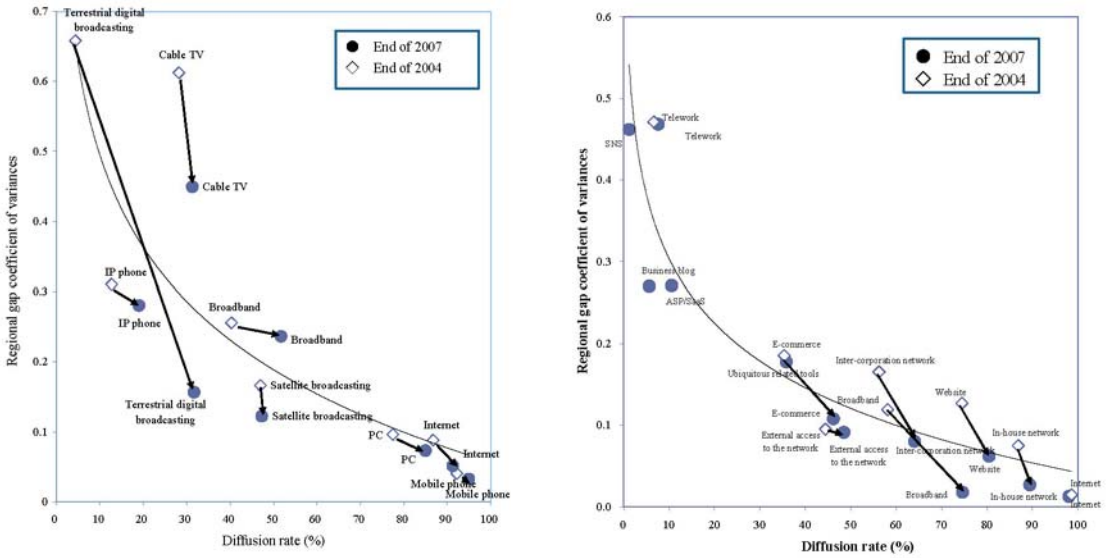
When taking a look at the installation and usage of

Fig. 1-8 Usage of ICT in households by region

	Mobile phone ownership rate	PC ownership rate	Internet usage rate	Broadband usage rate	IP phone usage rate	Terrestrial digital broadcasting audience rating	Cable TV audience rating	Satellite broadcasting audience rating
Highest region	Hokuriku 99.4%	Hokuriku 94.1%	Hokuriku 96.0%	Hokuriku 73.4%	Kinki 29.2%	Minami Kanto 38.0%	Hokuriku 62.7%	Hokuriku 59.2%
Lowest region	Shikoku 89.8%	Shikoku 72.8%	Shikoku 81.6%	Tohoku 32.8%	Chugoku 11.3%	Shikoku 20.5%	Tohoku 11.2%	Hokkaido 39.6%
Difference (points)	9.6	21.3	14.4	40.6	17.9	17.5	51.5	19.6

(Source) "Communication Usage Trend Survey (2007)," MIC

Fig. 1-9 Usage of ICT in households/corporations and regional gap thereof (left: households, right: corporations)



* For Business blog, SNS, ASP/SaaS, Ubiquitous related tools, there is no data in the end of 2004.

(Source) "Communication Usage Trend Survey," MIC

ICT devices in corporations by region at two time points (end of 2007 and 2004) and the regional gap thereof, it is observed that the diffusion rate increased for almost all items while the regional gap narrowed, indicating that use of ICT by corporations has a relatively small regional gap **(Figure 1-9)**. However, there are regional gaps in such services as ASP/SaaS, teleworking, business blogging, SNS, etc., and their diffusion is not progressing much.

3. Regional revitalization through ICT use

(A) Use of ICT in regions

A. Significance of regional revitalization through use of ICT

It is believed that today's regions lack the best human resources or corporations with unique skills that attract companies outside the region as well as the necessary information and capital to attract such human resources. However, on the other hand, each region is fully endowed with the potential resources to achieve economic growth, and it is essential to tap and utilize such regional resources using unique ideas and creative approaches to facilitate regional development in the future. ICT is expected to play a crucial role as a tool to make use of such regional strengths and to overcome any weaknesses. It is thought that ICT would contribute primarily to the enhancement of the information transmission capacity of the region through correction of the information gap, secondly to the improvement of labor productivity of corporations and thirdly to the improvement of peoples' welfare and the reconstruction of local communities.

Below, we have analyzed the use of ICT systems and their subsequent effects, and the methods for operations, etc. of municipalities, based on the results of the nation-wide questionnaire surveys on municipalities.

B. Formulation of ICT use index for each municipality

When ICT use is analyzed, the administrative fields of municipal governments were categorized into eight groups: namely, 1) crime and disaster prevention, 2) welfare/healthcare, 3) medical care, 4) education and culture, 5) industry and agriculture, 6) transportation and tourism, 7) administrative services and 8) community. The function of ICT systems in each field were then divided into seven sub-groups (six for the transportation and tourism field), and we have con-

[4] Examples of ICT systems in each area are as follows:① crime/disaster prevention (high-altitude disaster monitoring camera, local protection system, etc) ②welfare/healthcare (monitoring system for the elderly living alone, home health check system, etc.) ③medical care (wide-area medical chart network, remote medical services, etc.) ④education/culture (remote classroom system, e-learning system, etc.), ⑤ industry/agriculture (online sales for specialties, information provision system to attract outside corporations), ⑥ transportation/tourism (tourism information system, information provision system for location of buses, etc.), ⑦administrative services (public facility reservation system, e-application system for administrative procedures, etc.), ⑧community (local SNSÅAe-conference system between administration and residents, etc.)

ducted questionnaire surveys on a total of 55 items[4], to find out what kind of function each system developed by municipal governments has. Furthermore, from the viewpoint of recently installed systems not yet being fully functioning, the introduction periods were rated with points, assigning introduction prior to 2006 with 10 points, introduction after 2007 with 8 points and no introduction with zero points, then the function was multiplied by the introduction timing to obtain the scores. Then, we created the "ICT Field-specific Use Index" that would indicate the use of ICT in eight fields in individual municipalities and the "ICT Comprehensive Use Index" that integrates with fields as an indicator of the overall use of ICT.

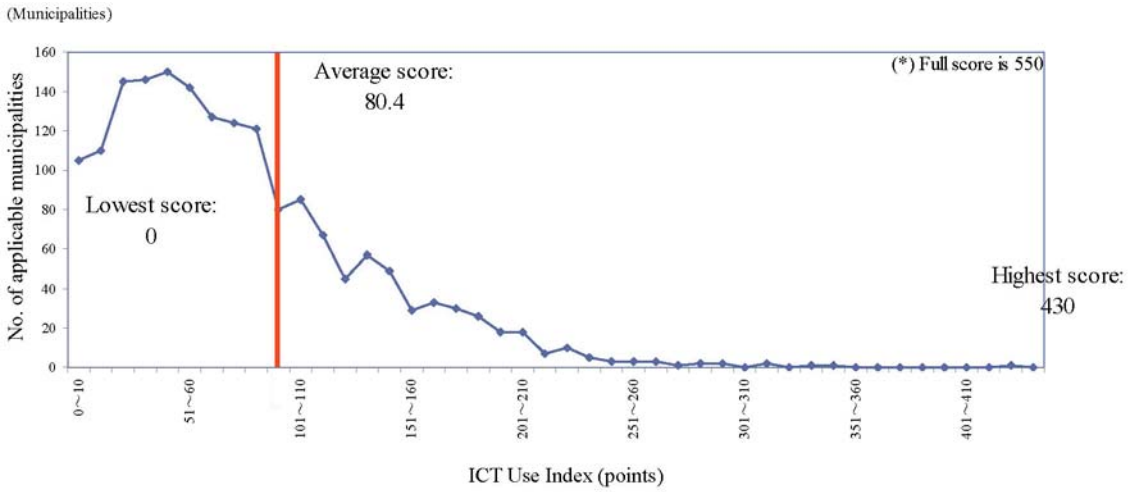
C. ICT use by municipalities

(a) Comprehensive use of ICT

(i) Overall view of ICT use

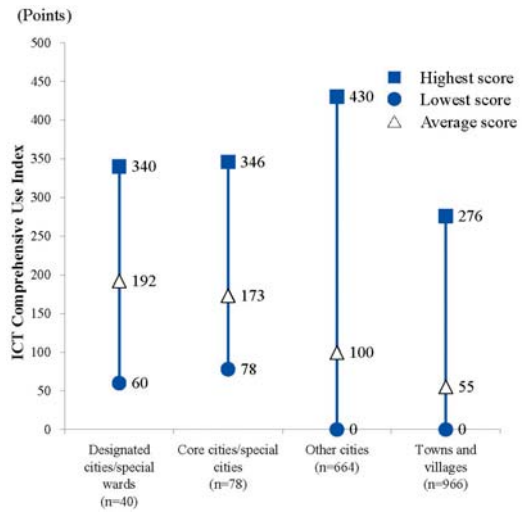
When viewing the ICT use of the 1,748 municipalities in the country using the ICT Comprehensive Use Index, the best score attained was 430 out of the full score of 550, the lowest score was zero, and the average score was 80.4. The result shows that while there are municipalities taking highly innovative approaches, many other municipalities are still not able to fully utilize ICT **(Figure 1-10)**.

Fig. 1-10 Distribution of ICT Comprehensive Use Index



(Source) "Investigative Study on Regional Informatization Approaches and Regional Revitalization"

Fig. 1-11 Distribution of ICT Comprehensive Use Index by city categorization



(Source) "Investigative Study on Regional Informatization Approaches and Regional Revitalization"

Fig. 1-12 Municipalities with high ICT Comprehensive Use Index

Rank	Municipality	Score
1	Fujisawa City, Kanagawa Pref.	430
2	Hirakata City, Osaka Pref.	346
3	Osaka City, Osaka Pref.	340
4	Hiroshima City, Hiroshima Pref.	318
5	Nishinomiya City, Hyogo Pref.	316
6	Nagoya City, Aichi Pref.	300
7	Miyoshi City, Hiroshima Pref.	292
8	Sukagawa City, Fukushima Pref.	284
8	Kyoto City, Kyoto Pref.	284
10	Naganuma Town, Hokkaido Pref.	276

* Shaded cities are cities or towns other than designated cities, core cities or special cities.

(Source) " Investigative Study on Regional Informatization Approaches and Regional Revitalization"

(ii)ICT use by municipality

Viewing the use of ICT by city categories reveals that the average score is highest in ordinance-designated cities and special districts, followed by core cities/exception cities, and then other cities and towns and villages, indicating that the larger the size of the municipality, the higher the average score **(Figure 1-11)**. However, focusing on the highest score, the highest score of the designated cities/special districts is lower than that of other cities. Cities and towns other than designated cities are ranked high in the ICT Comprehensive Use Index, indicating that municipalities taking pioneering approaches are not necessarily limited to large-size municipalities **(Figure 1-12)**.

(b) Field-specific ICT use in eight major fields

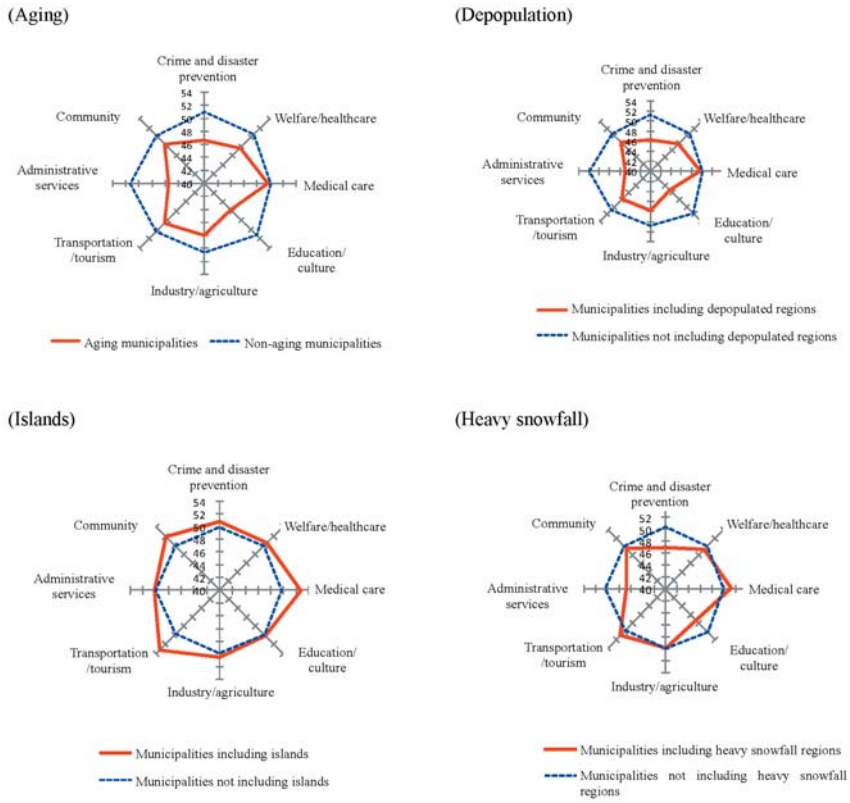
When viewing ICT use according to the attributes of municipalities, ICT use is relatively advanced in municipalities with elderly populations of 30% or more (hereinafter referred to as "aged municipalities") and municipalities located in disadvantaged areas (such as depopulated areas) in the fields such as welfare/healthcare, medical care, industry/agriculture, transportation/tourism and community **(Figure 1-13)**. For these municipalities, responding to aging and depopulation, etc. is the priority issue that administrations are faced with. It is therefore assumed that more weight is being placed on the fields for which ICT use is thought to be effective in terms of the reduction of social and welfare expenditures, cultivation of local industries, and utilization of tourism resources, etc., namely, welfare/healthcare, industry/agriculture, and transportation/tourism. In municipalities including islands, ICT is utilized more in all fields compared to municipalities that do not include islands.

(2) Key factors of ICT use

A. Development of promotional system, formulation of informatization plan and ICT-related budget percentage

A total of 2,748 municipalities are classified into four categories depending on the progress of promotional systems (condition as to whether a department in charge of ICT has been established and a Chief Information Officer (CIO) has been appointed) to examine the use of ICT according to ICT-related budget percentage. When municipalities implementing both the preparation of a promotional system and the formulation of an ICT plan are compared with munici-

Fig. 1-13 ICT Use Index by fields, viewed by the attribute of municipalities



*ICT Field-specific Use Index of municipalities are converted to deviation scores, and the average values of each attribute group are illustrated graphically.

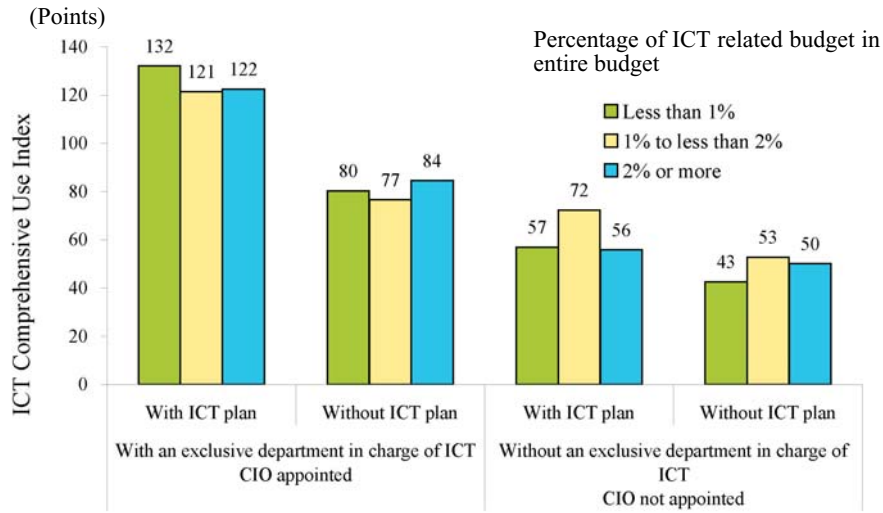
(Source) "Investigative Study on Regional Informatization Approaches and Regional Revitalization"

palities implementing neither of them, the average score of the ICT Use Index differs greatly, with the former scoring more than double the latter **(Figure 1-14)**. It shows that there is a possibility that the formulation of an ICT plan results in the effective use of ICT, in addition to the establishment of departments in charge of ICT and the appointment of a CIO.

