Chapter 1

Utilizing "Smart ICT" Advancement to Create New Values

Part 1

Section 1 New ICT Trend: "Smart ICT" to Produce Japan's Vigor and Growth

1. "Smart ICT" to produce Japan's vigor and growth — General —

(1) ICT and economic growth — A basic framework —

a. Factor decomposition from the macroeconomic viewpoint

From the macroeconomic viewpoint, economic growth is decomposed into labor input, capital input and total factor productivity. Labor input represents the quantitative expansion and qualitative improvement of labor. TFP indicates productivity improvements that cannot be explained by labor or capital input growth.

b. ICT as growth engine — ICT-using industries' growth combined with ICT industry's growth

First, ICT has served as a growth engine. In ICT-using industries or sectors, TFP growth through labor productivity growth induced by information capital investment and through production method improvements has been combined with the integration of various products and services with Big Data and smartphone use to boost value added to products and services. On the other hand, growing demand for ICT services and equipment in the ICT-using sectors has encouraged the ICT industry's technological innovation and development and produced the ICT industry's growth, leading to a virtuous circle. The entire ICT industry, including the software, services and hardware sectors, has served as a growth engine to drive Japan's economy.

c. ICT as versatile tool -- Using ICT for solving global social challenges and expanding such solutions globally

Another role of ICT in economic growth, which has attracted attention over recent years, is to serve as a versatile tool. Social challenges that have become constraints on growth in Japan are or will become common to other countries. Japan may use ICT-based innovations for solving these challenges and expand the solutions and relevant know-how globally. Such global expansion is expected to come through efforts to use ICT for various social challenges facing Japan.

(2) Using new ICT trend to drive growth — Smart ICT —

Cloud, Big Data, mobile, social and other new ICT technology and service innovations are producing a new ICT growth base. The new ICT trend is expected to greatly improve growth potential in various areas not only for the ICT industry but also for ICT-using industries or sectors.

As Big Data technologies have been used more widely, for example, systems that had been used mainly for production lines at large companies and sales management at large distributors are now available for easy use for street shop management and public areas including education and healthcare.

The use of social media for various analyses has expanded from advertisement to a wide variety of other areas. It has been pointed out that as goods have growingly been commoditized, every industry or sector has grown more service-oriented, with how to maximize values for continuous use rather than exchange being important for competition. ICT has traditionally accelerated this trend toward a stage where ICT users are co-creating values.

As for solving social challenges, meanwhile, Big Data and M2M (machine to machine) sensor networks can be used for efficiently controlling various social infrastructures. They can also be expected to contribute to solving resources problems facing Japan. Furthermore, open data may be used for creating various user-friendly public services at the initiative of the private sector.

In this way, the new ICT trend or "smart ICT" has gone beyond traditional ICT systems used mainly for improving operations and productivity and has the potential to produce a new growth engine.

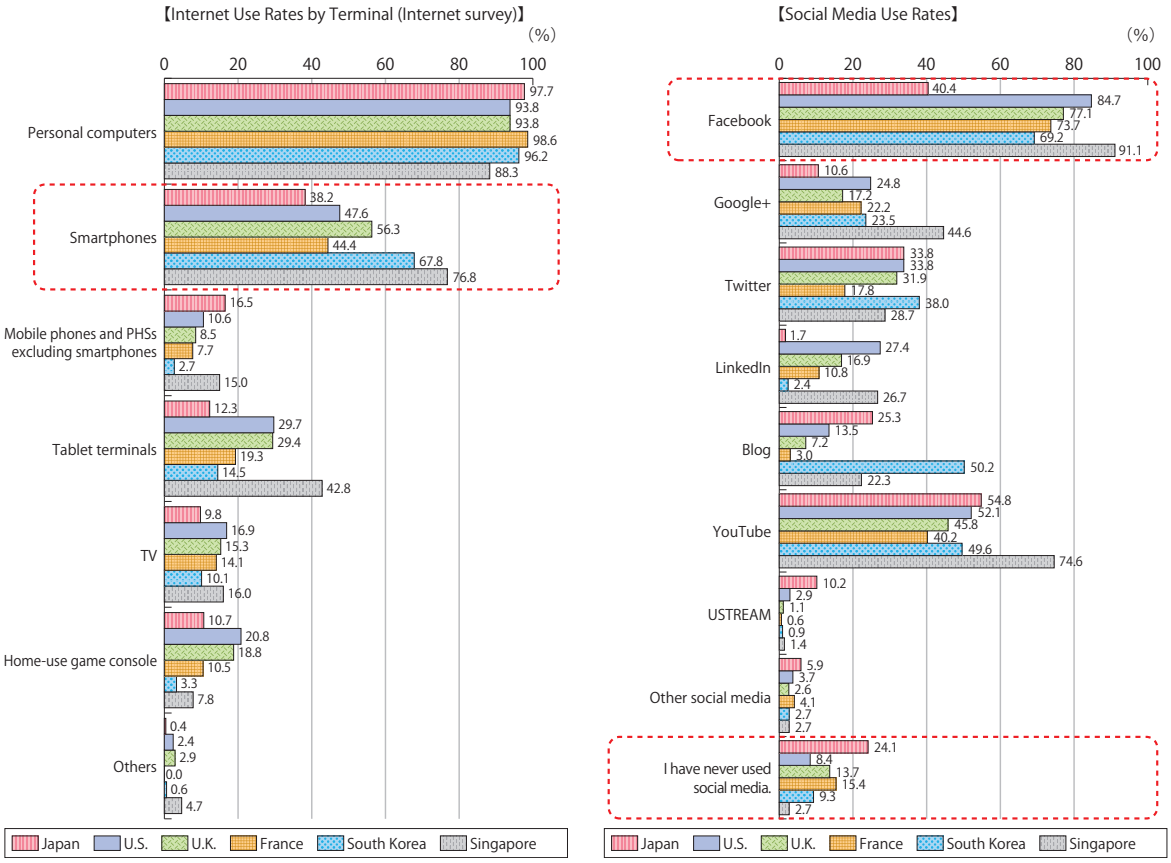
(3) Using smart ICT for accelerating Japan's vigor and growth

How have Smart ICT components including mobile (smartphone and M2M), cloud computing, Big Data and social media technologies diffused in Japan? Figures 1-1-1-1 and 1-1-1-2 show the results of an Internet survey on the diffusion of smartphones and social media in Japan, the United States, the United Kingdom, France, South Korea and Singapore. They indicate that Japan has not necessarily achieved the world's top position in diffusing smartphones or social media.

The survey's results regarding various Internet services show that users of e-commerce online purchases of and trade in goods and services in Japan accounted for 78.3% of respondents in the survey. Although the percentage share is the highest among the six countries, the share for users of electronic central and local government services (electronic applications, declarations and reports) in Japan is limited to 16.2%, far lower than in the other countries.

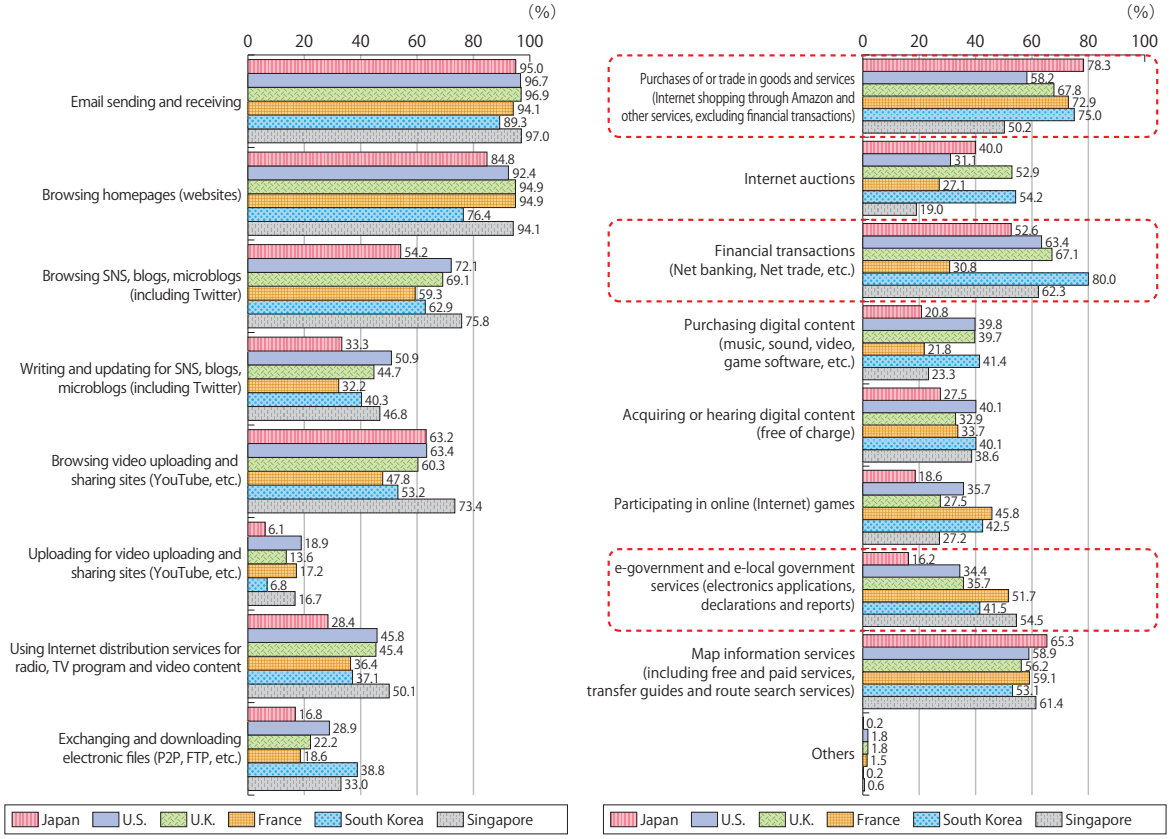
A comparison of cloud network technology use rates among Japanese and U.S. enterprises (in March 2013) shows that the rate in the United States reached 70.6% against 42.4% in Japan (Figure 1-1-1-3). There is a wide

Figure 1-1-1-1 Smartphone and social media use rates (comparison between 6 countries)