B. Population size, wide-range cooperation and ICT-related budget percentage

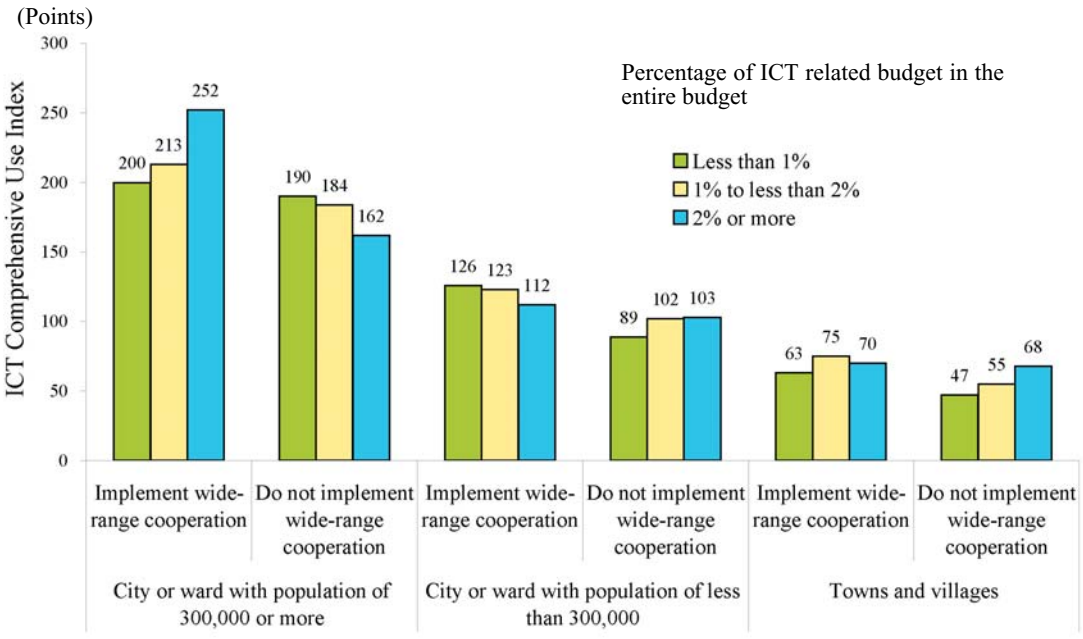
A total of 1,748 municipalities in Japan are classified according to size of population and ICT-related budget percentage, and we have examined their use of ICT as to whether they implement wide-range cooperation with neighboring municipalities in developing applications. It can then be observed that municipalities implementing wide-range cooperation make advanced use of ICT, more than those not implementing such cooperation, regardless of population size **(Figure 1-15)**. From this, it is fair to conclude that the joint development of systems involving several municipalities is the key factor in promoting the use of

Fig. 1-14 ICT Comprehensive Use Index (by promotional system, ICT plan, and ICT related budget percentage)



(Source) "Investigative Study on Regional Informatization Approaches and Regional Revitalization"

Fig. 1-15 ICT Comprehensive Use Index (by population size, wide-range cooperation, and ICT related budget percentage)



(Source) "Investigative Study on Regional Informatization Approaches and Regional Revitalization"

ICT.

C. Effect of supportive measures by the government

A total of 2,748 municipalities are classified into four categories depending on the progress of promotional systems (conditional on whether a department in charge of ICT has been established and a CIO appointed) to examine the use of ICT according to the ICT-related budget percentage. It is found from this analysis that the average score of the ICT Comprehensive Use Index of municipalities that have established promotional systems is about twice as high as that of municipalities that have not established such systems, even if both groups use supportive measures from the government **(Figure 1-16)**.

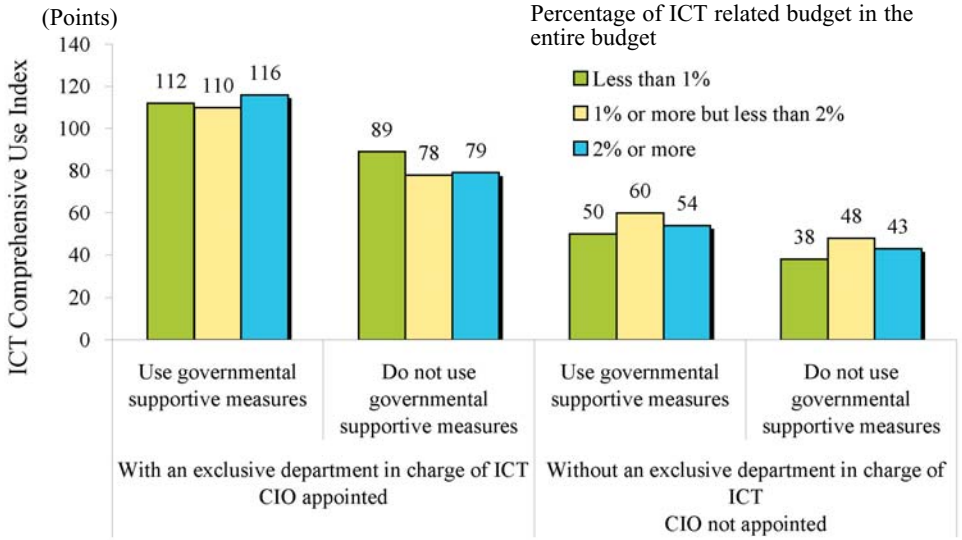
Therefore, it can be said that the simple acceptance of supportive measures does not always facilitate ICT use, but the key to the effective promotion of ICT is that municipalities should contrive ways to take full advantage of supportive measures.

(3) Evaluation and analysis of use of ICT

A. Subjective evaluation of municipalities on use of ICT

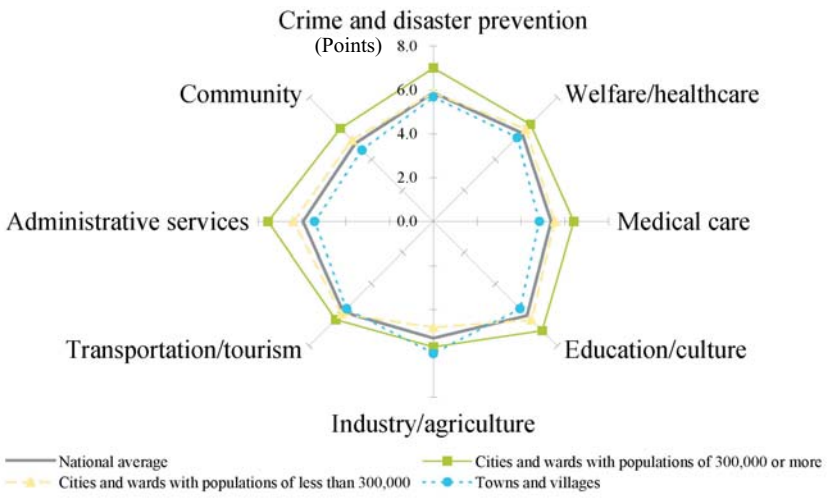
We asked municipalities using ICT if the use of

Fig. 1-16 ICT Comprehensive Use Index (by promotional system, use of governmental supportive measures, and ICT related budget percentage)



(Source) "Investigative Study on Regional Informatization Approaches and Regional Revitalization"

Fig. 1-17 Effect of ICT use in each field by population size



(Source) "Investigative Study on Regional Informatization Approaches and Regional Revitalization"

ICT was effective in terms of the following five items in each field: (i) improvement of the efficiency of administrative cost reduction, (ii) expansion of areas covered by administrative services, (iii) improvement of accuracy of information provided to residents, (iv) acceleration of speed such as the expedited response to the needs of residents, and (v) increased volume of information provided to residents.

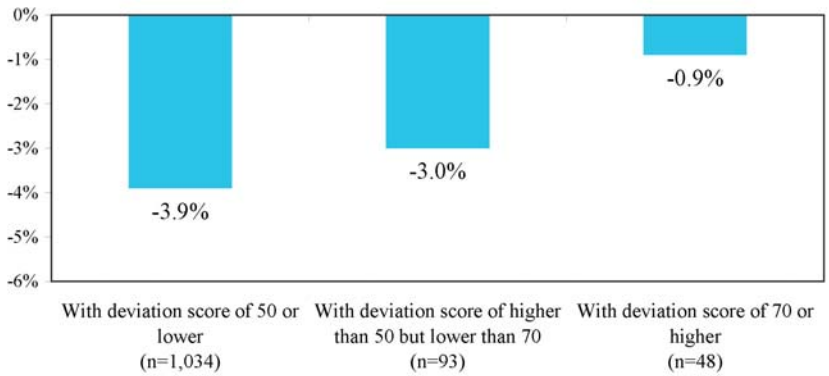
The response "fully effective" was given two points and "quite effective" one point, and other responses a zero point, and the average score for the questions from (i) to (v) in each field is used to show the evaluation of effect of ICT utilization by population size in municipalities. The result shows that the average score is highest and the effect is most noticeably felt in the administrative services field among both cities and wards with populations of more 3000,000 and less than 300,000. And the average score of towns and villages is highest in the industry/agriculture field **(Figure 1-17)**. In contrast, the average scores are low and the effect of ICT is not felt in the fields of medical care and community. This is because the effect is not exercised just by introducing an ICT system and that it will require separate care in terms of human resources development in these fields, such as the improvement of user skills and knowledge, etc.

B. Relation between ICT use and regional revitalization

(a) Industry/agriculture field

A total of 1,175 municipalities throughout the county are classified into three groups in accordance with the level of ICT utilization in the field of industry/agriculture and the change in income from agricultural production per farming household from 2000 to 2005 is examined. The result shows that while municipalities with low deviation scores of less than 50, or those with low ICT utilization, have the largest

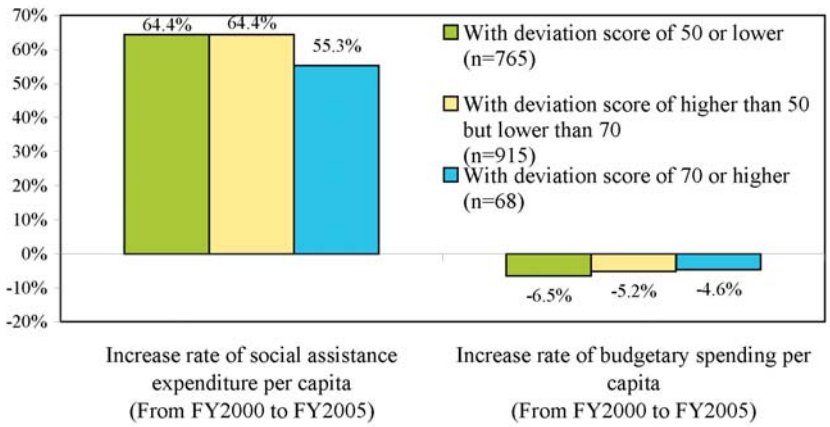
Fig. 1-18 Increase rate of production agricultural earnings per farming household by ICT use



* The data of the increase rate of production agricultural earnings per farming household are based on the Statistics on Earnings related to Agricultural Production by MAFF.

(Source)" Investigative Study on Regional Informatization Approaches and Regional Revitalization"

Fig. 1-19 Increase rate of social assistance expenditure and budgetary spending per capita by ICT use



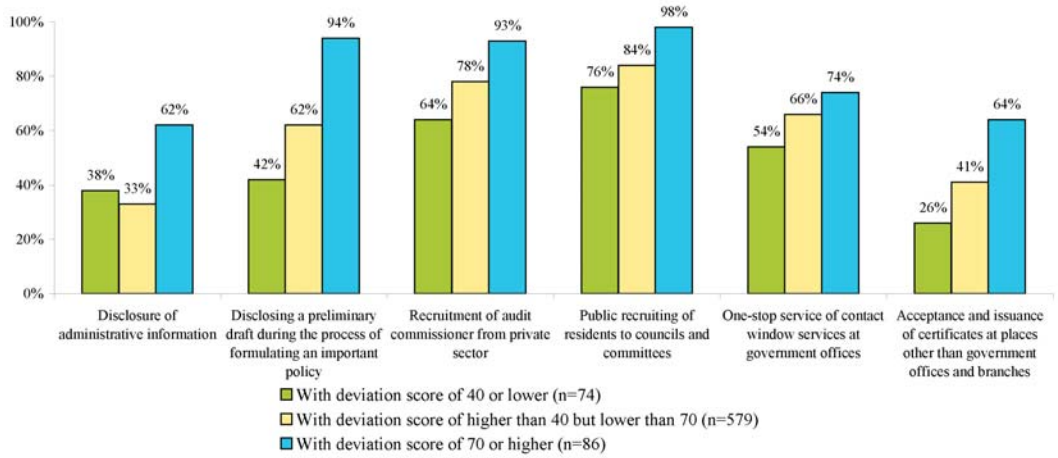
* The data of the increase rate of social assistance expenditure per capita and the increase rate of budgetary spending per capita are based on the Study on the Settlement of Accounts by Municipalities by MIC.

(Source)" Investigative Study on Regional Informatization Approaches and Regional Revitalization"

reduction rate at 3.9%, municipalities with high deviation scores of more than 70, or those with high ICT utilization, have the smallest reduction rate at 0.9%, exhibiting a difference between these groups of 3.0 points. From this, it is found that there is a clear correlation between the level of ICT utilization and the change in income from agricultural production.

The background to this may lie in the impact of

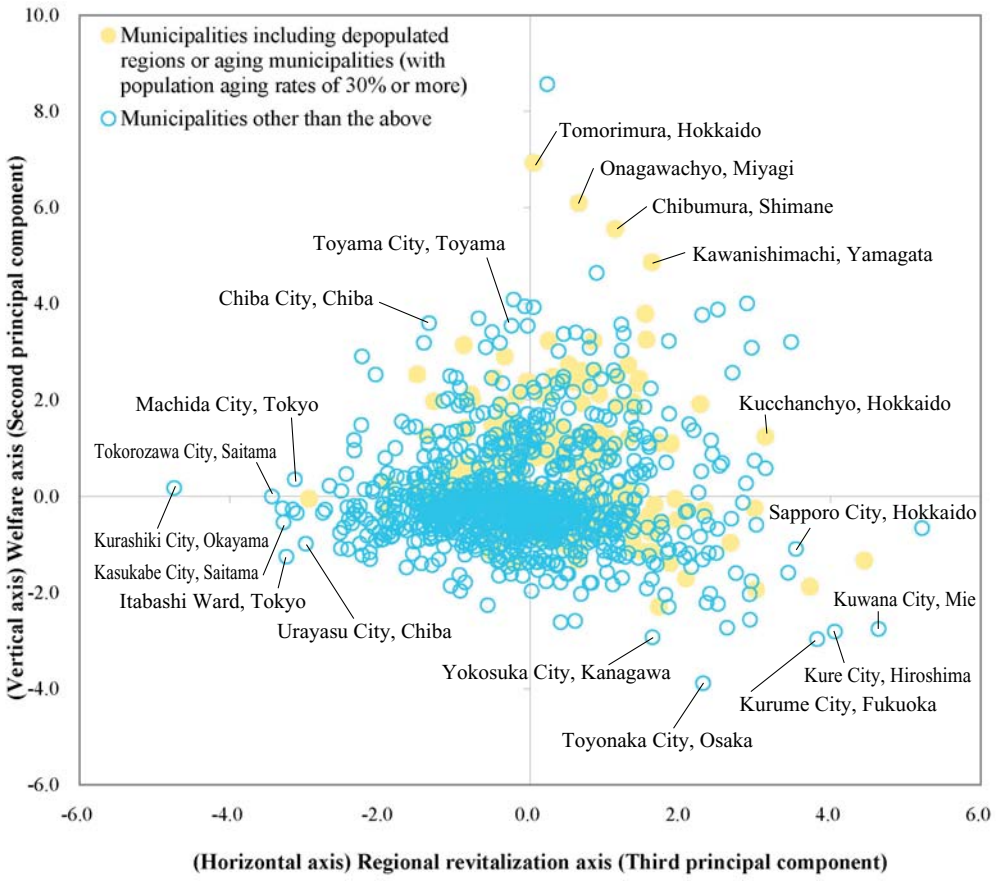
Fig. 1-20 Implementation of administrative services by ICT use



* The data of the state of implementation of administrative services, etc. are based on the Data of the Fifth Comparison Survey on the Administration of Municipalities throughout Japan, 2006 by the Nikkei Institute of Industry and Regional Economy

(Source) "Investigative Study on Regional Informatization Approaches and Regional Revitalization"

Fig. 1-21 Categorization of municipalities



(Source) "Investigative Study on Regional Informatization Approaches and Regional Revitalization"

ICT utilization, such as the introduction of a sales system via the Internet, on the income from agricultural products. With this system, for instance, local products and specialties that have previously only been consumed locally can now be sold to consumers in remote areas, enlarging the market throughout the country by the introduction of an Internet-based sale system. In reality, more than 50% of municipalities with high ICT utilization have introduced net sales systems, whereas those with low ICT utilization have not introduced such systems.

(b) Welfare/healthcare field

A total of 1,748 municipalities in the country are classified into three groups in accordance with the level of ICT utilization in the field of welfare/healthcare, and the change in social assistance expenditure from FY2000 to FY2005 is examined. The result shows that while municipalities with a high deviation score of more than 70, or those with high ICT utilization, have an the increased rate of 55.3%, municipalities with a low deviation score of less than 50, or those with low ICT utilization, have an increased rate of 64.4%, exhibiting a difference between these groups of 9.1 points. From this, it is found that there is a clear correlation between the level of ICT utilization and a restraining effect of an increase in social assistance expenditure.

(c) Administrative services

A total of 739 cities and wards in the country are classified into three groups in accordance with the level of ICT utilization in the field of administrative services, and the efforts of cities and wards in administrative services are examined. The implementation rate of such efforts as disclosure of administrative information, promotion of participation by residents in administration and improving the efficiency of administrative affairs is high among municipalities with advanced ICT use. For example, with respect to the state of disclosing a preliminary plan during the process of formulating an important policy or the state of accepting and issuing various certificates at places other than the main or branch offices, the score of municipalities with high ICT utilization with a deviation score of 70 or more is twice the score of municipalities with low ICT utilization with a deviation score of 40 or less **(Figure 1-20)**. This suggests that municipalities with a high awareness of the disclosure of administrative information, promotion of community participation in administration and facilitation of efficiency of administrative procedures are making active use of ICT in the field of administrative services.

C. Classification of municipalities in terms of ICT use

Using a principal component analysis, one of the multivariate analysis methods, a new index is created from a field-specific ICT use index in municipalities to show the structure of the relationships among ICT systems, such as the strength of such relationships. A graphic classification of municipalities based on the index is shown in **Figure 1-21**. Municipalities positioned on the upper side of the vertical axis (welfare axis) are characteristic of intensive use of ICT in the fields of welfare/healthcare and medical care, while those positioned on the right side of vertical axis (regional revitalization axis) are utilizing ICT intensively in fields such as industry/agriculture and transportation/tourism.

When the attributes of the municipalities positioned on the first quadrant which have high scores on both axes are examined, 43.0% of them have an increasing aging population profile, including depopulation areas. These municipalities have high administrative demands for regional vitalization and response to aging population, such as the development of local industry and utilization of tourism resources, and therefore, they are assumed to be using ICT specializing in these fields.

Section 2
Growth and International Competitiveness of ICT Industry

1. Growth of the ICT industry

(1) Domestic output

Nominal domestic output of the ICT industry in 2006 is 95.2 trillion yen and the ICT industry is the largest industry among all industries, accounting for 9.8%. Looking at the trend, it declined from 2000 to 2004, but has turned to an increase since 2005 **(Figure 1-22)**.

On the other hand, real domestic output of the ICT industry in 2006 is 123.8 trillion yen, up by 3.0% from the previous year. Real domestic production has been increased consistently since 1995, recording an average growth rate of 5.2% from 1995 to 2004. Since the growth of nominal growth output is smaller than that of real output, the ICT industry can be identified as an industry with a noticeable reduction in prices compared with other industries **(Figure 1-23)**.

(2) Gross Domestic Product (GDP)

Real GDP of the ICT industry has grown consistently since 1995, and the average growth rate from 1995 to 2006 is 7.1%. Looking at the real GDP of major industries from 1995 to 2006, the average growth rate of 7.1% for the ICT industry is the highest, followed by electrical machinery (annual average growth rate 6.8%) and transportation machinery (3.5%). On the other hand, the industries recording negative growth are iron and steel (-2.3%), retail (-1.3%), construction (-1.2%), and transportation (-1.1%) **(Figure 1-24)**.

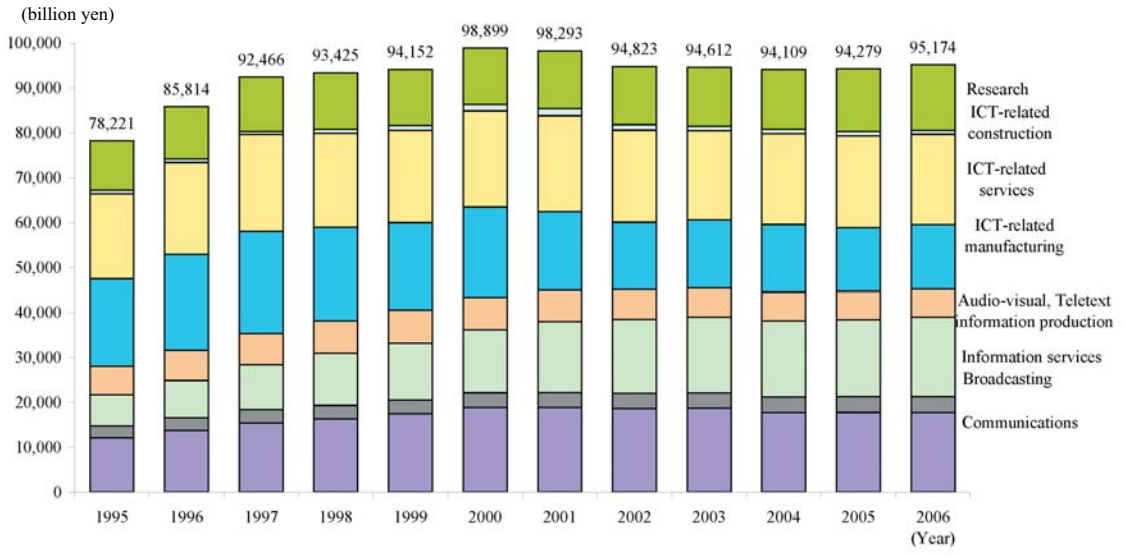
(3) Contribution to Japan's economic growth

The ICT industry has consistently contributed to the real GDP growth of Japan since 1996. In 2006, the degree of contribution of the ICT industry to the real GDP growth rate of 2.7% was 1.0%, with a contribution rate of 37.0%. It is therefore fair to say that the ICT industry has always been a driving force in the economic growth of Japan **(Figure 1-25)**.

(4) Number of employees

The number of employees in the ICT industry in 2006 was 3.853 million people (up by 1.9% over the previous year), accounting for 6.8% of all industries. When compared with 2005, while the number of employees increased in information services (up by 5.1%), research (up by 2.5%) and ICT-related services (up by 2.1%), there was a decline in the number of employees in the ICT-related construction industry (down by 13.7%) and ICT-related manufacturing (down by 2.1%) **(Figure 1-26)**.

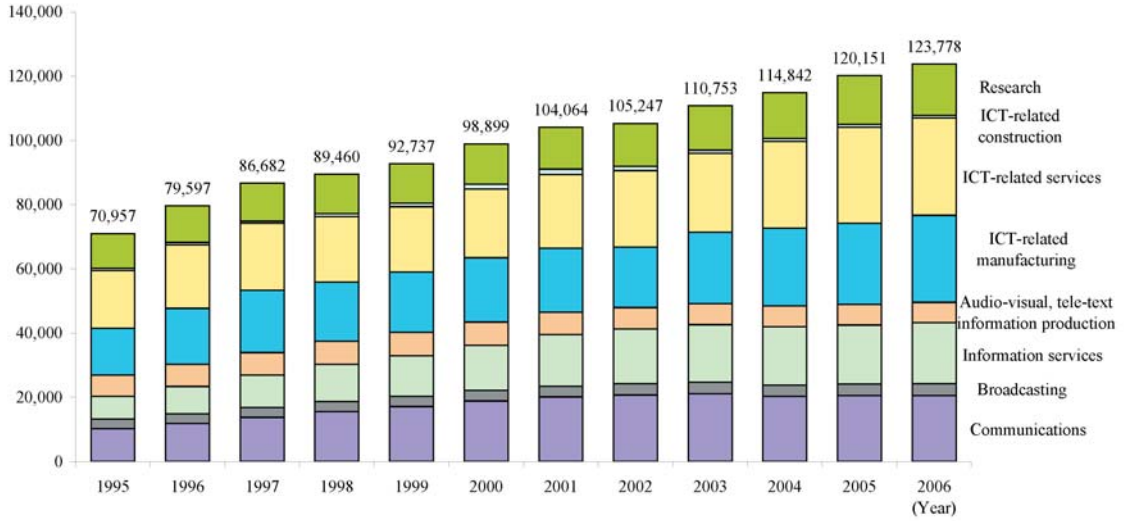
Fig. 1-22 Trends in nominal domestic output of ICT industry



(Source) "Survey on Economic Analysis of ICT"

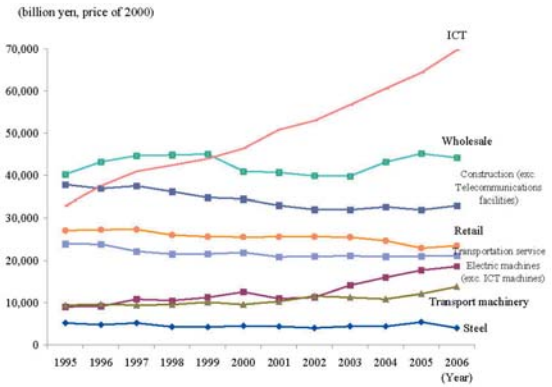
Fig. 1-23 Trends of real domestic output of ICT industry

(billion yen: price of 2000)



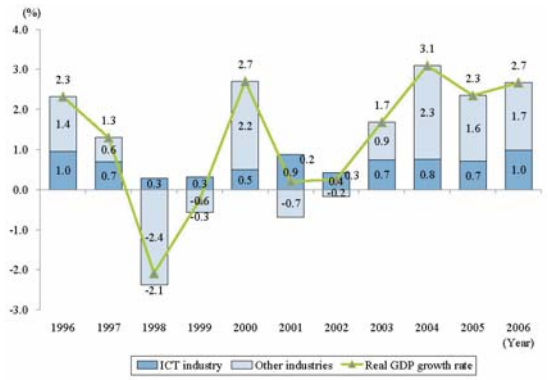
(Source) "Survey on Economic Analysis of ICT"

Fig. 1-24 Trends in real GDP of major industries



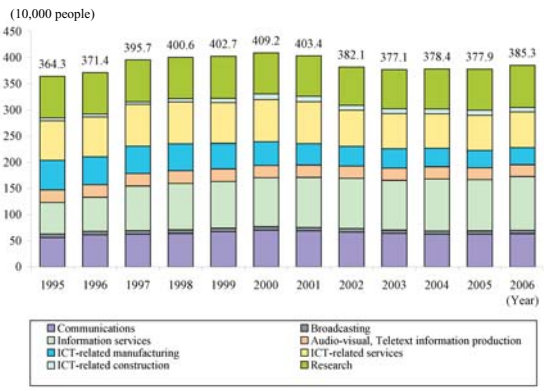
(Source) "Survey on Economic Analysis of ICT"

Fig. 1-25 Contribution of ICT industry to real GDP growth rate



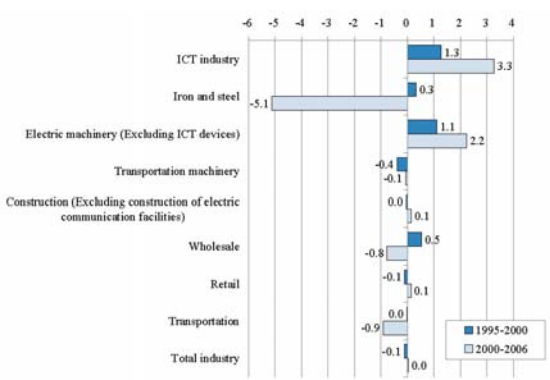
(Source) "Survey on Economic Analysis of ICT"

Fig. 1-26 Trends in the number of employees of ICT industry



(Source) "Survey on Economic Analysis of ICT"

Fig. 1-27 Contribution of TFP growth to domestic output growth by industry



(Source) "Survey on Economic Analysis of ICT"

(5) Growth rate of Total Factor Productivity (TFP)

Looking at the degree of the contribution of TFP growth rate to the domestic output of major industries, the ICT industry and electrical/machinery have made a great contribution from 2000 to 2006, with 3.3% and 2.2%, respectively **(Figure 1-27)**.

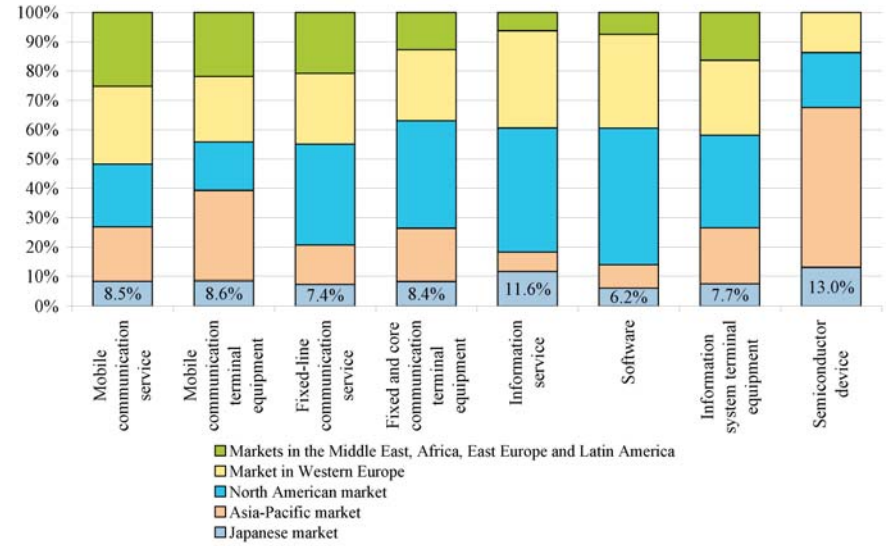
2. Status of the competitiveness of the ICT industry

(1) ICT-related global market

Looking at the proportion of the size of the ICT market by region, the size of the Japanese market accounts for around 10% of the global market in every sector. Semiconductor devices account for the largest proportion, but still at a low level of 13.0% **(Figure 1-28)**.

When looking at the annual average growth rate of the market from 2005 to 2007, the growth rate of the Japanese market is less than 5% in every sector, remaining at a low level compared with the average worldwide market. Markets in Asia-Pacific, the Middle-East, Africa, Eastern Europe and Central and South America are growing faster than the global

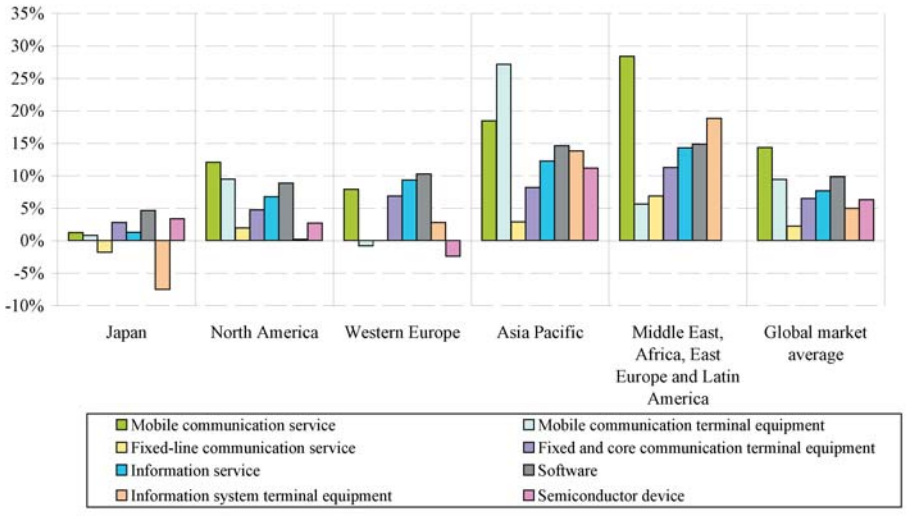
Fig. 1-28 Share of ICT related market by region (2007)



* For semiconductor devices, the Middle East, Africa and Eastern Europe are included in "Western Europe" and Latin America is included in "North America."

Based on the materials by Gartner

Fig. 1-29 Growth of ICT related market in the world by region (average of 2005-2007)



* For semiconductor devices, the Middle East, Africa and Eastern Europe are included in "Western Europe" and Latin America is included in "North America."

Based on the materials by Gartner

average, leading the global markets **(Figure 1-29)**. In order for the ICT corporations of Japan to continue to grow, it would seem to be important for them to expand their presence in the rapidly growing markets in Asia-Pacific, the Middle East, Africa, Eastern Europe and Central and South America.

(2) Presence of Japanese corporations in the ICT markets of the world

A. Communication-related markets

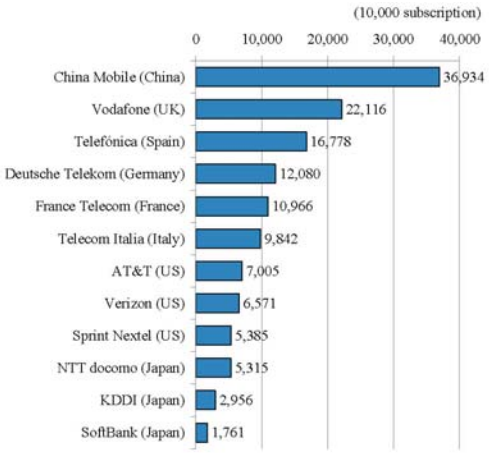
Out of communication services, mobile communication services are the most used in the world and global competition is intensifying. In terms of the number of subscribers of major mobile communication carriers, China Mobile of China is ranked top of the world. Major carriers in Europe have gained more subscriptions than major carriers in the U.S. and Japan by active overseas promotion. On the other hand, sales of major carriers in Japan, the U.S. and Europe together are higher than China Mobile of China **(Figure 1-30)**.