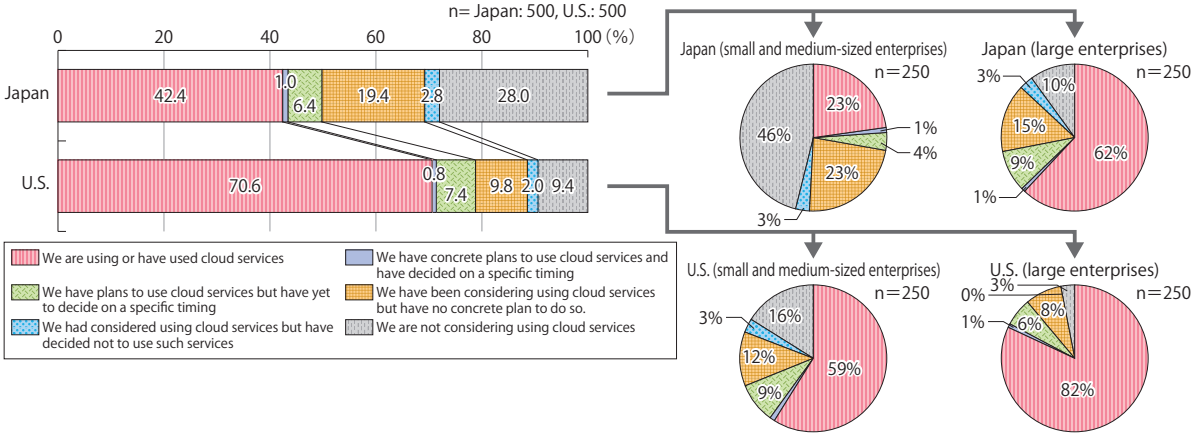
(Source) MIC "Survey Research on New Challenges for Advancement of ICT Infrastructure and Services" (2013)

Figure 1-1-1-2 Comparison of Internet use rates by usage



(Source) MIC "Survey Research on New Challenges for Advancement of ICT Infrastructure and Services" (2013)

Figure 1-1-1-3 Cloud network technology use at enterprises (Japan-U.S. comparison)

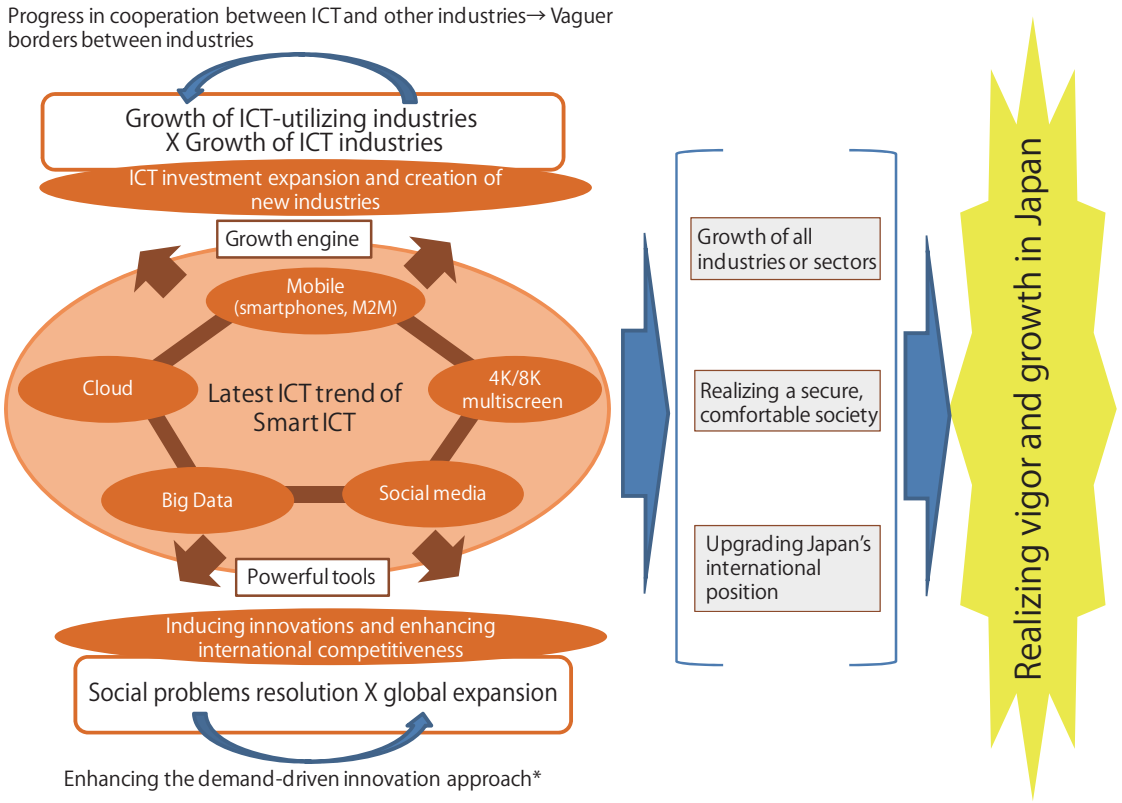


(Source) MIC "Survey Research on Foreign Policies for Use of Cloud Computing and other ICT Technologies" (2013)

disparity between Japanese and U.S. enterprises in the use of cloud computing as a key ICT component.

From the viewpoint of taking maximum advantage of the world's highest-level communications infrastructure, Japan is required to enhance all relevant initiatives to promote the utilization of ICT, particularly the new trend of Smart ICT, to improve the growth potential for all industries or sectors beyond the border between the ICT industry and ICT-using industries, to use ICT for solving global social problems not limited to those in Japan and to expand these solutions globally (Figure 1-1-1-4).

Figure 1-1-1-4 Smart ICT growth model (image)



*Demand-driven innovation approach: An approach in which developing solutions to global social challenges is designed to result in economic growth and improved international competitiveness.

2. Utilizing G-spatial information to create new values

(1) Presents state of G-spatial information

a. What is G-space?

G-spatial information is equal to geospace (or geospatial) information that is defined in the Basic Act on the Advancement of Utilizing Geospatial Information as location information, or "information indicating a specific location or area in the geospace (including information on the time involving the relevant information)" or information consisting of location information and "information related to the location information."

b. MIC initiatives

Each government agency implements various measures based on the basic plan on the advancement of utilizing geospatial information. The MIC carries out the operation of quasi-zenith satellite time control equipment, the diffusion and enlightenment of integrated GIS (geographical information system) technologies and the expansion of statistical GIS systems not only in the ICT field but also in local government and statistical fields.

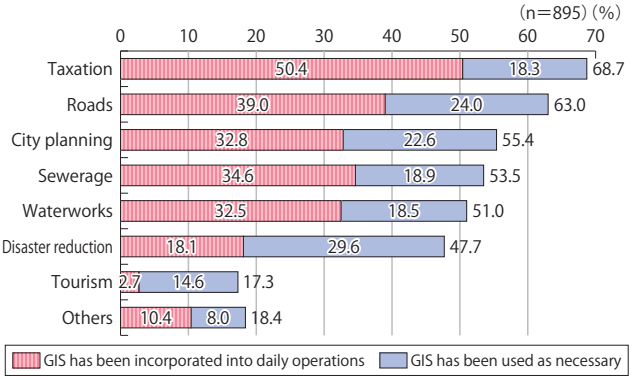
The MIC has continued to operate time control equipment for the first quasi-zenith satellite system, called Michibiki, for which the ministry conducted research and development until FY2011.

As for integrated GIS systems to be developed by local governments, they are required to promote the development of common use space data including basic geographical information to increase the operational efficiency when introducing the GIS systems. The central government is set to provide technical and auxiliary financial support to them. The statistical GIS system developed by the MIC Statistics Bureau takes advantage of the GIS mechanism to visualize statistical data of various surveys on background maps according to individual users' needs.

(2) Local governments' consciousness of G-spatial utilization

In a questionnaire survey, local governments were questioned about operational areas where GIS systems are used. The most frequently cited area was taxation. Particularly, more than 50% of respondents said that GIS systems are incorporated into routine operations. In addition, more than 50% also chose infrastructure management areas (Figure 1-1-2-1).

Figure 1-1-2-1 GIS utilization areas

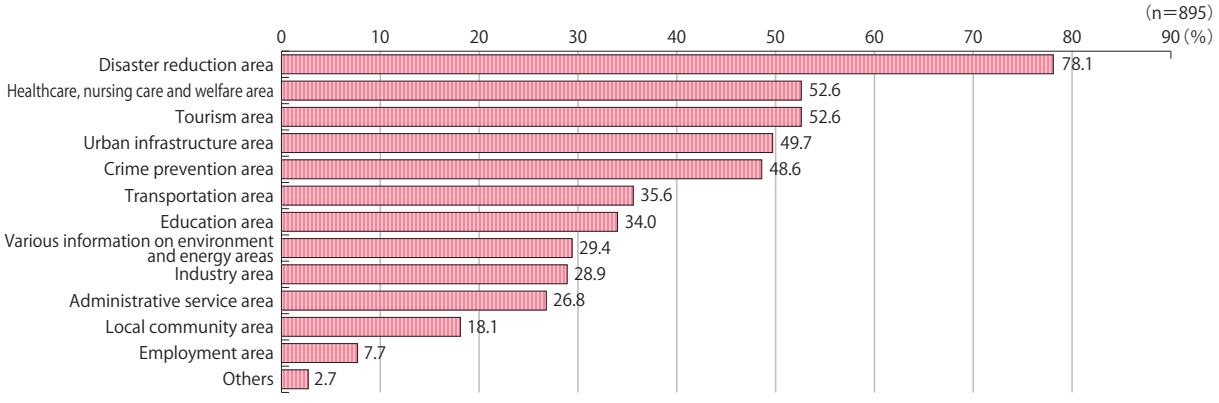


(Source) MIC "Survey Research on the Present State of Regional ICT Utilization" (2013)

Questioned on areas for which local governments hope to expand the utilization of GIS systems, nearly 80% chose the disaster prevention area. Around 50% chose healthcare/nursing care/welfare, tourism, urban infrastructure and crime prevention (Figure 1-1-2-2).