Looking at the market share of companies in the communication terminal and device market by region, the market share of Japanese corporations in mobile communication, PDAs, mobile infrastructure, optical transmission systems, LAN switches and routers for business use are 14.9%, 9.0%, 3.9%, 13.4%, 2.0% and 2.6%, respectively.

The largest share in the mobile phone device and

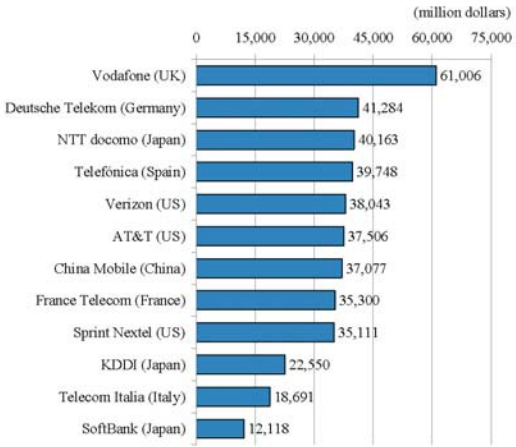
Fig. 1-30 Number of service subscribers and sales of the world's mobile communication carriers

Number of service subscribers (End of 2007)



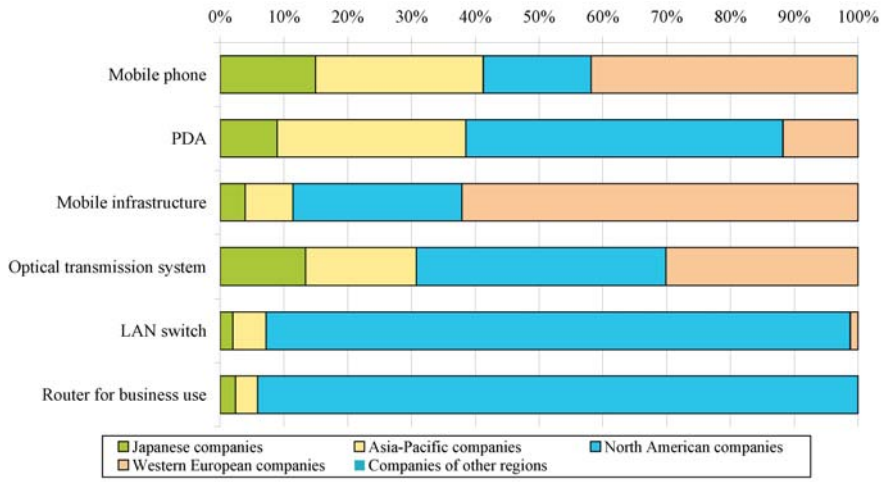
Based on the materials released by each company

Sales (FY2006)



Based on the materials by Thomson Reuters

Fig. 1-31 Vendor share by region in communication terminal/device markets in the world



* Data for mobile phones are for 2007, data for PDAs, LAN switches, routers for business use are for the first half of 2007, and data for mobile infrastructure and optical transmission systems are for 2006.

Based on the materials by Gartner

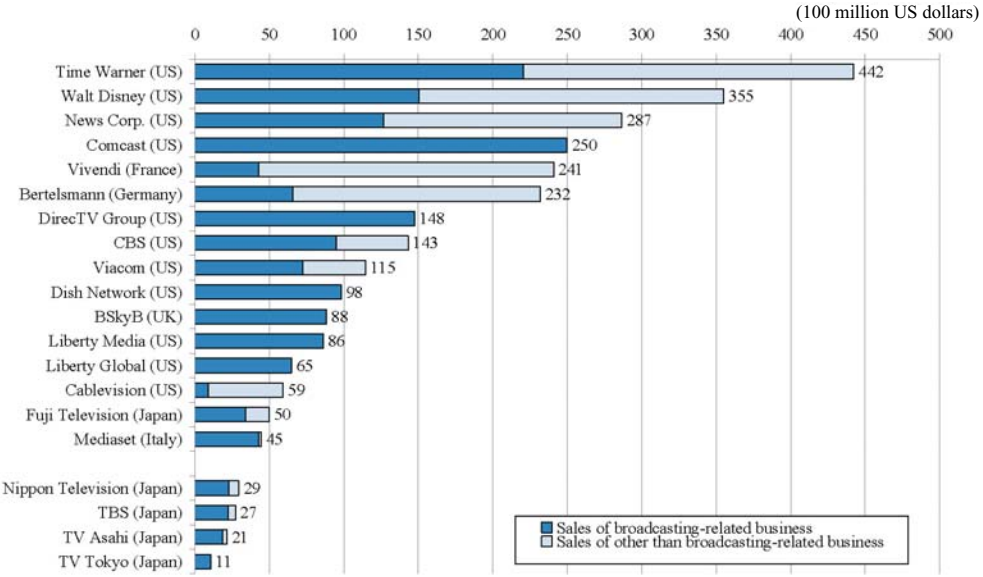
mobile infrastructure markets is accorded to European companies, at 41.8% and 62.1% respectively. The markets for PDAs, optical transmission systems, LAN switches and routers for business use are dominated by North American companies, with 49.7%, 39.2%, 91.6% and 94.1%, respectively **(Figure 1-31)**.

B. Broadcasting/media-related markets

Comparison of sales from major broadcasting/media companies of the world shows that conglomerate-type media companies in the western world dominate sales of the world **(Figure 1-32)**. Global competition for media services is assumed to be centered on the content, such as movies and TV programs; however, top U.S. companies are actively involved in global businesses through investment in overseas broadcasters.

As the Internet becomes an increasingly important in the field of media and broadcasting, the presence of companies which operate Internet businesses on a global scale is growing in the world. While top U.S. companies are actively involved in international busi-

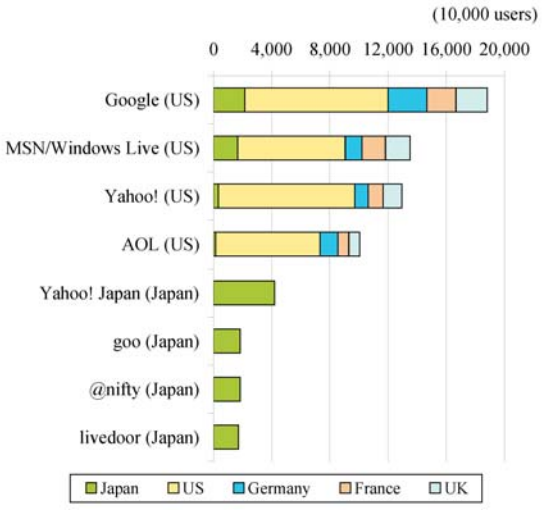
Fig. 1-32 Sales of major broadcasting/media companies of the world (FY2006)



Based on the materials released by each company and Thomson Reuters

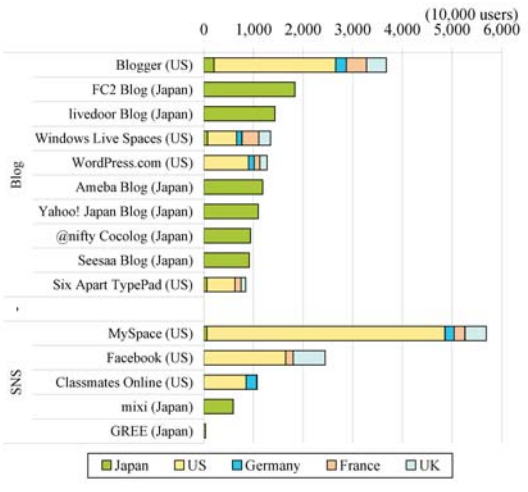
Fig. 1-33 Number of users of major websites by Japan and the U.S. in Japan, the U.S. and Europe (January 2008)

Search and portal



Based on the materials by Nielsen Online

Blog, SNS



Based on the materials by Nielsen Online

ness operations by establishing websites in many languages for overseas users, Japanese companies have yet to develop such overseas businesses **(Figure 1-33)**.

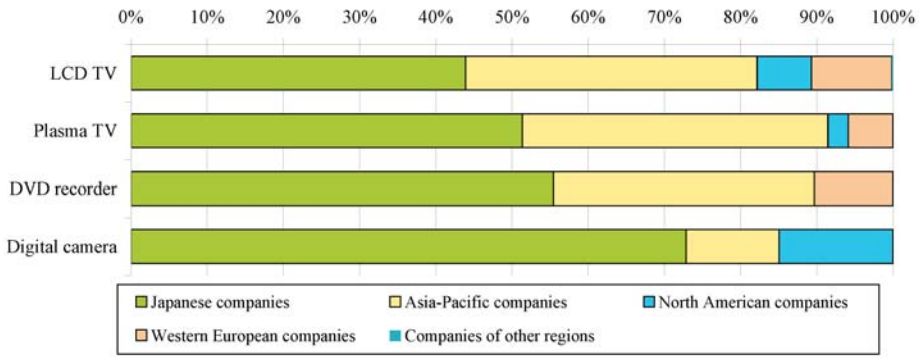
When looking at corporate market share in the broadcasting/media-related terminal and device markets, Japanese companies have a relatively a higher share than companies in any other regions of the LCD TV, Plasma TV, DVD recorder and digital camera markets, at 43.9%, 51.3%, 55.4% and 72.9%, respectively. In addition to Japanese companies, Asia-Pacific corporations have a high level of market share **(Figure 1-34)**.

C. Information system/service-related markets

Looking at corporate market share in the information services markets of the world in 2006, Japanese companies accounted for more than 10% in the system development and system management/control sectors, with 13.3% and 13.8%, respectively, but for less than 10% in the consulting, BPO, hardware product support, and software product support sectors, with 7.5%, 8.5%, 9.5%, and 7.3%, respectively. In all these markets, the highest share was achieved by U.S. companies. In the software market, U.S. market share is also extremely high, while the share of Japanese companies is 0.4% for application software and 2.5% for infrastructure software, both below 3% **(Figure 1-35)**.

When looking at corporate market share in the major information system-related terminal/device markets in the world, Japanese companies have a dominant market share in the copier market of 63.3%. Also, in the notebook PC and printer market Japan has a

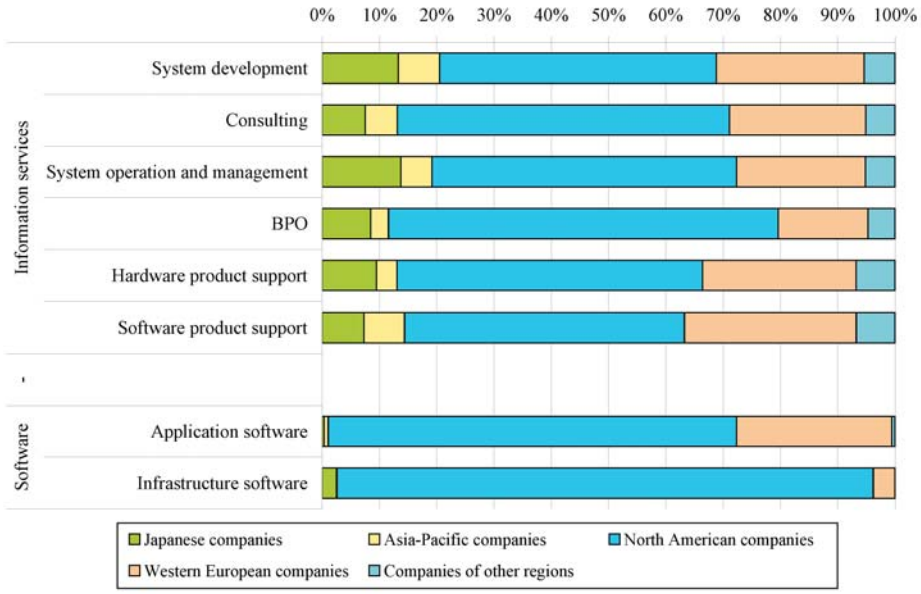
Fig. 1-34 Vendor share by region in broadcasting/media-related terminal/device markets in the world (2007)



*Data for digital cameras are for 2006

Based on the materials by Display Search for LCD TVs and Plasma TVs; the materials by Fuji Chimera Research Institute for DVD recorder and digital camera

Fig. 1-35 Vendor share by region in information services and software markets in the world (2006)



Based on the materials by Gartner

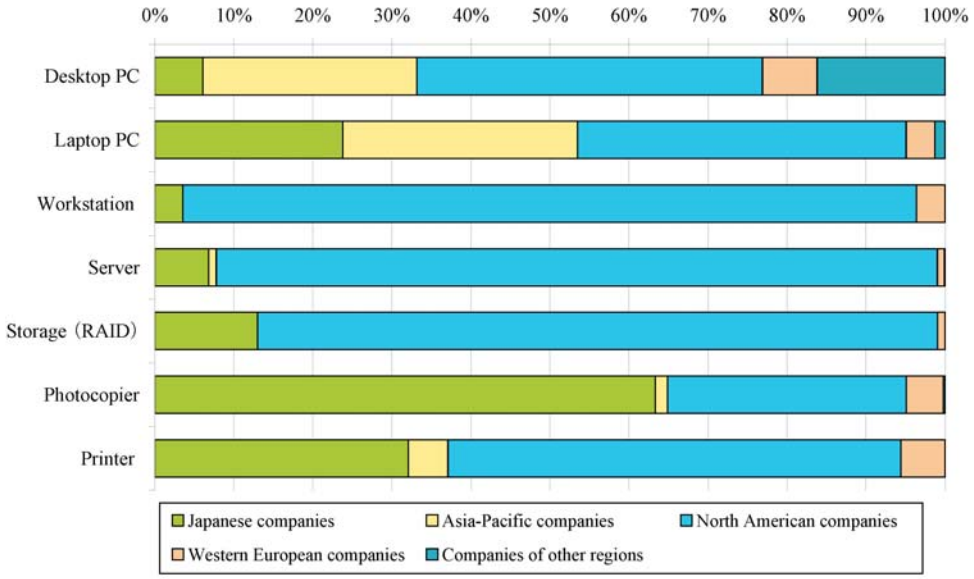
market share of 23.8% and 32.1%, respectively. On the other hand, the Japanese share of the desktop PC, workstation and server market is 6.1%, 3.6% and 6.8%, respectively: all less than 10%. In the storage market, Japan has a 13.0% market share **(Figure 1-36)**.

D. Device-related markets

Looking at corporate market share by region in the semiconductor device markets of the world, Japanese corporations have a relatively high market share compared with corporations in other regions in the market for optoelectronics devices used for visual/image-related equipment, etc., and in the market for discrete semiconductors, which are electronic circuit elements including transistor diodes, etc., at 18.9% and 15.3%, respectively. Application Specific semiconductor devices and memories have a market share of 18.9% and 15.3%, respectively, but processors account only for 1.6%. **(Figure 1-37)**.

Japanese companies and Asia-Pacific companies dominate the display device market. In the markets for LC devices for mobile phones and plasma displays, Japanese corporations have a market share of 51.1%

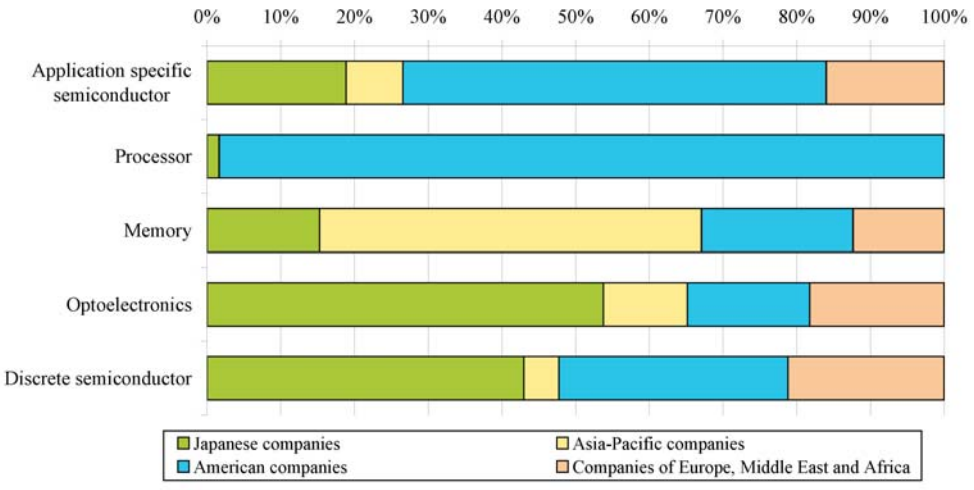
Fig. 1-36 Vendor share by region in information system-related terminal/device markets in the world (2007)



* Data for storage (RAID) are of 2006

Based on the materials by Gartner

Fig. 1-37 Vendor share by region in semiconductor device markets in the world (2006)



Based on the materials by Gartner

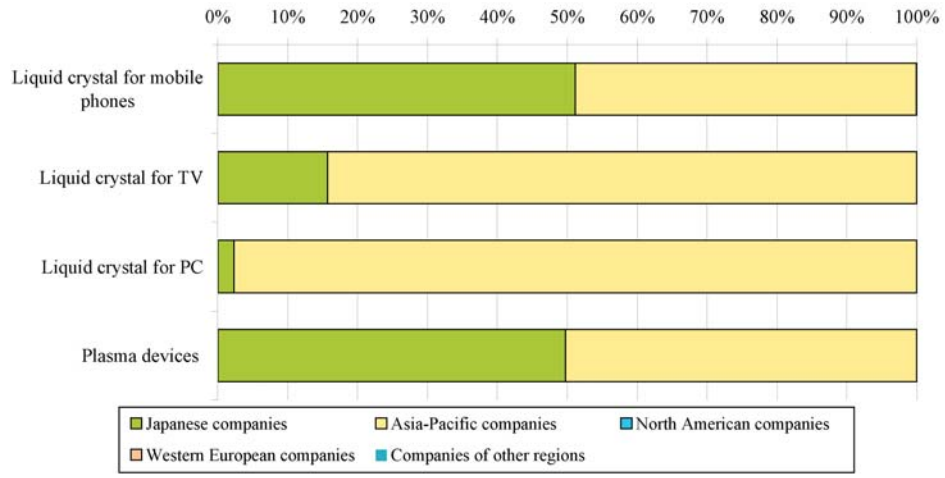
and 49.8%, respectively, sharing the markets with Asia-Pacific corporations. However, the market share of Japanese companies in the LC devices for TVs and PCs, which is the volume zone, is 15.7% and 2.3%, respectively, as those markets are dominated by Asia-Pacific companies **(Table 1-38)**.