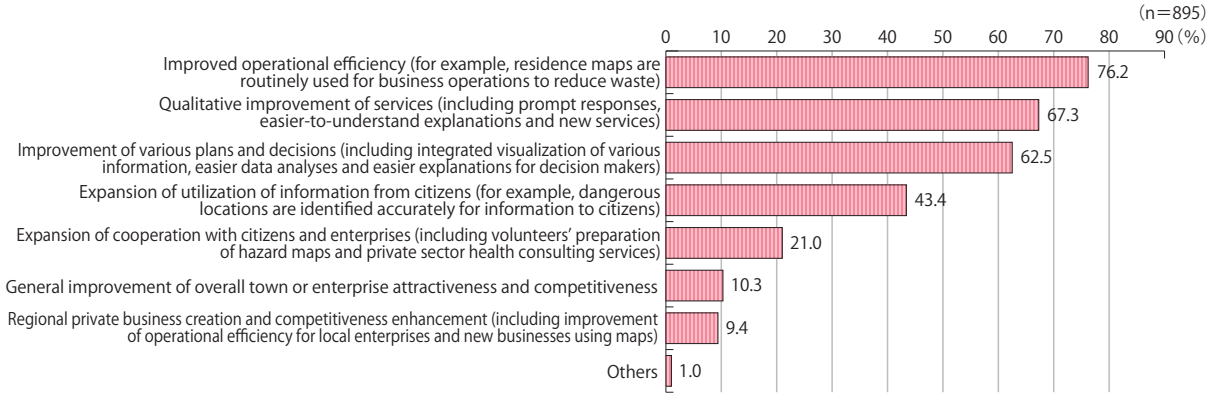
Questioned about the GIS effects that local governments expect, they cited "greater operational efficiency" most frequently. Following this option were "improvement of service quality" and "improvement of various plans and decisions" which were chosen by more than 50% (Figure 1-1-2-3). Questioned about challenges for expanding GIS utilization, about 60% of respondents in the survey said "financial conditions are severe." Other frequently cited challenges were that "systems for cross-sectional utilization or joint utilization with outsiders have yet to be developed," that "in-house promotion arrangements are insufficient" and that "staff members' skills (for operation, analyses, utilization, etc.), and software and tools for utilization are insufficient." They dominantly pointed to a lack of both in-house hardware and software (Figure 1-1-2-4).

Figure 1-1-2-2 Areas for which local governments hope to expand GIS utilization



(Source) MIC "Survey Research on the Present State of Regional ICT Utilization" (2013)

Figure 1-1-2-3 Expected GIS effects



(Source) MIC "Survey Research on the Present State of Regional ICT Utilization" (2013)

Figure 1-1-2-4 Challenges for expanding GIS utilization

(Source) MIC "Survey Research on the Present State of Regional ICT Utilization" (2013)

(3) Society pursued through utilization of G-space and ICT

In order to solve challenges facing Japan and realize a desirable society, we should visualize and share a specific future image of a G-spatial society and how to utilize G-space and ICT as the key to the society. In a future G-spatial society, humans, goods and information that have been isolated will be mutually connected through the thorough utilization of G-spatial information and ICT, allowing us to visualize and share humans, goods and information that have been invisible and promote co-creation, mutual assistance and coexistence among humans, goods and information. Then, what has so far been impossible or difficult to realize will be realized.

(4) MIC initiative — G-space × ICT promotion council

The MIC established the G-space × ICT promotion council in March 2013 to consider how to fuse space information with communications technology to bring about innovations to our lives at a time when ICT is dramatically changing and evolving in quality and volume.

The council has proposed "construction of a G-spatial open data platform," "establishment of the world's most advanced G-spatial disaster management system" and "realization of success models in 'G-spatial City' (as temporarily named)" to revitalize the economy through creating new industries and services, to build the world's most advanced disaster management system and to realize regional invigoration with advanced and pace-setting approaches.

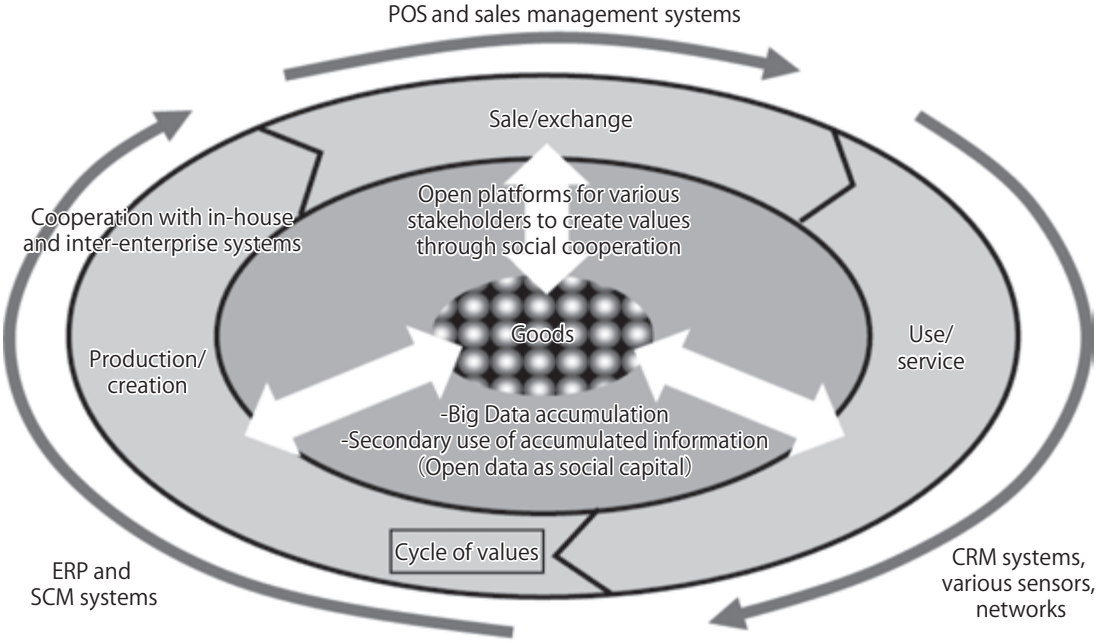
3. Smart revolution to produce changes in business operations

(1) ICT evolution and spreading "kotozukuri"

a. Definition of "kotozukuri"

Kotozukuri (creation of events) began to attract attention as a quasi-business approach in the marketing area for the distribution industry. The area has the concept of service-dominant logic (SDL). Unlike the goods-dominant logic (GDL) that focuses on values for exchange of goods, the SDL concept proposes that attention should be paid to values for customers' use of goods or services when new products are developed. The concept meets the trend where manufacturers have grown more service-oriented. The phenomenon where manufacturing enterprises produce values from continuous relations with customers through services may represent kotozu-

Figure 1-1-3-1 Information and communications system supporting the "kotozukuri" cycle model



(Source) MIC "Condition Survey on *Kotozukuri* Trend and ICT Cooperation" (2013)

kuri.

Even in the manufacturing industry's monozukuri (creation of goods), adding values other than those for functions of goods upon their exchange (sale or purchase) or creating mechanisms or processes to produce values upon customers' use of goods, may represent kotozukuri.

b. Kotozukuri and ICT

(a) Changes in ICT infrastructure

In the 1980s when the focus was shifting from general-purpose computers to personal computers, general-purpose computers were still processing mainstay business operations, with technologies used mainly for replacing human labor.

Later, ICT shifted to a client server age. In that age, enterprises generally acquired domains to use email and open homepages. As the Internet diffused as an open network, systems linking enterprises spread to help expand e-commerce not only for sales but also for procurement. The objective of the introduction of technologies then was to computerize and network all operations to innovate the entire business process.

A social ICT age started in 2010. The objective of the introduction of technologies in this age may be to comprehensively support human intelligent operations or cooperation between humans. The key to success for enterprises is whether they can use social media to create more open places and continuously produce new values together with various stakeholders. In this age, it is important for buyers and sellers, or consumers and enterprises, to sympathize with each other, go in the same direction and co-create new values. The base for such efforts is information and communications infrastructure as an open platform.

c. Directions of future ICT kotozukuri

The past spread of kotozukuri, ICT evolution supporting the spread and the recent trends lead us to find two major future directions.

In the first direction, kotozukuri to create mechanisms for producing values within and between enterprises will develop into more open processes where diverse stakeholders will be involved. In the second direction, values for the use and experiences will be increased further.

The kotozukuri mechanism to create social values and the kotozukuri process to produce new values through customers' use of goods will be integrated to develop a cycle model for various individuals and organizations to repeat the creation, exchange and use of values. As indicated by Figure 1-1-3-1, kotozukuri as a value cycle model will be supported by open platforms for cooperation between various people and ICT based on Big Data to be collected and accumulated.

d. MIC initative — Discussions at ITC kotozukuri panel —

In March 2013, the MIC launched an ICT kotozukuri panel under the ICT Growth Strategy Meeting. Under the common recognition that ICT kotozukuri means building new businesses or mechanisms to utilize ICT from the viewpoint of users for creating higher added value, the panel has discussed the direction of promoting ICT kotozukuri to build a society where data produces new values for sustainable growth through new innovations in the "social," "business" and "user" areas.

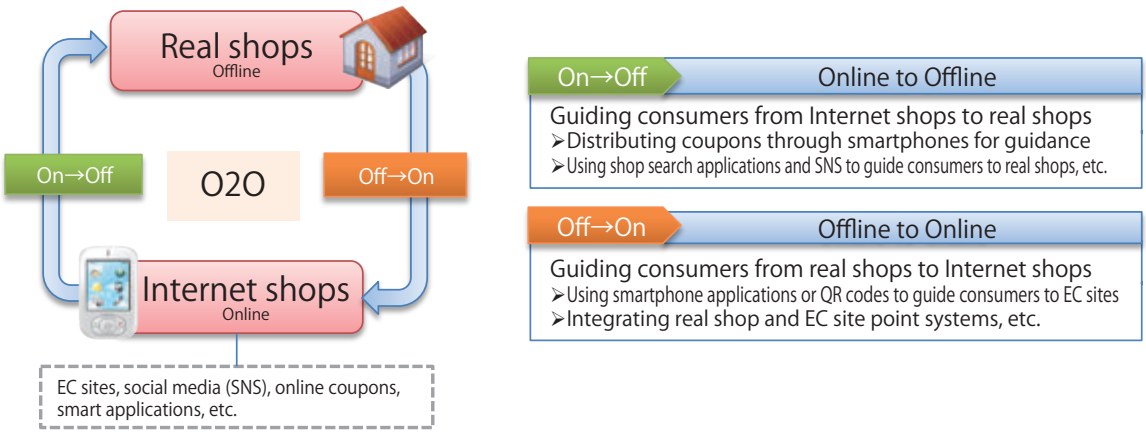
(2) Business operations changing under new ICT trends

a. O2O trends

(a) O2O outline

O2O indicates a series of mechanisms and initiatives where "online" Internet shops and social media cooper-

Figure 1-1-3-2 O2O image



ate and fuse mutually with purchases by "offline" real shops (Figure 1-1-3-2). In the past, O2O had mainly indicated a business approach where enterprises manage real and Internet shops. As real and Internet shops have been gradually fused, the fusion itself has begun to be called O2O.

Meanwhile, O2O frequently indicates an "online to offline" approach (for guiding consumers from Internet shops to real shops) including the distribution of coupons through smartphones. As Internet and smartphone diffusion has allowed consumers to easily get connected to the Internet, the "offline to online" approach (for guiding consumers from real shops to Internet shops) and the "online to offline" approach have been fused to blur the border between the two sales channels. This is significant.

(b) O2O trends in Japan

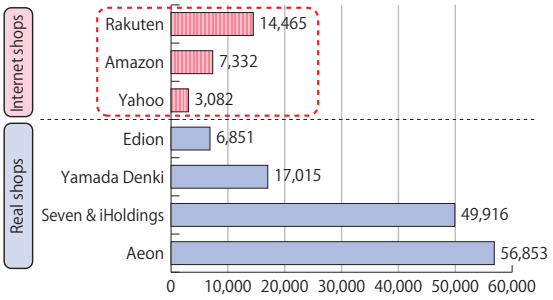
In Japan as well, both "online to offline" and "offline to online" guidance has diffused and is becoming settled.

Domestic goods sales through Internet sites in 2012 totaled about 1.4 trillion yen for Rakuten, about 730 billion yen for Amazon and about 300 billion yen for Yahoo, ranging from hundreds of billions of yen to more than 1 trillion yen per company. Their comparison with real shop sales indicate that Amazon sales have grown to the real shop sales level of electrical appliance shop chain Edion or supermarket chain Daiei. Rakuten sales rose close to real shop sales of Japan's largest electrical appliance shop chain Yamada Denki (Figure 1-1-3-3).

Japan's "online to offline" services are focusing on coupon issuance through smartphones. Even those that had kept a distance from Internet marketing have started various "online to offline" services.

An analysis of a questionnaire survey of enterprises on "online to offline" services in Japan indicates that O2O services have diffused widely, producing specific effects including improvement of goods and services awareness (Figure 1-1-3-4).

Figure 1-1-3-3 Major retailers' sales in 2012 in Japan

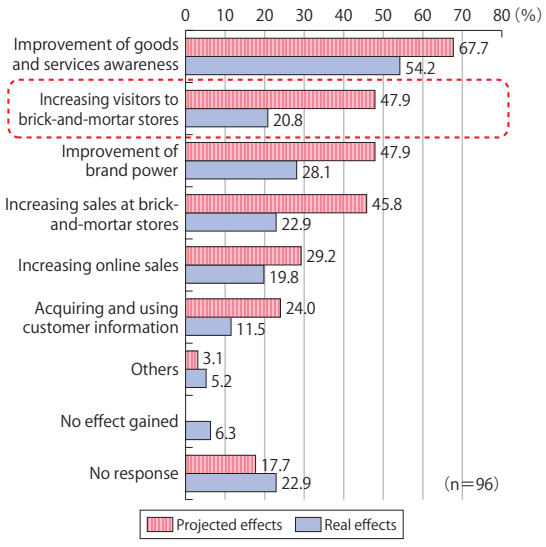


(Note) Data for Amazon is its full-year domestic sales in 2012 at 1USD=94JPY (2012 full-year finaical data), and data for Rakuten and Yahoo are their full-year goods sales in 2012 (2012 full-year finaical data). Yahoo includes Yahoo! Shopping, Yahoo! Ticket, and Yahoo! Travel. The above figure also indicates the 2012 sales of Aeon, Seven & I Holdings, Yamada Denki, and Edion(2012 full-year finaical data), as reference data to be compared with the scale of online sales.

Unit: 100 million yen

(Source) MIC "Survey Research on Business Operation Changes Caused by O2O" (2013)

Figure 1-1-3-4 Guidance from Internet sites to real shops and effects



(Source) MIC "Survey Research on Impacts of ICT Innovation on Japan's Social and Economic Systems" (2013)

Section 2 "Innovation" and Global Expansion of ICT Industries

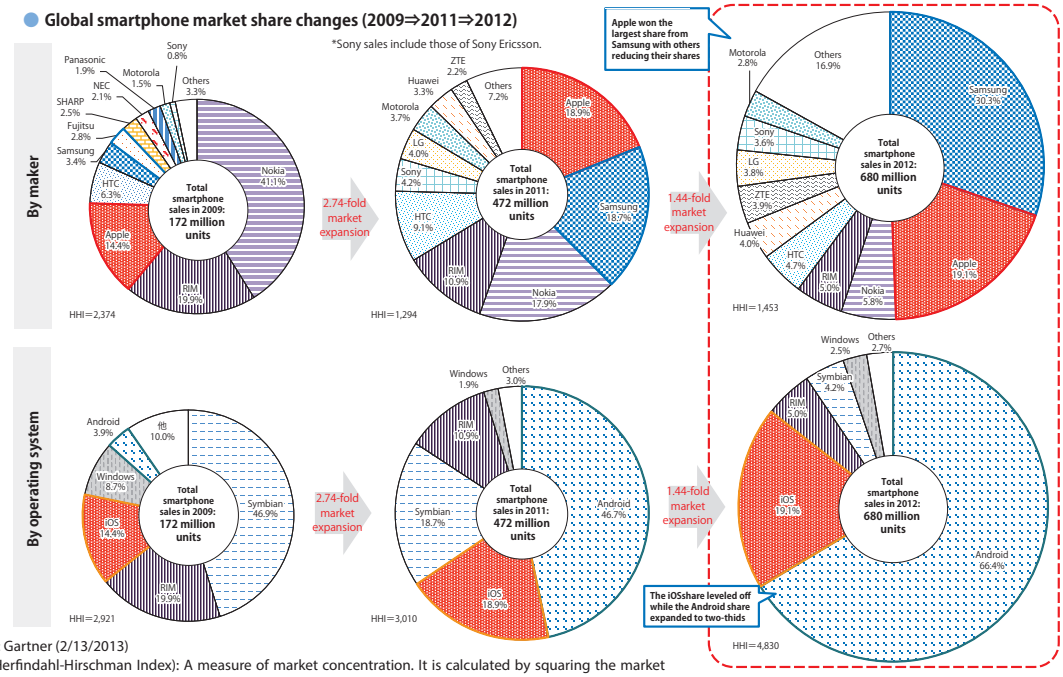
1. Overview of ICT industry innovation in Japan

(1) Mobile terminal market trends

Global smartphone sales in 2012 expanded 1.44-fold from 2011. Among smartphone manufacturers, South Korea's Samsung and the United States' Apple accounted for almost half the global sales. Third and smaller smartphone producers including Japanese firms, Nokia, and RIM reduced their respective market shares (Figure 1-2-1-1).

Japan's smartphone sales in 2012 increased 1.29-fold from 2011. Among smartphone manufacturers, Apple commanded the largest share of annual sales. In addition, Samsung expanded its share, while Japanese smartphone producers generally narrowed their shares (Figure 1-2-1-2).

Figure 1-2-1-1 Global smartphone market share changes

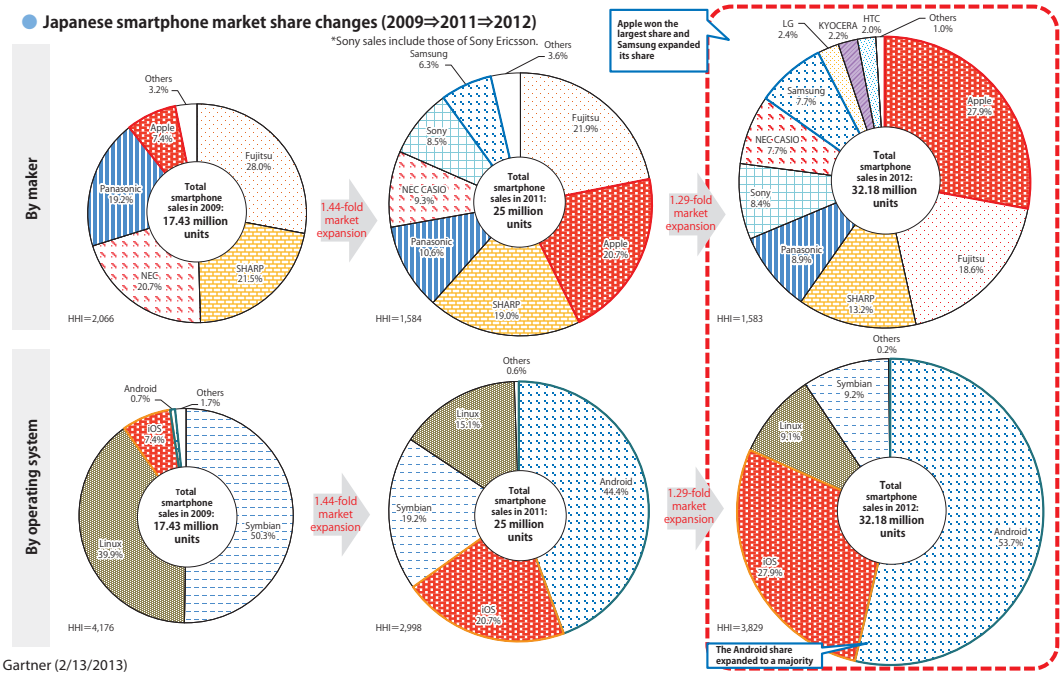


Source: Gartner (2/13/2013)

* HHI(Herfindahl-Hirschman Index): A measure of market concentration. It is calculated by squaring the market share of each firm competing in a market, and then summing the resulting numbers. A higher index indicates higher market concentration. Usually,the index is calculated in terms of sales value shares. Here, however, data constraints forced us to base the calculation on sales volume.