(3) Presence of Japan in ICT-related exports in the world

Looking at the market share by region of ICT-related exports in the world, China's export value market share is high for all products, establishing itself as the world's production base. However, countries in the Asia-Pacific region such as South Korea and Taiwan hold large shares for semiconductor devices.

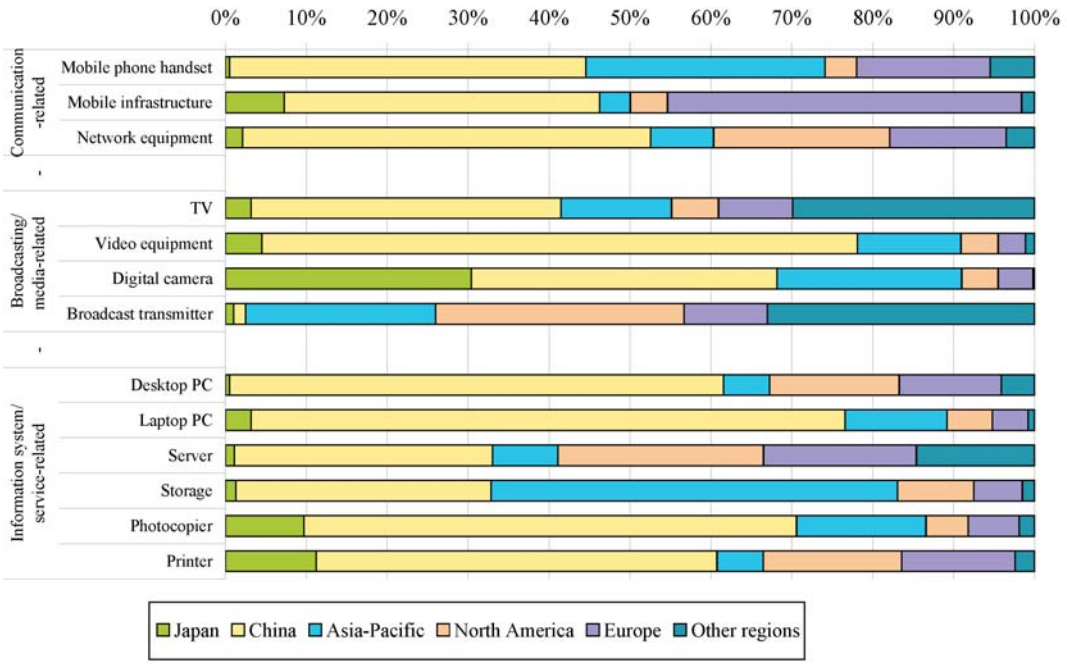
Japan's share is less then 10% except for only a few products. In particular, its share does not reach 5% for many terminal equipment products. In North America, there are many products with a high corporate market share but there are not many products with an export share as high as the corporate market share, which indicates that many production factories have been transferred overseas, such as to China **(Figure 1-39 and Figure 1-40)**.

Fig. 1-38 Vendor share by region in display device markets in the world (2007)



Based on the materials by Display Search

Fig. 1-39 Export value share by region of ICT-related terminals and devices in the world (2007)



Based on the materials by World Trade Atlas

3. Challenges for strengthening the competitiveness of the ICT industry

(1) Degree of overseas presence of ICT companies and their profitability

Japanese companies tend to not go out into markets abroad unless they hold large domestic market shares. This is because the domestic market is highly competitive, which keeps the business size per company small, and they cannot enjoy economies of scale to start businesses abroad **(Fig. 1-41)**.

On the other hand, North American companies tend to increase their shares abroad even if they do not hold large market shares in their own countries. It is suggested that they have in view global business operations from the start **(Fig. 1-42)**.

Looking at business profits, ICT vendors in Japan are the world's top-class performers in terms of sales, but strong sales do not result in large operating income **(Figure 1-43)**.

ICT vendors in the United States are achieving sales and operating income in both domestic and overseas markets in a well-balanced manner, obtaining large operating income ratio. On the other hand, domestic business takes up about 80% of operating income for ICT vendors in Japan, and their operating income ratio of overseas business is generally low **(Fig. 1-44 and 1-45)**.

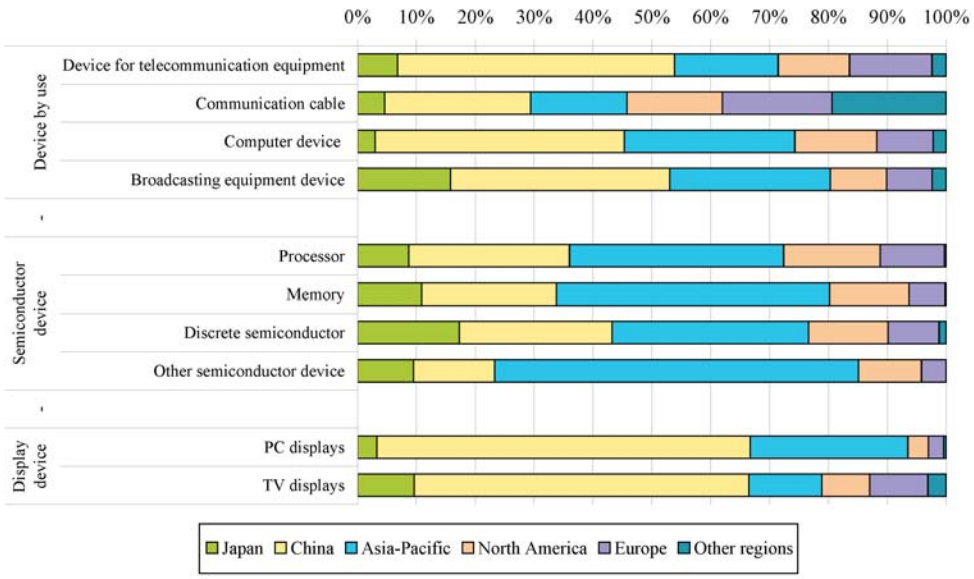
(2) Business environment surrounding ICT industry

Looking at the year when the major ICT vendors were established, the majority were firms of long-standing in Japan, established in the pre-War period or right after the War. However, in North America, new corporations are being established continuously, growing into big businesses. In Japan, it would seem to be important to develop an environment that will generate new companies continuously and also grow into big businesses **(Figure 1-46)**.

Many of the founders of major newly emerging ICT companies in the U.S. have majored in engineering, such as computer science, etc. On the other hand, many of the founders of newly emerging ICT companies in Japan have majored in humanities, such as economic and business administration, etc. Since universities, etc. in the U.S. are providing human resource development programs in cooperation with outside companies and investors, it would seem to be crucial for Japan to develop human resources with knowledge of both business and technology **(Figure 1-47)**.

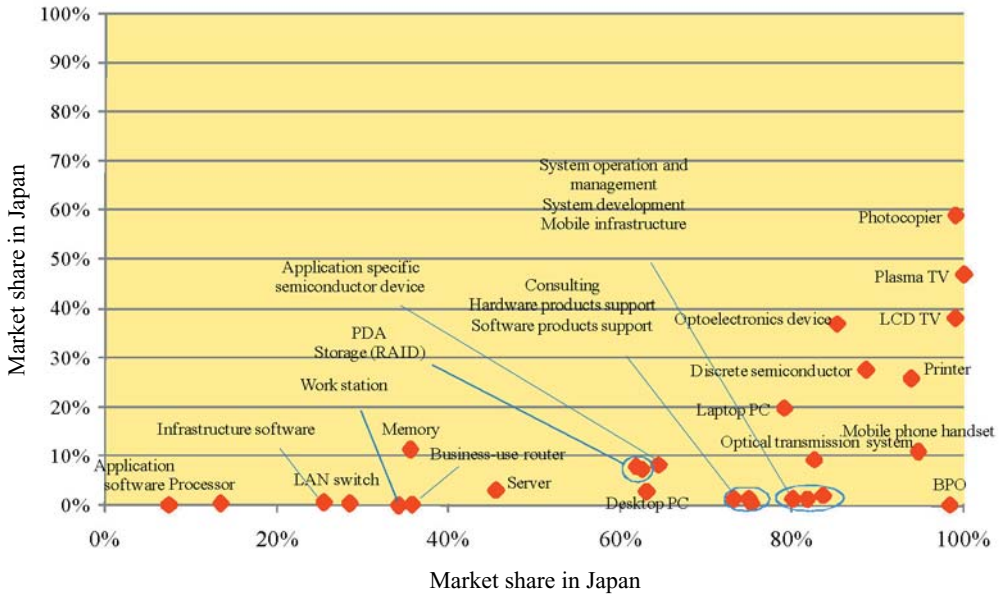
Looking at the number of patent applications submitted to WIPO in the field of advanced ICT, Japan's share is less than 10% in many sectors. Japan's share of the number of patents in all fields including those other than ICT is 16.6%. When compared with this figure, the number of patent applications in the ICT field is generally at a low level. It would seem to be necessary to further enhance an intellectual property strategy **(Figure 1-48)**.

Fig. 1-40 Export value share by region of ICT-related devices in the world (2007)



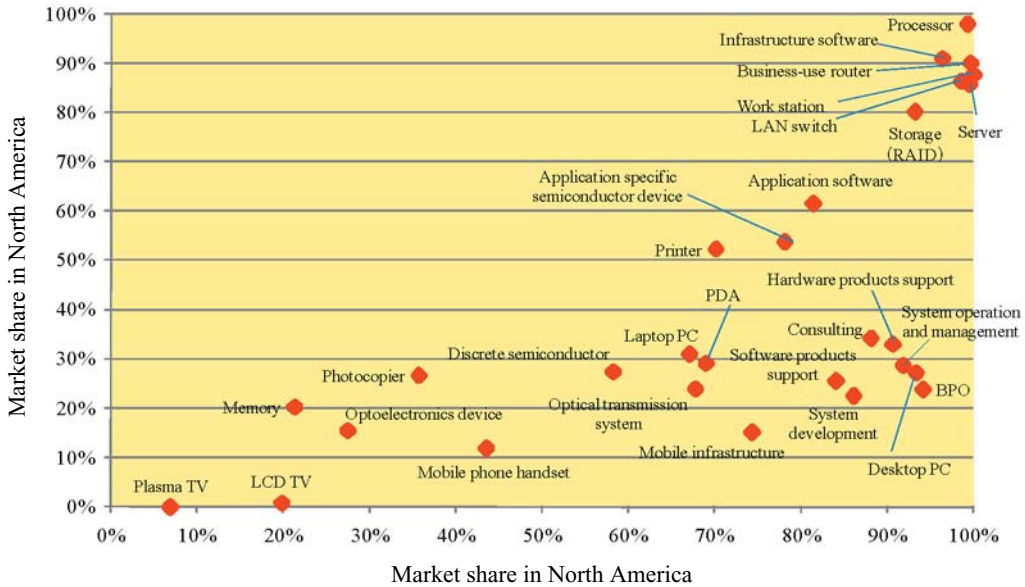
Based on the materials by World Trade Atlas

Fig. 1-41 Market shares of Japanese companies in their own region and outside



Based on the materials by Gartner

Fig. 1-42 Market shares of North American companies in their own region and outside



Based on the materials by Gartner

Fig. 1-43 World's top ICT vendors in terms of sales and business profits

■Companies with large sales

Rank	Corporate name	Country	Sales (100 million dollar)
1	Siemens	Germany	1059.2
2	Samsung Electronics	South Korea	918.6
3	Hitachi	Japan	917.3
4	HP	U.S.	916.6
5	IBM	U.S.	914.2
6	Matsushita Electric Industrial	Japan	815.3
7	Sony	Japan	742.6
8	Toshiba	Japan	637.0
9	Dell	U.S.	574.2
10	Nokia	Finland	542.2
11	Microsoft	U.S.	511.2
12	LG Electronics	South Korea	498.3
13	Fujitsu	Japan	456.5
14	Motorola	U.S.	428.8
15	NEC	Japan	416.5
16	Hon Hai	Taiwan	405.2
17	Philips	Germany	355.7
18	Intel	U.S.	353.8
19	Cisco	U.S.	349.2
20	Canon	Japan	348.9

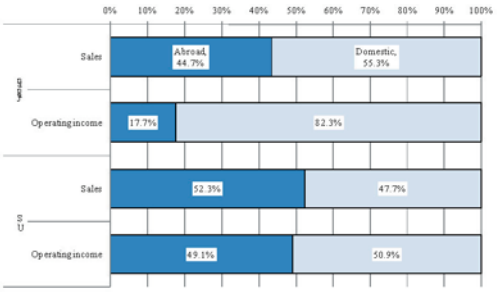
■Companies with large operating income

Rank	Corporate name	Country	Operating income (100 million dollar)
1	Microsoft	U.S.	190.4
2	IBM	U.S.	122.1
3	Samsung Electronics	South Korea	96.9
4	Cisco	U.S.	87.0
5	Nokia	Finland	68.0
6	HP	U.S.	67.7
7	Siemens	Germany	67.6
8	Intel	U.S.	62.1
9	Oracle	U.S.	61.3
10	Canon	Japan	59.3
11	Apple	U.S.	44.1
12	Motorola	U.S.	41.6
13	Matsushita Electric Industrial	Japan	41.1
14	Ericsson	Sweden	39.9
15	Google	U.S.	35.9
16	Texas Instruments	U.S.	33.7
17	SAP	Germany	33.7
18	Dell	U.S.	31.7
19	Qualcomm	U.S.	28.4
20	Hon Hai	Taiwan	23.6

* Data are of ICT vendors with consolidated sales in FY2006 of 1 trillion yen for Japanese companies and 8 billion US dollars for overseas companies.

Based on the materials by Thomson Reuters

Fig. 1-44 Regional comparison of sales and operating income for major ICT vendors of Japan and the U.S. (FY2006)



Based on the materials by Thomson Reuters

Fig. 1-45 Domestic operating income ratio and overseas operating income ratio of major ICT vendors of Japan and the U.S.