(Source) Prepared by MIC from Gartner data

Figure 1-2-1-2 Japanese smartphone market share changes



Source: Gartner (2/13/2013)

(Source) Prepared by MIC from Gartner data

(2) Venture and ICT trends

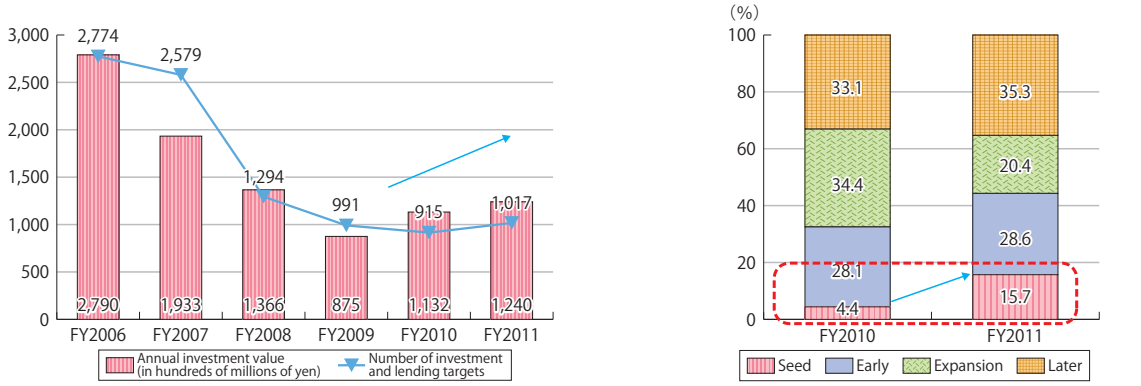
a. Venture startup trends

In Japan's venture startup trends over recent years, the number of ventures subject to investment by venture capitals and their venture investment value plunged due to the FY2008 Lehman Shock and have continued a recovery since FY2010. Venture capitals have shifted to earlier-stage investment in more promising ventures (Figure 1-2-1-3).

b. ICT area trends and venture launching environment evolution

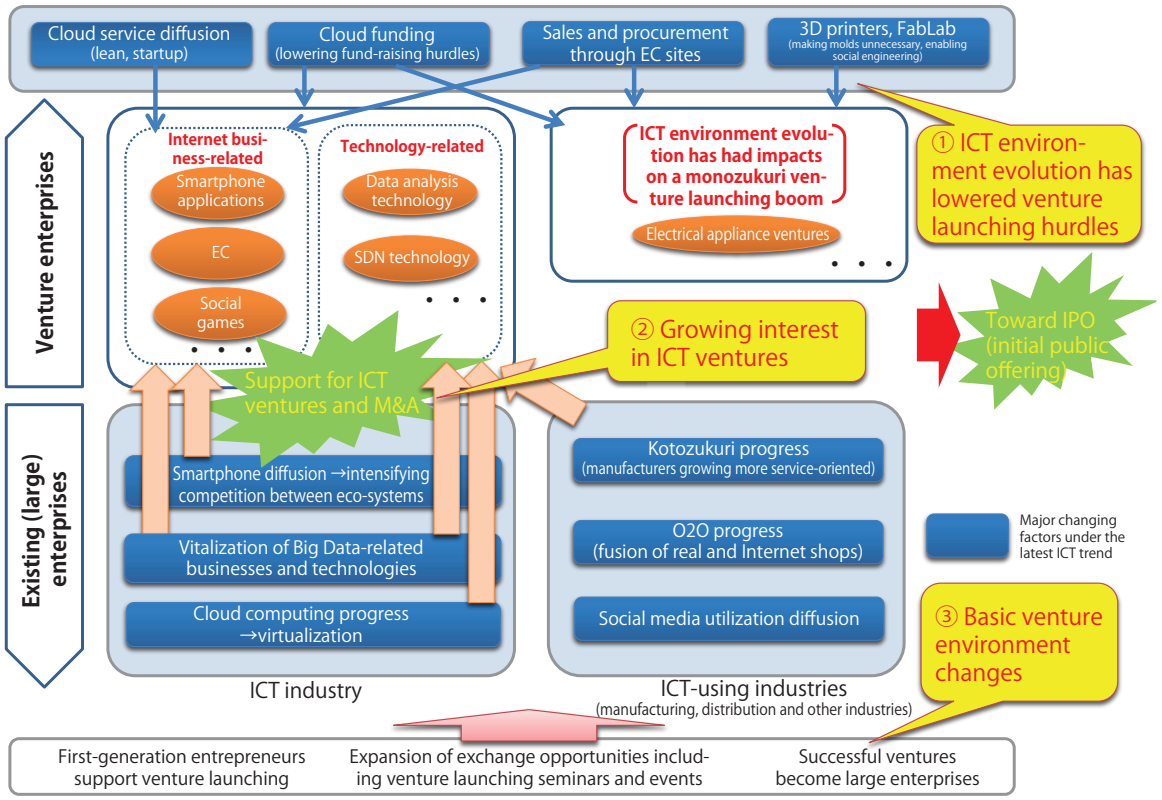
ICT area developments, including the diffusion of cloud services and electronic commerce, might have been coupled with basic environment changes such as growth of first-generation ICT and other ventures and activities of large and successful entrepreneurs to contribute to the vitalization of venture launching in both ICT and non-ICT industries. The recent rapid diffusion of smartphones and tablet computers and the Big Data technology advancement have encouraged both the ICT industry and ICT-using industries to grow more interested in ICT ventures. The recent ICT area developments and venture launching environment changes are shown in Figure 1-2-1-4.

Figure 1-2-1-3 Number of venture capital investment targets, investment value and investment stages



(Source) Venture Enterprise Center "Annual Report on Venture Businesses"

Figure 1-2-1-4 ICT area developments and venture launching environment evolution



(Source) MIC "Survey Research on ICT Industry's Global Strategy" (2013)

2. Global expansion of ICT industries

(1) Global market for ICT industry

Commercial characteristics of global players in their respective mainstay sectors indicate that IT service and other upper-layer players have higher growth potential and yieldability. But telecommunications equipment, electronics, electronics-related equipment and other lower-layer players have posted negative profit growth, indicating progress in the commoditization of their products. Among them, the communications layer, though continuing steady growth, sees a globally mature market (Figure 1-2-2-1).

In developed regions other than Japan, services for upper layers are projected to continue growing. Meanwhile, the environment in Japan is severe for devices and other lower layers. But lower layers are predicted to achieve high growth in emerging countries (Figure 1-2-2-2).

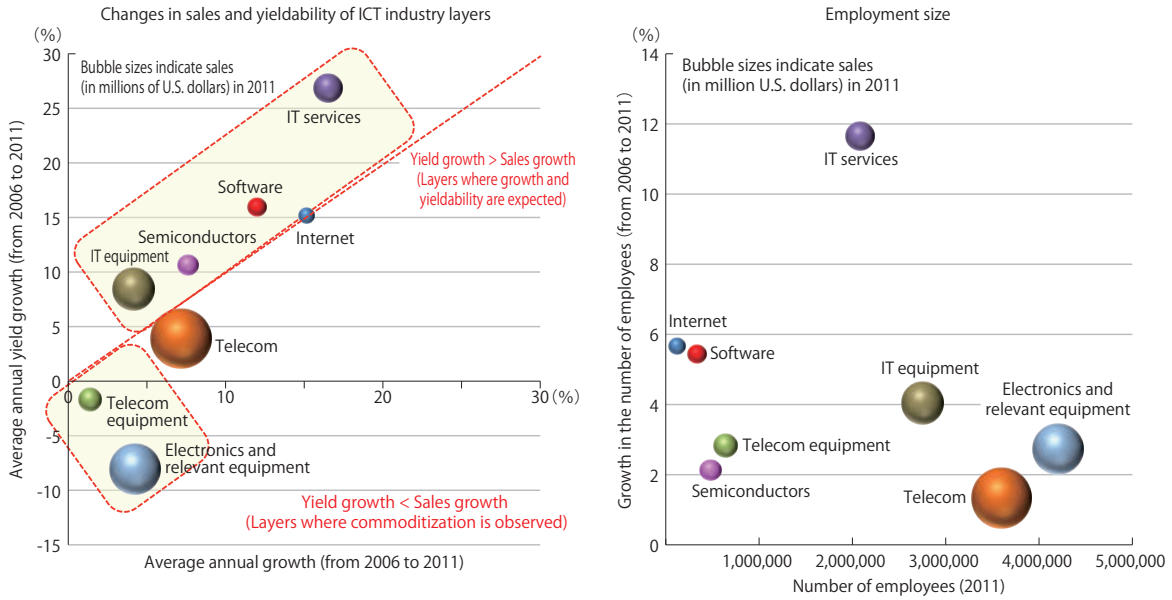
(2) Global expansion models for ICT industry

Based on the abovementioned trends, global expansion models for the ICT industry are illustrated in Figure 1-2-2-3. From the viewpoints of major global expansion promoters, customer segments, relations with ICT-using industries and mainstay businesses in ICT industry layers, global expansion models are divided into five categories – (1) communications services expansion, (2) ICT service expansion, (3) infrastructure export expansion, (4) equipment vendor service expansion and (5) platform expansion.

(3) Global expansion for communications layer

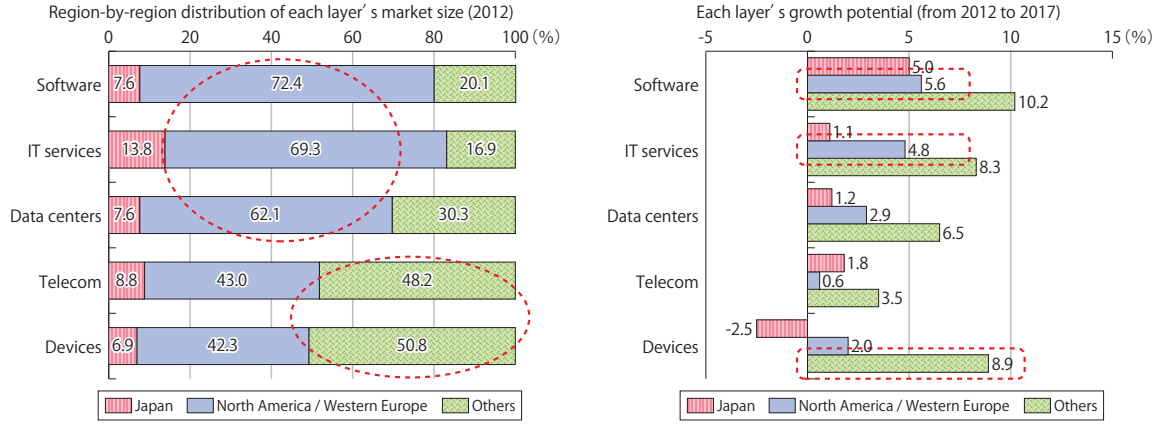
The global communications market (covering mobile and fixed communications) is projected to grow 2.1% annually through 2017. A steady global shift is expected to mobile data communications services for such terminals as smartphones (Figure 1-2-2-4). Of the global mobile