	Domestic	Abroad
Japan	6.4%	1.8%
U.S.	15.6%	13.7%

Based on the materials by Thomson Reuters

Fig. 1-46 Founded years of major ICT vendors in the world

	Japan		North America		Europe		Asia	
1990~			Google	1998	(Infineon)	1999	(AU Optronics)	2001
							Asustek	1990
1980~	(NTT Data)	1988	Qualcomm	1985	(STMicroelectronics)	1987	Quanta	1988
			Dell	1984			Lenovo	1984
			Cisco	1984			Compal	1984
			Sun Microsystems	1982				
1970~			Seagate	1979	SAP	1972	Acer	1976
			EMC	1979			Hon Hai	1974
			Oracle	1977				
			Apple	1976				
			Microsoft	1975				
1960~			SAIC	1969	(Nokia)	1967	Samsung	1969
			Intel	1968	CapGemini	1967		
			EDS	1962				
1950~	Kyocera	1959	CSC	1959			LG	1958
	Sanyo Electric	1950						
1930~	Sony	1946	Tyco Electronics	1941				
	Seiko Epson	1942	HP	1939				
	Canon	1937	Texas Instruments	1930				
	Ricoh	1936						
	Konica Minolta	1936						
	Sharp Corporation	1935						
	Fujitsu	1935						
	tsushita Electric Indust	1935						
	Fujifilm	1934						
1900~	Mitsubishi Electric	1921	Motorola	1928				
	Hitachi	1920	IBM	1914				
	Olympus	1919	Xerox	1906				
	Toshiba	1904						
~1900	NEC	1899	Nortel	1895	Alcatel-Lucent	1898		
			Eastman Kodak	1880	Philips	1891		
					Ericsson	1876		
					Siemens	1847		

* ( ) shows companies founded as a spin-off from an existing company or through business integration

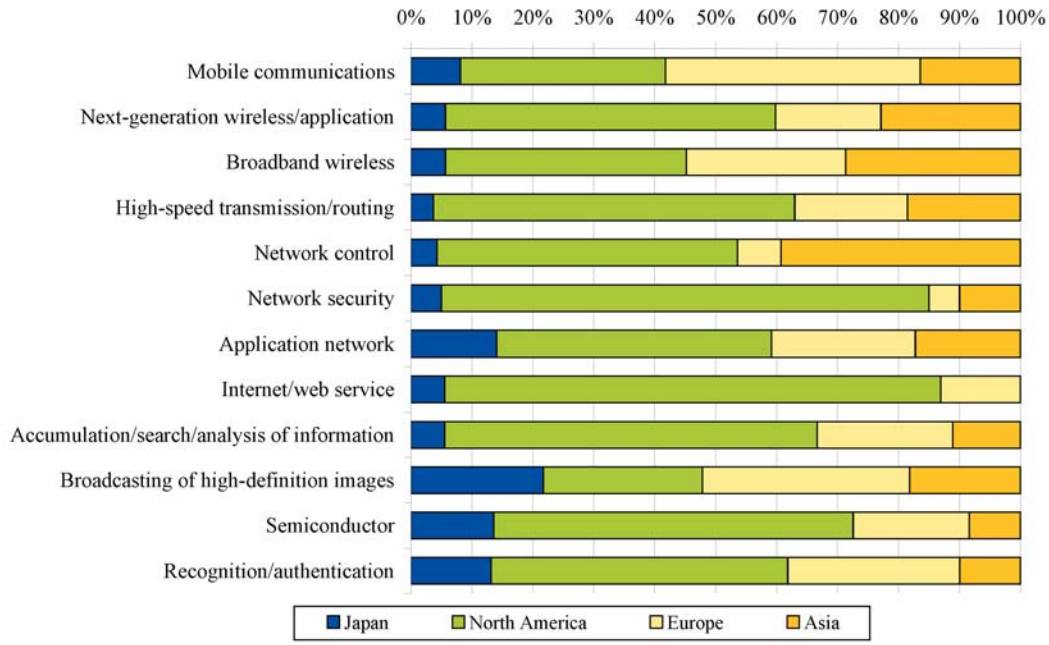
Based on the materials released by each company

Fig. 1-47 Background of the founders of new ICT companies in the United States

Year founded	Name of founder	Academic background		Major	Humanities	Science and technology
1998	Sergey Brin	Stanford University	Master	Computer science		○
	Larry Page	Stanford University	Master	Computer science		○
1995	David Filo	Stanford University	Master	Electrical engineering		○
	Jerry Yang	Stanford University	Master	Electrical engineering		○
1995	Pierre Omidyar	Tufts University	Bachelor	Computer science		○
1985	Irwin Jacobs	Massachusetts Institute of Technology	Doctor	Computer science, Electrical engineering		○
	Andrew Viterbi	University of Southern California	Doctor	Communication engineering		○
1984	Len Bosack	Stanford University	Master	Computer science		○
	Sandy Lerner	Stanford University	Master	Computer science		○
1982	Scott McNealy	Stanford University	Master	Business	○	
	Vinod Khosla	Indian Institute of Technology Delhi	Bachelor	Electrical engineering		○
		Stanford University	Master	Business	○	
	Andy Bechtolsheim	Stanford University	Doctor	Computer science, Electrical engineering		○
1982	John Warnock	University of Utah	Doctor	Computer science		○
	Charles Geschke	–	–	–		
1979	Richard Egan	Northeastern University	Bachelor	Electrical engineering		○
	Roger Marino	–	–	–		
1975	Bill Gates	Harvard University	Bachelor	Computer science		○
	Paul Allen	–	–	–		

Based on the materials released by each company

Fig. 1-48 Share of the number of ICT-related patent applications to WIPO by region (2002-2007)



(Source) "Study on the Cross-Country Comparison on R&D in ICT Field"

4. Improvement of corporate productivity through the use of ICT

(1) Comparison of U.S.-Japanese investment for informatization

Real investment for informatization in 2006 in Japan was recorded at 19.2 trillion yen, or with an increase of 7.1% over the previous year and the percentage of investment for informatization among private investment is 22.2%. On the other hand, real investment for informatization in 2006 in the U.S. recorded 448.6 billion US dollars, up by 11.9% from the previous year, and the percentage of investment for informatization among private investment is 34.0%.

When the change in real investment for informatization is compared between Japan and the U.S., while the investment for informatization in Japan in 2006 grew by 1.88, that in U.S. grew by 3.73. The growth rate of the U.S. is about twice that of Japan **(Figure 1-49)**.

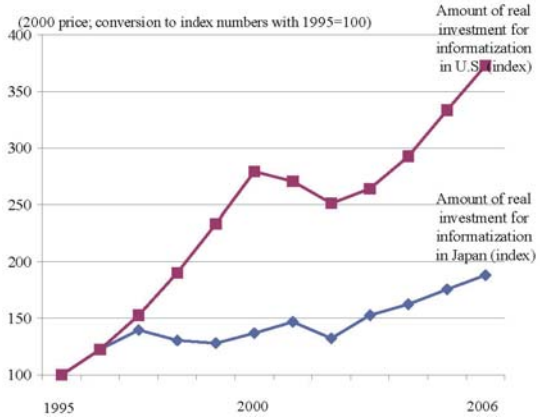
(2) Comparison of ICT capital stock between Japan and the U.S.

Japan's ICT capital stock in 2006 increased by 6.6% from the previous year to 42.2 trillion yen and the ratio of ICT capital stock to private capital stock is 3.6%. ICT capital stock for the U.S. in 2006 grew by 9.9% from the previous year to 976.9 billion US dollars, and the ratio of ICT capital stock to private capital stock was 8.3%. When a change in ICT stock is compared between Japan and the U.S., while Japan's ICT capital stock grew by 1.99, that of the U.S. grew by 3.77 from 1995 to 2006. The growth rate of the U.S. is nearly twice that of Japan **(Figure 1-50)**.

(3) TFP growth and improvement of labor productivity

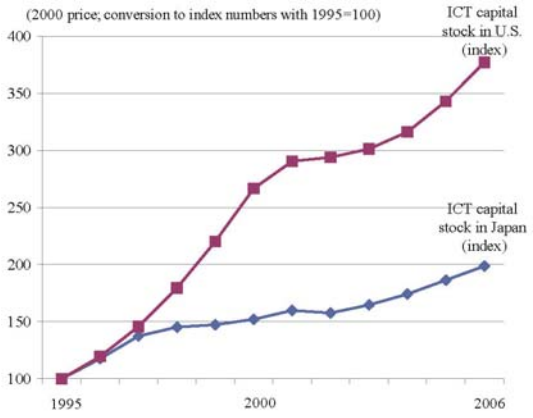
Labor productivity in the U.S. has been improving consistently since 1990, with a growth rate of 2.7% from 2000 to 2006. On the other hand, labor productivity in Japan has remained virtually unchanged, and the growth rate from the same period is lower than that of the U.S. at 2.1%. When factors contributing to labor productivity growth are compared, it is observed that the growth of labor productivity in the U.S. is largely attributed to TFP growth, whereas labor productivity growth in Japan is largely dependent on capital deepening **(Figure 1-51)**.

Fig. 1-49 Comparison of Japan-U.S. change in real investment for informatization



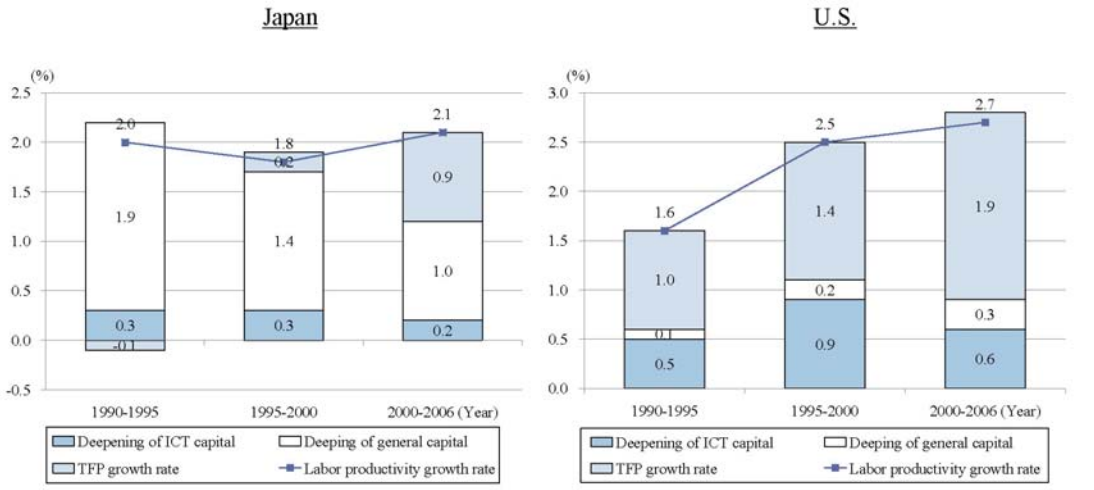
(Source) "Survey on Economic Analysis of ICT"

Fig. 1-50 Comparison of Japan-U.S. change in ICT capital stock



(Source) "Survey on Economic Analysis of ICT"

Fig.1-51 Contribution of TFP growth to the growth of labor productivity



(Source) "Survey on Economic Analysis of ICT"

Section 3
New Lifestyles by Ubiquitous Networks

1. Current state of ICT usage in people's lives

(1) Internet use

The Internet population at the end of 2007 is estimated to be 88.11 million people (up by 0.7% from the previous year), with a penetration rate estimated to be 69.0% (up by 0.5 points) **(Figure 1-52)**.

When personal Internet use is compared by generation between 2007 and 2004 (three years earlier), use is expanding across all generations; particularly, use by the generations between 50 and 79 years of age, which increased by about 10 points from three years earlier **(Figure 1-53)**.

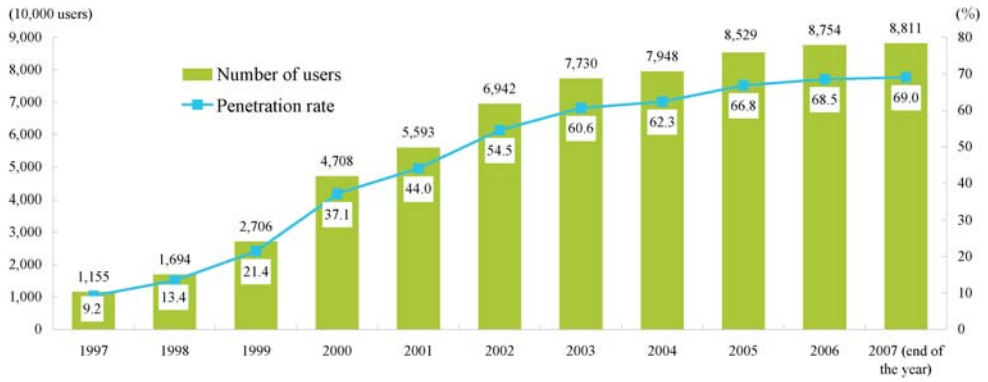
(2) Broadband use

The proportion of Internet users on home computers who use broadband circuits is 40.6% of the entire population above age 6 as of the end of 2007, which accounts for 79.6% of home Internet users **(Figure 1-54)**.

(3) Web use

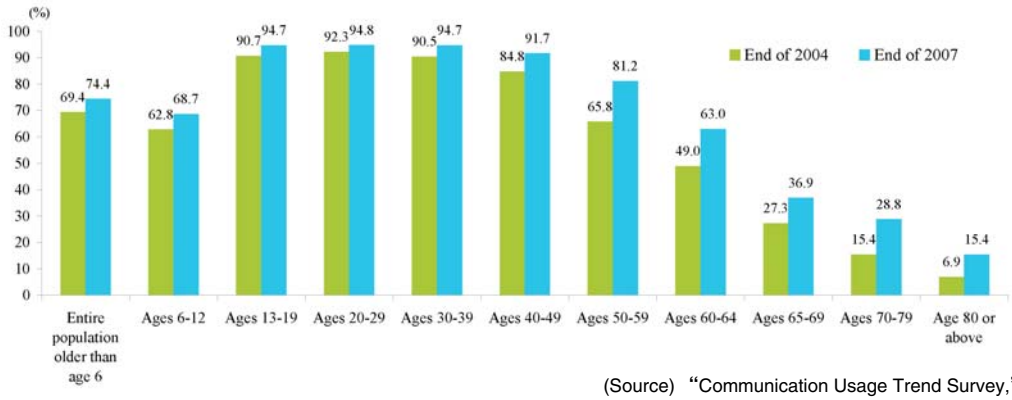
When the characteristics of use by function/services by generation[5] are examined, use of Internet shopping, Internet auctions and financial transactions

Fig. 1-52 Trends in the number of Internet users and penetration rate



(Source) "Communication Usage Trend Survey," MIC

Fig. 1-53 Internet use by generation (comparison between end of 2004 and end of 2007)



(Source) "Communication Usage Trend Survey," MIC

[5] Students, persons not in employment employed and part-time workers aged 20-29 are classified as the young generation, full-time employees and those engaged in family businesses are classified as the working group, housewives aged between 20-64 and persons not in employment and part-time workers aged between 30-64 are classified as the homemaker group, and those over 65 years of age are classified as senior citizens (excluding those in employment).

show only a small difference in the usage rate among generations. On the other hand, there is a gap between the young generation and other generations in terms of use for viewing videos and listening to music, looking up/writing in SNS, and online games. The former use is to use the website as a "tool", and this is already established in every generation. The latter use is to use the website as a "media" source, and although this usage is yet to be established, it is assumed that it will expand as the young generation grows up **(Figure 1-55)**.

2. Media and information in the ubiquitous society

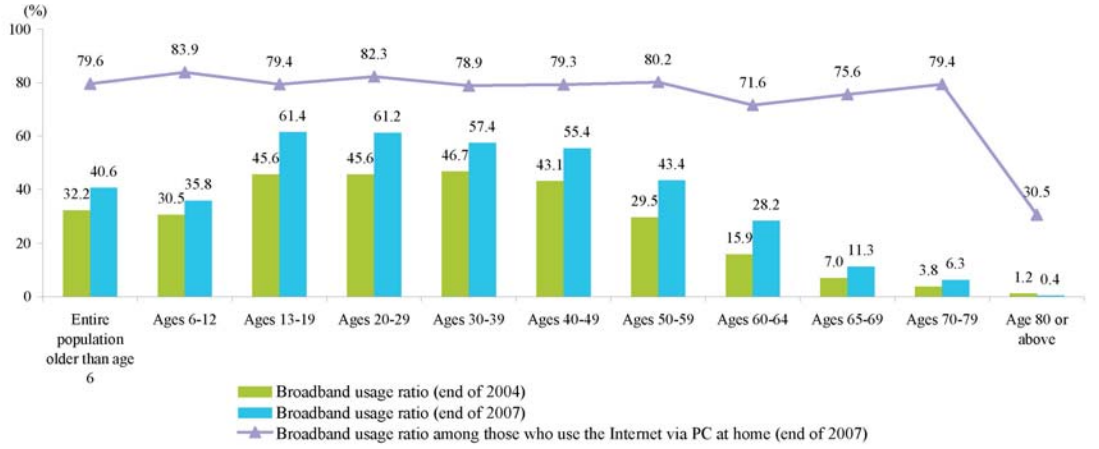
(1) Media use in today's society

Questionnaire surveys were conducted about the frequency of use in the past two to three years of the following six media that have been picked as those likely to be being used in daily life, namely: TV, newspaper, magazines/books, radio, website/e-mail on PCs (hereinafter referred to as "PCs"), and "website/e-mail on mobile phones (hereinafter referred to as "mobile phones") **(Figure 1-56)**. The response "no change" tends to be the most cited on a whole. When looking at the respondents who chose either "increased" or "decreased", more young people responded that their use of newspapers has decreased than those who responded that their use had increased; a difference of 4.1 points, indicating that the young generation is reading fewer newspapers. With respect to PCs, the response of "increased" exceeded that of "decreased" by 53.1 points among the young-generation, whereas the figure is only 23 points among senior citizens. As for mobile phones, the response of "increased" exceeded that of "decreased" by 38.8 points among the young generation, whereas the percentage of the response of "increased" and that of "decreased" is nearly the same among senior citizens.

(2) Evaluation of media

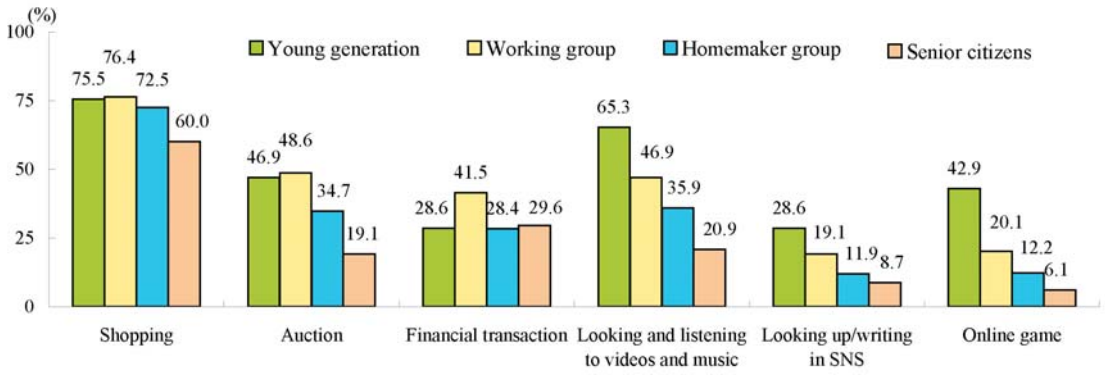
Figure 1-57 is the summary of the results of a questionnaire survey as to how the media is evaluated by users.

Fig. 1-54 Broadband use by generation (comparison between end of 2004 and end of 2007)



(Source) "Communication Usage Trend Survey," MIC

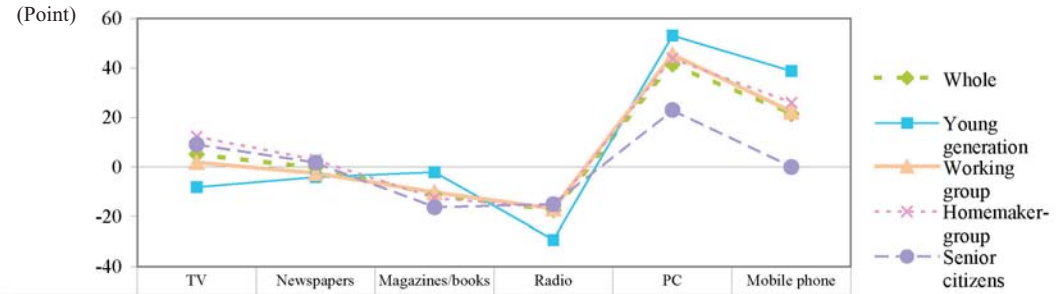
Fig. 1-55 Function/services used on the website (PCs/mobile phones) (Multiple answers)



(Source) "Investigative Study on Access to Information and Consumer Behavior in the Ubiquitous Network Society"

The results by generation show that PCs are evaluated "high" among the young-generation on the whole, whereas senior citizens tend to appreciate newspapers more. When looking at the results by media, the "entertainment" aspect of TV media, "accuracy" and "familiarity (dealing with familiar topics)" aspects of newspapers, "large volume (of information)" aspect of PCs are highly appreciated by

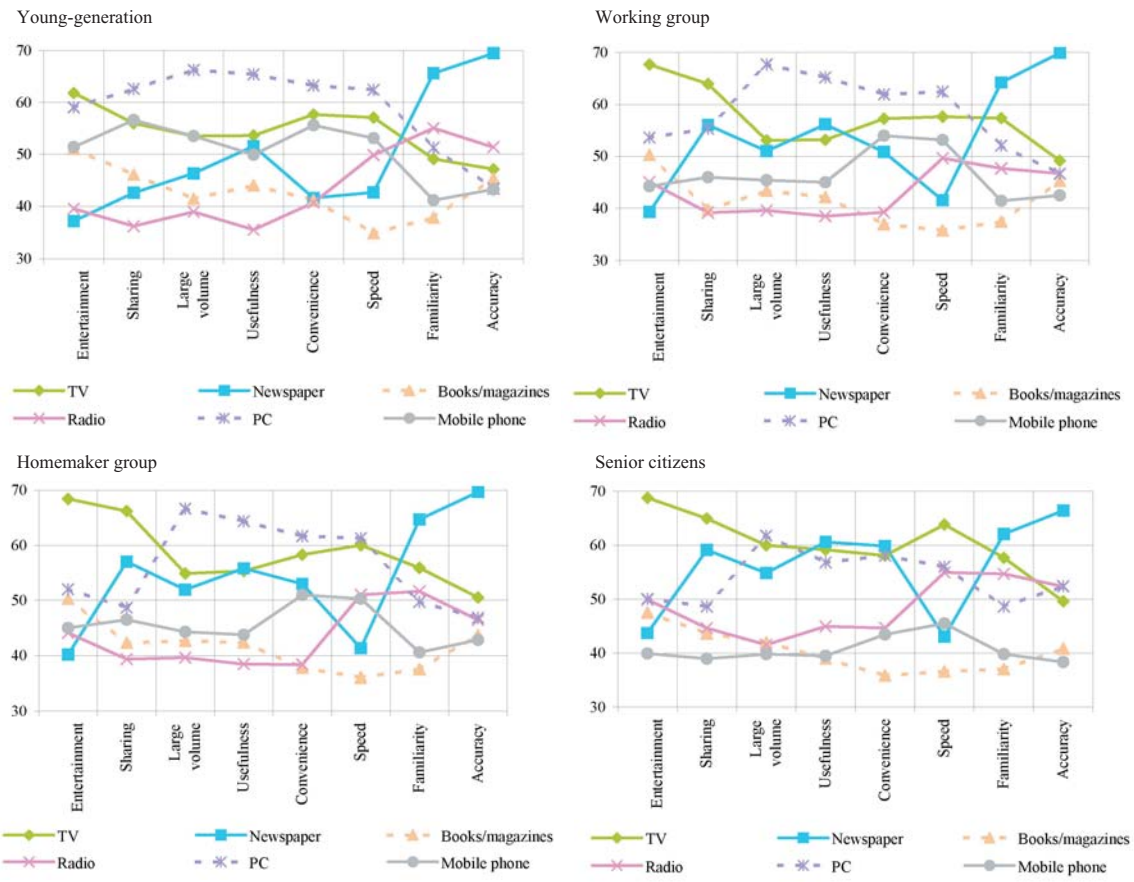
Fig. 1-56 Change in the frequency of media use over the past 2-3 years (the figures are obtained by subtracting the percentage of "reduced" responses from the percentage of "increased" responses)



	TV	Newspapers	Magazines/books	Radio	PC	Mobile phone
Whole	5.1	-0.3	-11.2	-17.4	41.5	21.4
Young generation	-8.2	-4.1	-2.1	-29.2	53.1	38.8
Working group	1.9	-2.5	-10.2	-16.8	45.4	22.4
Homemaker- group	12.3	3.0	-12.4	-16.4	43.9	26.0
Senior citizens	9.1	1.8	-16.3	-15.0	23.0	0.0

(Source) "Investigative Study on Access to Information and Consumer Behavior in the Ubiquitous Network Society"

Fig. 1-57 Evaluation on media (The proportion of respondents who answered "there is a relevant characteristic" has been converted to deviation score)



(Source) "Investigative Study on Access to Information and Consumer Behavior in the Ubiquitous Network Society"

all groups. With respect to PCs, "utility (usefulness)", "convenience (easy access)", and "speed" are highly appreciated by the young-generation, working group and homemaker group. As for mobile phones, the young-generation evaluates "sharing (transmission or storing of own ideas and opinions)" and "convenience" as "high".

As seen from the above results, TV's evaluation has been established as an entertainment media and newspapers as accurate and familiar media. It is thus thought that they will continue to play a role by making use of such characteristics. On the other hand, the volume, utility, convenience and speed of PCs are highly appreciated and the sharing and convenience of mobile phones are also highly appreciated, particularly by the young-generation, and the use of PCs and mobile phones as media tools is expected to expand.

3. Changes in consumer behavior

(1) New consumption patterns in the ubiquitous society

One of the most remarkable changes in people's lives caused by advanced ubiquitous networks is a change in consumption patterns. Before the ubiquitous society arrived, it took time to exchange information and the volume of information exchanged was markedly smaller, and consumers' consumption took place within a limited time and with limited information. There is a principle of AIDMA which is a theoretical model of consumers' psychological processes with regard to product purchase in such limited circumstances. This principle proposes that consumers' behavior is composed of five stages: "attention" to a product, "interest" in the product, "desire" for the product, "memory" of the product, and "purchase (action)" of the product.

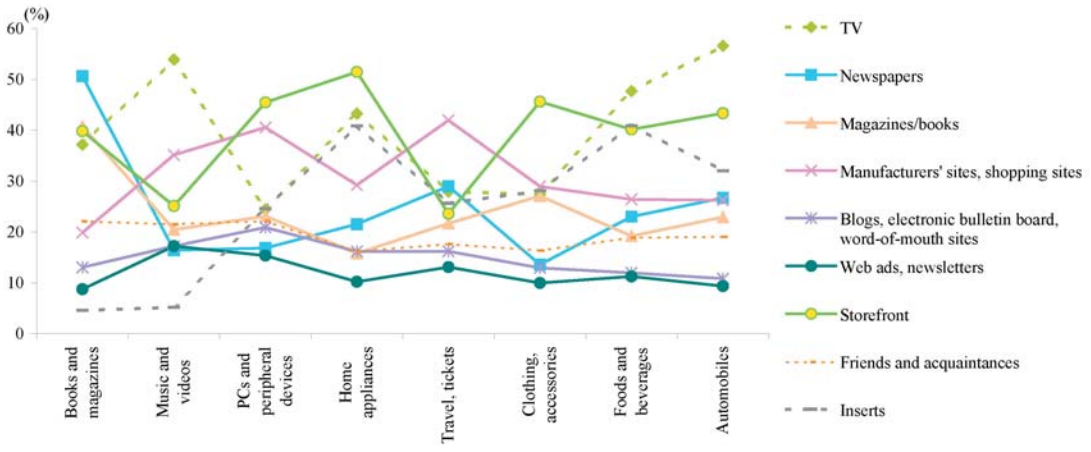
However, now that large volumes of information can be exchanged in an instant regardless of time or place, new consumption patterns have emerged, besides AIDMA. Specifically, after consumers pay "attention" to and become "interested" in a product, they gather "information" on the product on the Internet and make comparisons and examinations of several attractive products using the information collected, and make purchase decisions after "evaluation on options", and move to actual "purchase". Furthermore, a consumer who has actually purchased a product discloses his/her own experience of the purchase on the Internet and the information is "shared" among consumers. Such "word of mouth information" becomes a source of information on the product for other consumers. Thus, after becoming interested in a product, a new process of consumer behavior centered on "information" seems to take place.

(2) Attention/information collection/evaluation of options

A. Attention

When looking at the information sources of individual products that have caught consumer attention and interest, the products with the most cited response of "storefront" are PCs and peripheral devices, home appliances, and clothing/accessories. The products with the most cited response of "TV" are music/videos, foods/beverages, and automobiles **(Figure 1-58)**. By transmitting information that impacts on a wide range of consumers with a combination of music and images, TV plays an important role in giving an opportunity for consumers to form an image of the product, know about and become inter-

Fig. 1-58 Information sources that serve as a trigger to learning about the product and increasing interest (multiple answers allowed)



(Source) "Investigative Study on Access to Information and Consumer Behavior in the Ubiquitous Network Society"

ested in the product. The proportion of the Internet as an information source remains at a low level as a whole, indicating that the Internet serves relatively little in giving an opportunity for consumers to know and become interested in a product.

B. Information collection

We asked what methods were used to collect information about the details and reputation of a product in the 12 months before its purchase. The products with most the cited response of "storefront" are PCs and peripheral devices, home appliances, clothing/accessories, foods/beverages, and automobiles. The products with the most cited response of "manufacturers' sites" are music/videos, PCs and peripheral devices, and travel/tickets **(Figure 1-59)**. Compared with the "attention" stage, the response of "manufacturers' sites" are large on the whole, next to "storefront," showing the high percentage of people who are gathering information through the Internet. It is fair to say that the Internet is a suitable means for information collection since it can accurately send the very information that a consumer wants to that very consumer. On the other hand, the number of respondents who selected "TV" which 'plays' an important role at the stage of "attention" was relatively small on the whole. It is thus fair to conclude that TV, which transmits one-way information about the characteristics of a product, is not necessarily suitable for consumers to use for gathering information, and the role of TV as part of the information collection process is smaller than at the "attention" stage.

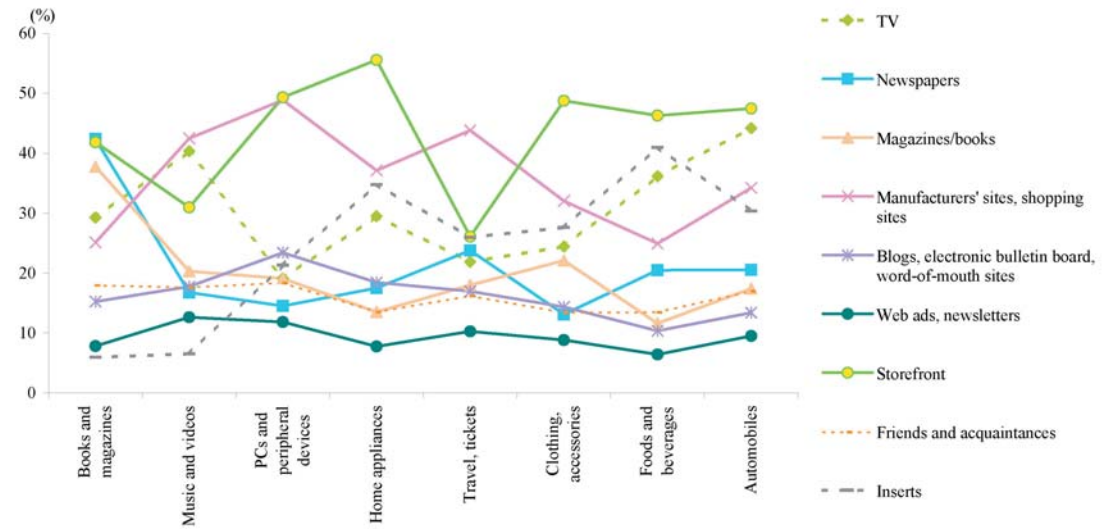
C. Evaluation of options

We asked about the means of evaluation of functions and retail shops for several products prior to purchase. Eight types of target products can be roughly divided into two types of product group depending on the method of evaluation **(Figure 1-60)**. One group includes music/videos, PCs and peripheral devices, travel/tickets with a relatively high citation of "manufacturers' sites", and the other group includes books/magazines, home appliances, clothing/accessories, foods/beverages and automobiles with a relatively high citation of "storefront".

With respect to the former product group with many responses of "evaluation based on the manufacturers' sites", price and function are the central factors when evaluating a product before purchase. Many people listen to music on the website before buying. As shown, when making a purchase decision, the decision can be made instantly as long as information is available since the basis for evaluation can be obtained through the Internet. In other words, there is little necessity to evaluate a product by going to a shop and the process from information collection to decision making is quite short.

On the other hand, with respect to the latter product group with many responses of "evaluation at a storefront", people seem to evaluate a product based on criteria that cannot be collected through the Internet, such as the looks and design of the product, contents, quality, size, etc., in addition to price and functions. When deciding to buy such a product, people tend to decide to buy the product by going to shops and considering where the product is positioned on the evaluation axes. In other word, when evaluating the options, there are products that have high famil-

Fig. 1-59 How people gathered information such as details on products and reputation before purchasing in the last 12 months (multiple answers allowed)



(Source) "Investigative Study on Access to Information and Consumer Behavior in the Ubiquitous Network Society"

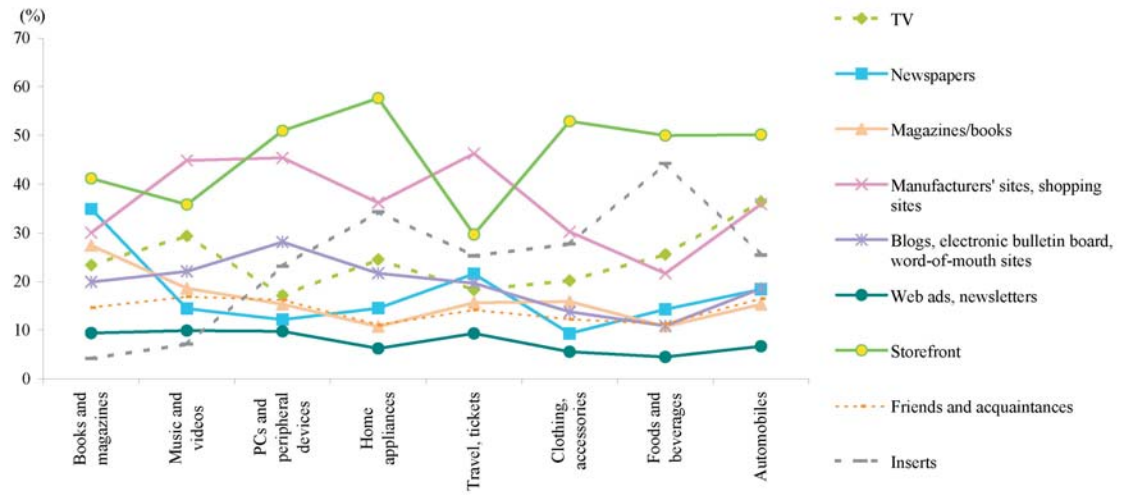
iarity with Internet use and there are other products that do not have familiarity depending on the characteristics of the product and evaluation axes set by consumers. Nonetheless, if more information is made available on the Internet, Internet use for evaluating options can possibly be expanded.