Figure 1-2-2-1 Analysis of growth potential in global ICT market layers



(Sources) Prepared from MIC "Survey Research on ICT Industry's Global Strategy" (2013) and OECD (earnings of 250 largest enterprises in ICT industry)

Figure 1-2-2-2 Region-by-region distribution of global ICT market and growth



Source: Prepared by MIC from Gartner data

Figure 1-2-2-3 Global expansion models for ICT industry

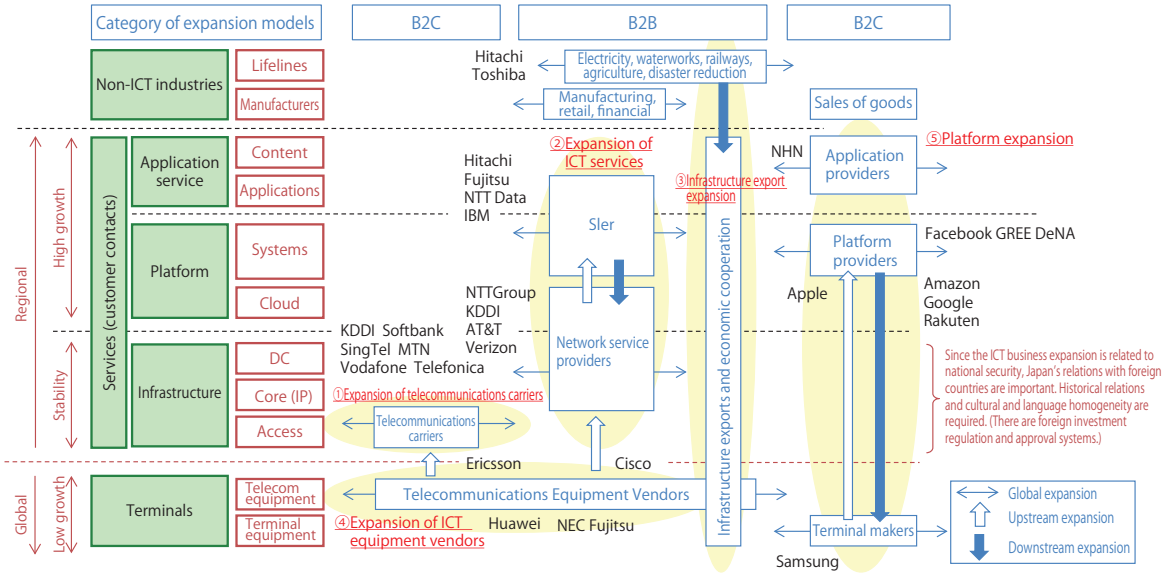
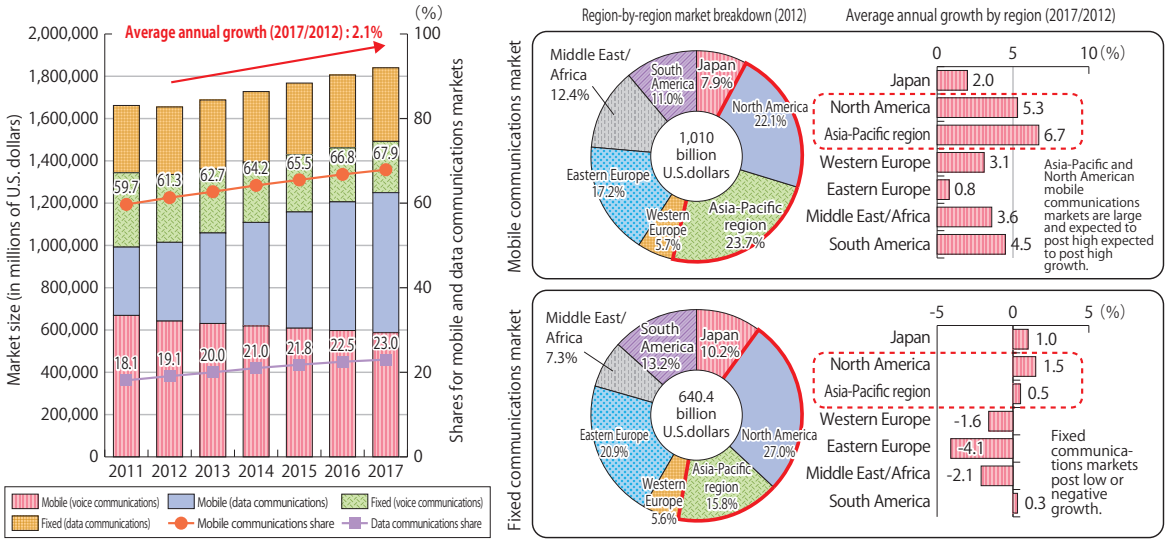


Figure 1-2-2-4 Projected global communications market sizes



(Source) Prepared by MIC from Gartner data

communications market, Japan accounted for 7.9% in 2012. North America and the Asia-Pacific region respectively accounted for 22-23%, representing the largest markets in the world. Projected mobile communications market growth through 2017 in Japan is limited to 2.0%, against higher growth rates of 5.3% for North America and 6.7% for the Asia-Pacific region.

a. Global expansion models for communications layer

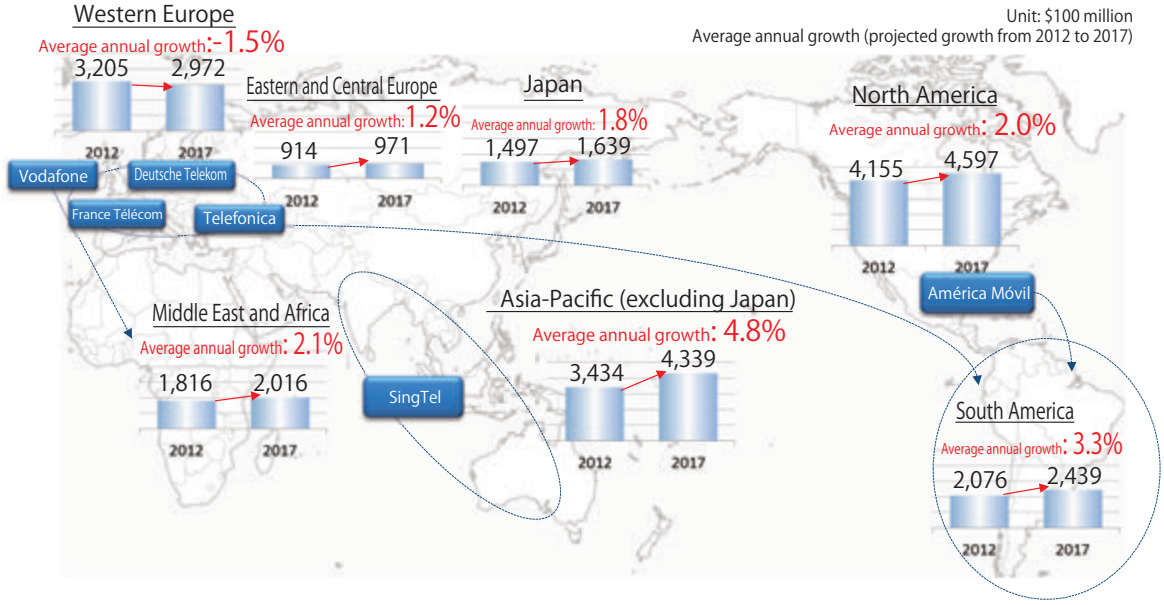
Figure 1-2-2-5 shows the growth potential for regional communications markets in the global market and telecommunications carriers' global expansion. The figure indicates that these service providers in Europe where communications market growth has been capped are expanding into South America, the Middle East and Africa where the communications markets have high growth potential. America Movil in Mexico is expanding into South America and SingTel of Singapore is expanding operations within the Asia-Pacific region.

b. Prospects for telecommunications carriers' global expansion

Telecommunications carriers in Japan and other countries have created two models for overseas expansion. (1) The first model represents global expansion based on historical reasons including colonial age relations between colonial powers and their colonies and the need for international expansion after an early introduction of competition in domestic communications markets. (2) The second model for overseas expansion takes advantage of relations with neighboring countries based on geographical factors including limited national land and market sizes.

North America, South America and the Asia-Pacific region subject to the Trans-Pacific Partnership free trade negotiations represent the world's three fastest-growing markets. If Japan leads other TPP participants

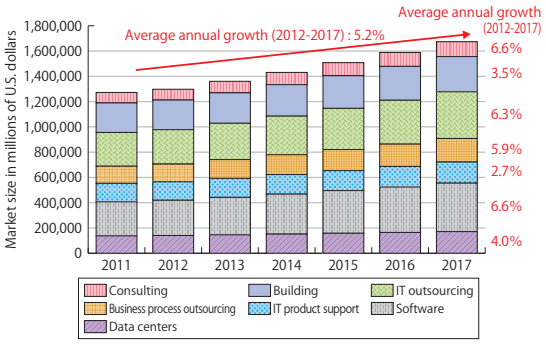
Figure 1-2-2-5 Telecommunications carriers' global expansion and market growth potential



(Source) Prepared by MIC from Gartner data

to repeal or relax regulations on foreign investment and ensure fair access to communications infrastructure, Japanese telecommunications carriers may expand into these regions more easily and offer better service terms and conditions. Japanese telecommunications carriers thus have potential to overcome constraints in the mature domestic market and benefit from the high growth potential of the Pacific Rim region by taking advantage of Japan's location in the high-growth region and its relations with neighboring countries based on geographical factors for their global expansion according to the above second overseas expansion model.