(3) Purchase/Sharing

A. Purchase

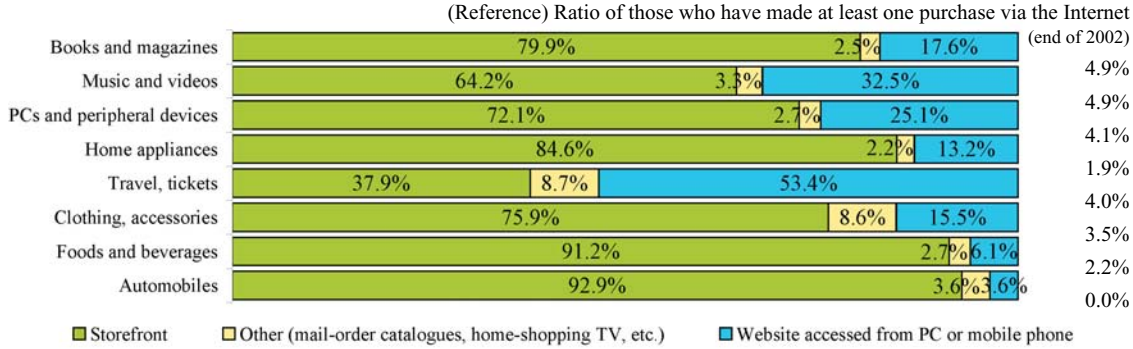
The most frequently used channels for the purchase of products in the last 12 months were examined, and it was found that the products with the most cited answer of "storefront" were automobiles (92.9%), foods/beverages (91.2%) and home appliances (84.6%). The products with the most cited response of "PCs/mobile phones" were travel/tickets (53.4%), music/videos (32.5%) and PCs and peripheral devices (25.1%) **(Figure 1-61)**. The results show that the products cited as "using manufacturers' sites" in section (2)-C Evaluation of Options, correspond with the products cited as "using PCs/mobile phones for purchase", which supports the hypothesis that the process from information collection to purchase decision is short for these products. When compared with five years ago, the ratio of those who purchase products via the Internet is increasing rapidly. This trend is particularly notable for products of consistent quality and for which the entire process from information gathering to purchase decision can be done via the Internet, such as travel/tickets or music/videos. For example, the proportion of those who make travel/ticket purchases via the Internet has already exceeded that of those who make in-store purchases. The Internet has been widely established as a purchase channel and online shopping is coming to threaten the position of storefront purchasing.

Fig. 1-60 How people evaluated the functions of products and stores beforehand in the last 12 months (multiple answers allowed)



(Source) "Investigative Study on Access to Information and Consumer Behavior in the Ubiquitous Network Society"

Fig. 1-61 The most frequently used channel to purchase products in the last 12 months



*Since those who purchased automobiles via websites of PCs/mobile phones in the last 12 months are negligibly low, the figures here are listed as reference.

(Source) "Investigative Study on Access to Information and Consumer Behavior in the Ubiquitous Network Society"
"Communication Usage Trend Survey (2002)," MIC

B. Sharing of purchasing experience

We then asked if they have shared their own purchase experiences by product type, the young-generation who have shared their experiences via websites accessed by PC and mobile phones cited "books/magazines" most frequently, at 20.8%, followed by "travel/tickets" at 17.0% and "music/videos" at 16.7%. It is thus fair to say that the trend of sharing the purchase experience with the general public is gradually spreading, led by the young-generation **(Figure 1-62)**. It is expected that such a trend will expand across the generations.

In response to such new movement, companies are also expanding their efforts to find new contact points with consumers, centered on the Internet. For instance, the rate of companies with more than 100 employees which launched company websites has reached 83.6%, proving that use of the Internet is being widely spread as a means to provide information to business partners and consumers **(Figure 1-63)**. The percentage of companies which have launched at least either a business blog or SNS is 6.8%, or one company out of about 15 companies. As seen by the number of employees, the percentage of large corporations with more than 2,000 employees is high at 15.5%, proving that the movement of using consumer-participatory CGM (Consumer Generate Media) for business activities is gaining momentum, particularly among large corporations.

Under such circumstances, the so-called "Web 2.0", which contributes to the further expansion of ubiquitous networks, the flow of information concerning consumption, with, for example, the disclosure of opinions of consumers themselves and the use of evaluations of other consumers as a criteria for making decisions about their own consumption, is now becoming a two way communication pathway, in which participants involved in consumption send and receive information, evolving from the traditional one-way path in which companies, the suppliers of products, used to send information to consumers. On Web 2.0, information concerning companies and products is not necessarily positive, but may contain critical and negative information that the companies have been reluctant to release.

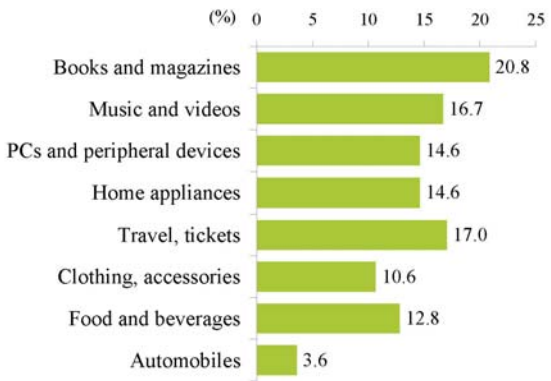
Therefore, in a society with abundant information, in order for companies to provide consumers with information concerning their products effectively, it is increasingly necessary to review conventional corporate strategies and to build new relationships with consumers; specifically, actively utilizing information sent by consumers and developing more effective advertising..

4. Tasks for realizing a safe and secure ubiquitous network society

(1) Experiences of damages accompanying the use of the internet

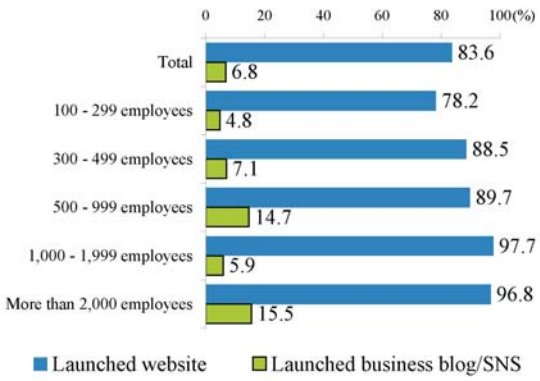
When being asked about any bad experiences accompanying the use of the Internet in households in the past 12 months, the most cited response was "received unsolicited e-mails", at 40.8% as of the end of 2007, followed by "Detected computer virus but not infected" at 20.0%, and "Infected by computer virus" at 16.0% **(Figure 1-64)**. As for bad experiences accompanying the use of mobile phones, "received unsolicited e-mails" was most frequently cited, followed by "received fictitious-claim e-mails" at 7.9%, indicating a tendency toward damaging e-

Fig. 1-62 Share of those who had shared their own purchase experiences with others via websites accessed by PC and mobile phone among young generation



(Source) "Communication Usage Trend Survey (2007)," MIC

Fig. 1-63 Ratio of companies launching websites, business blog and SNS (by number of employees)



(Source) "Communication Usage Trend Survey (2007)," MIC

mails.

Companies using ICT networks were then questioned in the same manner, and frequently cited answers were "detected computer virus but not infected" at 37.7% and "infected by computer virus" at 16.7% **(Figure 1-65)**.

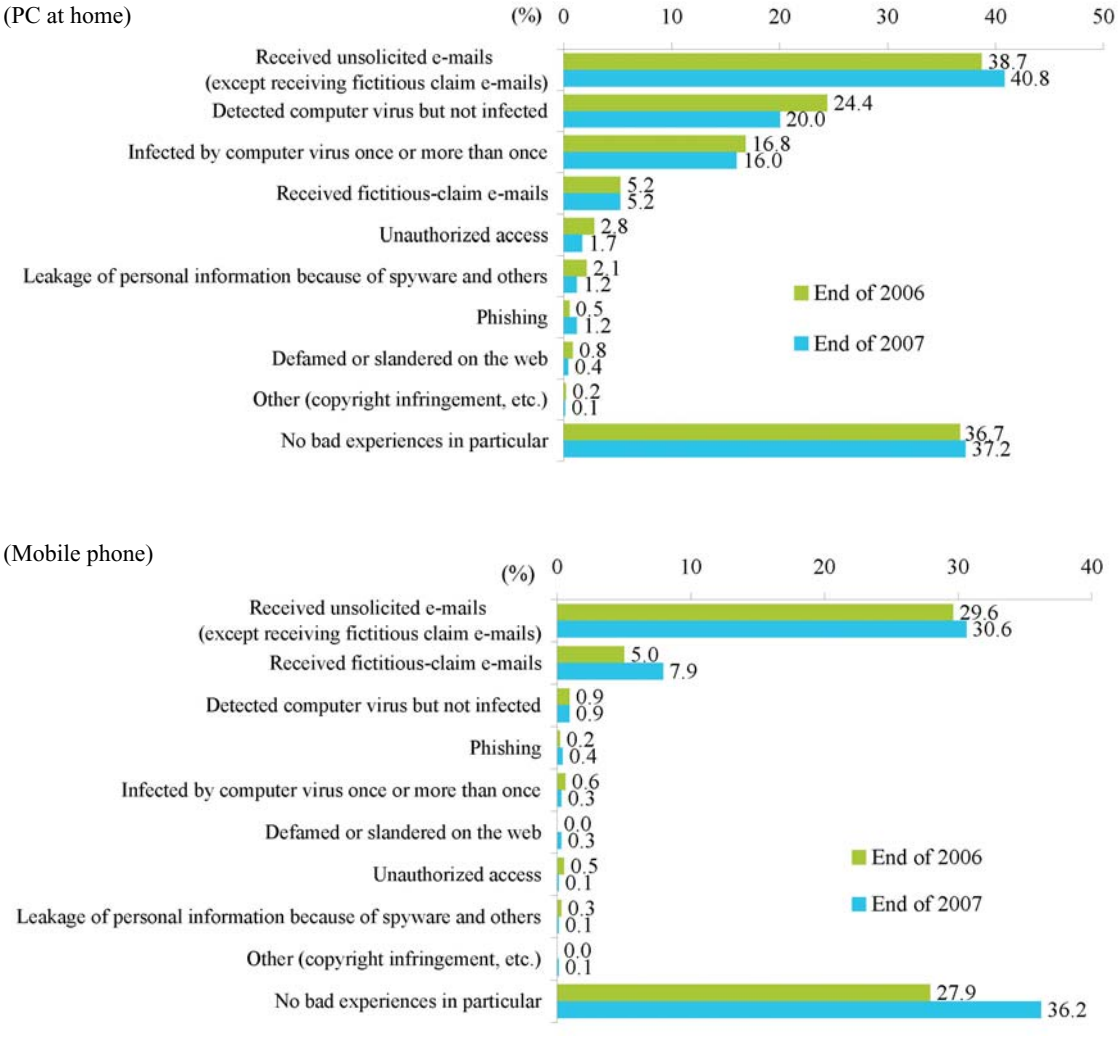
(2) Internet use by young people

Rapid penetration of the Internet brings about great convenience to users, or the general public, but at the same time, the importance of safe and secure use of the Internet by young people is increasingly pronounced; for example, it has been pointed out that young people are involved in crime through access to harmful sites and that the so-called "underground school website" has been a hotbed for bullying.

We asked households with children under age 18 whether they were aware of filtering software services, and 77.7% of households (up by 5.7 points from the previous year) answered either "know well" or "have heard of" filtering software used on PCs and 63.3% of households (up by 21.6 points from the previous year) responded either "know well" or "have heard of" filtering software used on mobile phones **(Figure 1-66)**.

As to the question of whether a filtering software service is actually used, 12.9% of households (up by 1.8 points from the previous year) use filtering software on a PC and 21.6% of households (up by 14.2 points from the previous year) use filtering software on a mobile phone, depicting the spread of use compared with the end of 2006 **(Figure 1-67)**. As a background to the penetration of the use of filtering software services lie public-private efforts for developing an environment where young people can be connected to the Internet safely and securely; for example, the

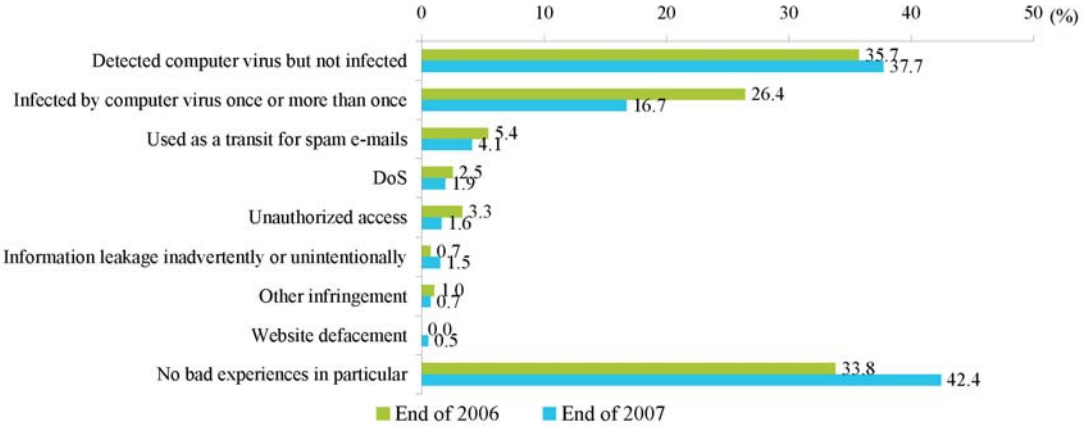
Fig. 1-64 Bad experiences accompanying the use of ICT networks in households (multiple answers allowed)



(Source) "Communication Usage Trend Survey," MIC

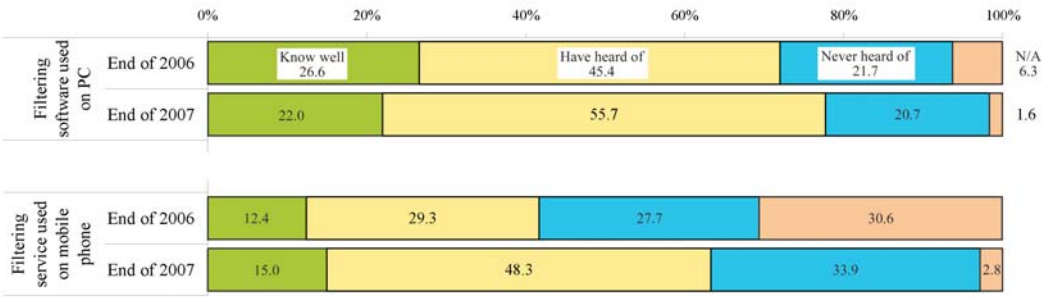
Ministry of Internal Affairs and Communications requested mobile phone operators, etc., to enhance their voluntary efforts for the spread and promotion of filtering services, in addition to an improvement in awareness.

Fig. 1-65 Bad experiences accompanying the use of ICT networks in companies (multiple answers allowed)



(Source) "Communication Usage Trend Survey," MIC

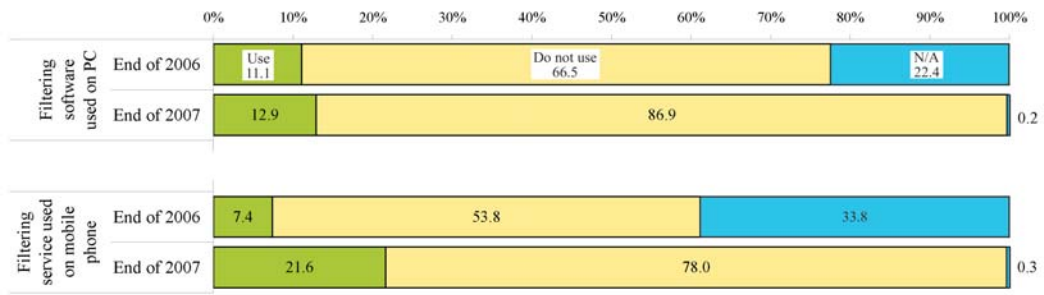
Fig. 1-66 Awareness of filtering services



* Asked of households with children age 18 or younger.

(Source) "Communication Usage Trend Survey," MIC

Fig. 1-67 Filtering services use



* Asked of households with children age 18 or younger that access the Internet via PC or mobile phone.

(Source) "Communication Usage Trend Survey," MIC