Figure 1-2-2-6 ICT service market trends



(Source) Prepared by MIC from Gartner data

(4) Global expansion for ICT service layer

a. ICT service layer market trends

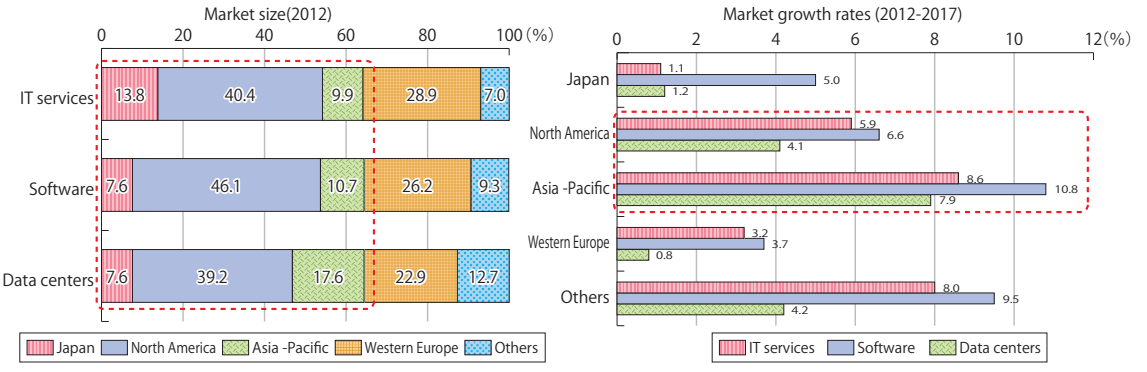
The global ICT market is projected to post an average positive annual growth rate of 5.2% between 2012 and 2017 under the globalization of business operations and the diffusion and expansion of information and communications systems (Figure 1-2-2-6).

Among regions, North America, Japan and the Asia-Pacific region account for more than 60% of IT service, software and data center markets. The markets for the three service categories are projected to grow 8-11% in the Asia-Pacific region and 4-7% in North America. These regions are predicted to continue high ICT service industry growth (Figure 1-2-2-7).

b. Prospects for global expansion for ICT service layer

Major Japanese ICT service enterprises have traditionally expanded into the global market in a manner to follow their Japanese customers expanding into the

Figure 1-2-2-7 Region-by-region ICT service market sizes and growth rates (2012-2017)



(Source) Prepared by MIC from Gartner data

United States, and ASEAN and other Asian countries. Following Japanese customers' global expansion alone may fall short of allowing these enterprises to grow more and more amid competition from European and American forerunners and low-cost local companies.

When anticipating Japanese ICT service enterprises' global expansion potential, we can conceive two major models — "horizontal global expansion" through M&A deals to increase business sizes and "global expansion based on upstream integration" through the enhancement or launching of upper layer services including consulting.

In the future, it may be effective for Japanese ICT service enterprises to take advantage of their strengths including quality, reliability and security for supporting their Japanese and foreign customers' global expansion with the abovementioned models in mind.

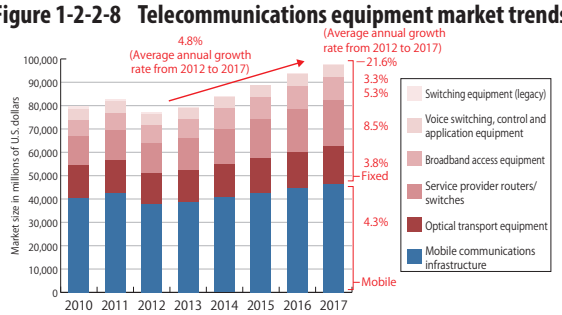
(5) Global expansion through infrastructure exports

a. Drafting and releasing infrastructure export strategy

Under its growth strategy, Japan must proactively absorb infrastructure development demand mainly in emerging countries and take advantage of the demand for its powerful economic growth. To this end, Japan should take various business approaches including full turnkey contracts covering infrastructure engineering, construction, operation and management as well as project investment expansion. Infrastructure system exports are expected to produce composite effects including the development of overseas business bases for Japanese enterprises and the enhancement of their supply chains and to contribute to improving Japan's international position through its transfer of advanced technologies and know-how.

Given the expectations, the government created the Ministerial Meeting on Strategy relating to Infrastructure Export and Economic Cooperation chaired by the Chief Cabinet Secretary in March 2013 to support Japanese enterprises' overseas infrastructure system development and their acquisition of interests in overseas energy and mineral resources and to discuss Japan's key economic cooperation measures for their strategic and efficient implementation. In May 2013, the government released the Infrastructure Systems Export Strategy.

Figure 1-2-2-8 Telecommunications equipment market trends



(Source) Prepared by MIC from Gartner data

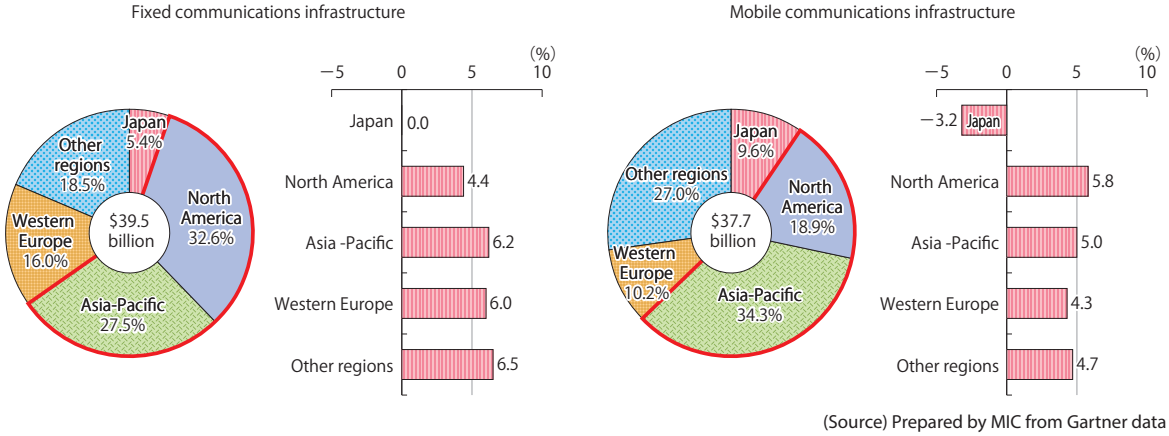
(6) Global expansion for telecommunications equipment layer

a. Telecommunications equipment market trends

The telecommunications equipment market is projected to grow at an average annual rate of 4.8% against the backdrop of globally expanding communications demand even amid the commoditization of telecommunications equipment. The mobile communications infrastructure portion accounts for nearly 50% of the market and is expected to steadily expand in the future. In the fixed communications infrastructure portion, demand is projected to decline substantially for legacy network equipment while expanding for IP (Internet protocol) network equipment. Particularly, router/switch demand is predicted to continue a high average increase of 8.5% (Figure 1-2-2-8).

Among regions, the Asia-Pacific region accounted for the largest share or $12.9 billion of the mobile communications infrastructure market in 2012. Of the fixed communications infrastructure market in the year, North America commanded the largest share or $12.9 billion. Through 2017, Asia-Pacific and other emerging countries are projected to steadily expand demand for fixed communications infrastructure. The Asia-Pacific region's mobile infrastructure demand is projected to grow to $16.5 billion (Figure 1-2-2-9).

Figure 1-2-2-9 Telecommunications equipment market breakdown by region



(Source) Prepared by MIC from Gartner data

b. Prospects for global expansion for telecommunications equipment layer

Telecommunications equipment vendors' global expansion approaches are roughly divided into two models — (1) a "horizontal expansion model" in which vendors focus on equipment or systems representing their technological advantages and (2) a vertical expansion or "managed-service" model where vendors undertake network operation and maintenance as best partners of overseas communications service companies.

In the telecommunications equipment layer where products have growingly commoditized through standardization, however, the horizontal expansion model mainly pursues a greater sales size taking advantage of lower prices and an overwhelmingly broad product lineup through mass production. It may be difficult for Japanese vendors to follow this model and successfully develop it into a sustainable business model unless they have overwhelming technological advantages and new markets where technological development can be foreseen.

On the other hand, the managed-service model is a standard business model for the global market. Therefore, Japanese telecommunications equipment vendors must obtain business resources for providing managed services by taking advantage of M&As and strategic alliances. In order to differentiate themselves from forerunners, they must find solutions as their strengths and develop complementary, win-win relations with major communications service companies. In global expansion, it is important for them to cooperate with global telecommunications carriers based in Japan and foreign courtiers.

Other conceivable models include (3) "expansion into upper layers" based on Japan's high technologies and know-how and (4) "infrastructure exports." In the upper layer market that is also competitive, Japanese vendors may take advantage of their excellent technologies and know-how to increase their overseas presence and expand into foreign markets. In the infrastructure exports market where Japan faces fierce competition from such big countries as the United States and China, Japanese vendors may fuse their ICT technologies with infrastructure or cooperate with manufacturers free from commoditization in order to expand into Asia-Pacific and other emerging countries where growth potential is great with demand growing for infrastructure.

(7) Global expansion for upper layers

a. Upper layer market trends

The upper layer market has been expanding rapidly amid the global development of wired and wireless broadband environments and free competition between market players. The market, though dominated by U.S. companies, increased its size (sales of major market participants) even after the Lehman Shock.

Upper layer enterprises, including digital content providers, are capable of driving the entire ICT industry in terms of growth potential and profitability (Figure 1-2-2-10).

b. Prospects for global expansion for upper layers

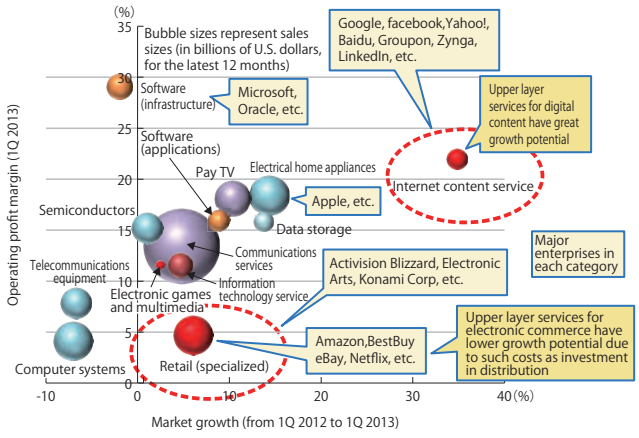
Only a limited range of enterprises including Google, Amazon, Apple and Facebook have been successful in platform development. In content and application development, requirements for local optimization in each country or region may be stronger for upper layers. When expanding into foreign countries, therefore, enterprises in these layers are expected to growingly localize know-how for ecosystems developed in their countries, while promoting M&As and strategic alliances with local rivals to secure local customer bases. Characteristically, upper layers can implement global expansion more promptly and easily than other layers. Their successful global expansion may produce massive job opportunities.

If the venture support environment is expanded to further develop upper layers, their platform development is expected to be promoted to further their global expansion.

(8) Estimated effects of ICT industry's global expansion

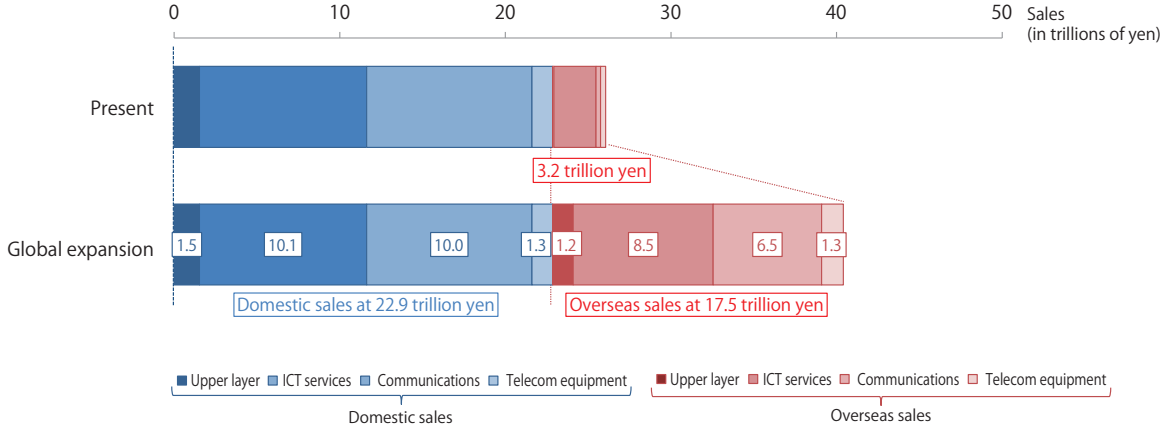
We estimated effects of successful global expansion by major Japanese enterprises in ICT service, communi-

Figure 1-2-2-10 Assessment of major U.S. publicly traded ICT industry enterprises by category



(Source) MIC "Research Survey on ICT Industry's Global Strategy" (2013)

Figure 1-2-2-11 Estimated effects of ICT industry's global expansion



(Source) MIC "Research Survey on ICT Industry's Global Strategy" (2013)

cations service, telecommunications equipment and upper layers building on models of foreign forerunners. As a result, we found that major Japanese enterprises in these layers have the potential to achieve 17.5 trillion yen in overseas sales, equivalent to three-quarters of their present domestic sales (in 2012), if they implement full-fledged global expansion (Figure 1-2-2-11).

This estimate, though excluding effects of the above-mentioned infrastructure exports in (5), indicates a great potential market resulting from these major Japanese enterprises' global expansion.

3. Broadcasting industry's global expansion and next-generation broadcasting initiative

(1) Broadcasting industry's global expansion

Japanese broadcasters are exploring various overseas expansion approaches in a bid to shift away from their heavy dependence on the domestic market.

Models for their overseas expansion are divided into two groups for an analysis, based on specific cases (Figure 1-2-3-1). One group represents a horizontal expansion through content-based multimedia development and alliances with other categories of enterprises to take advantage of broadcast content's influences for expanding business bases and value chains. The other represents enhancing involvement in broadcasting services in foreign countries through measures ranging from outright program sales to cooperation in producing programs, involvement in programming rights through securing programs and channels, and business alliances for participation in corporate management.

(2) MIC initiatives for overseas expansion of broadcast content sales

a. Discussions at panel on how to promote broadcast content sales

In November 2012, the MIC created a panel on how to promote broadcast content sales to consider challenges for (1) enhancing rights handling, (2) securing overseas opportunities for providing content, and (3) promoting the exploration of overseas and other new markets. A factor behind the slow overseas expansion of broadcast content is that the handling of rights fails to make progress in overseas markets that are smaller than the domestic market. Therefore, Japan should promote both "enhancing the efficiency and speed of the handling of rights" and "expanding overseas markets."

b. Economic spillover effects of global expansion of broadcast content sales

In his (second) speech on Japan's growth strategy in May 2013, Prime Minister Shinzo Abe came up with a policy of building on the Cool Japan initiative to promote "all Japan" efforts for manufacturing and services industries' overseas expansion. In this respect, the prime minister cited a goal of tripling broadcast content-related overseas sales in five years (by 2018) and indicated that the expansion's economic effects including those for peripheral industries would total 400 billion yen.

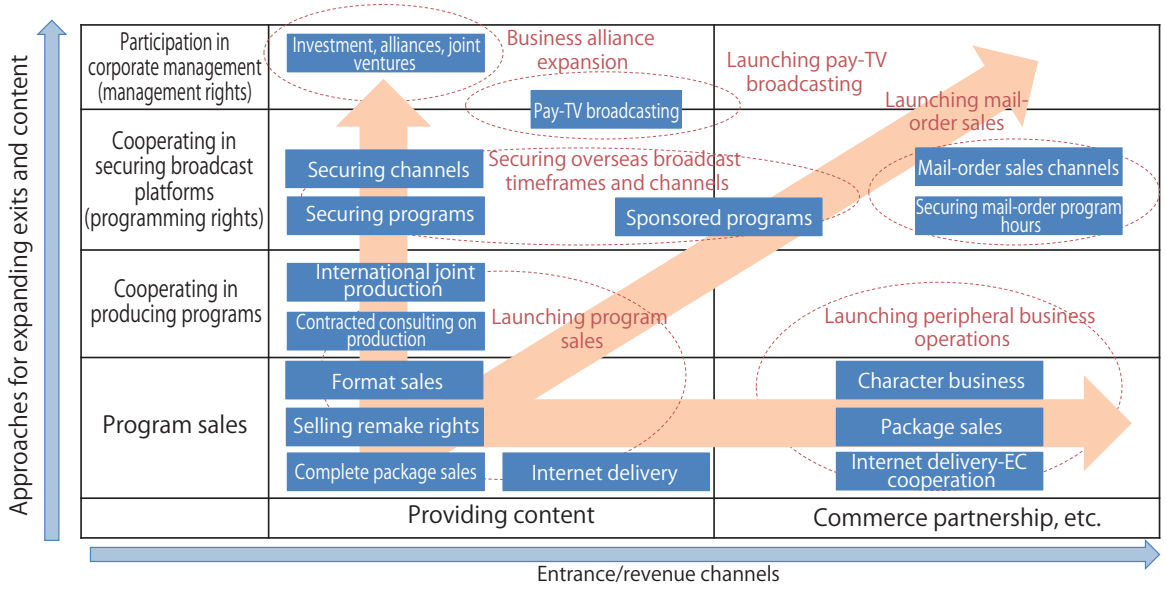
(3) Initiatives for diffusing next-generation broadcasting services (including 4K/8K initiatives)

a. 4K/8K (super hi-vision) initiatives and their significance

As the digitalization of broadcasting has been completed with advanced infrastructure developed for high-definition broadcasting and interactive services, the time has come to utilize the infrastructure for diffusing new digital broadcasting services. Meanwhile, Japan's public and private sectors have launched initiatives to realize next-generation broadcasting using 4K and 8K ultrahigh-definition technology to enhance the competitiveness of Japan's broadcasting industry. The definition of 4K means there are four times as many pixels than the present hi-vision (2K) level (about 2 million pixels). 8K indicates 16 times as many pixels.

The 4K/8K ultrahigh-definition technology can be expected to be used not only for televisions and broadcast-

Figure 1-2-3-1 Major approaches for overseas expansion of broadcast content sales



(Source) MIC "Research Survey on ICT Industry's Global Strategy" (2013)

ing but also for digital cinemas and digital signage and lead to exports of relevant equipment and content production know-how.

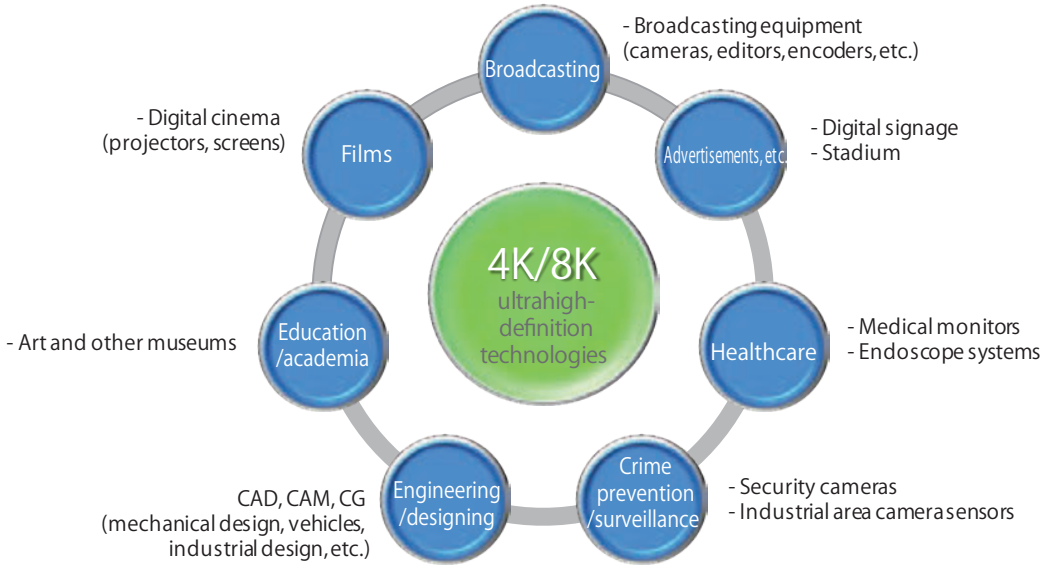
Japan, with its expertise in ultrahigh-definition technology, is expected to promptly commercialize and diffuse specific services to secure the broadcasting industry's technological capabilities and international competitiveness and to export relevant technologies, products and Japanese culture.

A report by the ICT Growth Strategy Meeting's panel on the advancement of broadcasting services at the MIC has indicated a roadmap where Japan will launch test 4K broadcasting in 2014 (when Brazil will hold the World Cup soccer tournament) and test 8K broadcasting in 2016 (when Brazil will hold the Rio de Janeiro Olympics).

b. Next-generation broadcasting expansion

The ultrahigh-definition technology may find application in a wide range of industrial purposes in addition to the abovementioned consumer goods and services. For example, 4K/8K ultrahigh-definition display and camera technologies may be used not only for broadcasting equipment but also for X-ray, mammography and other diagnostic images, tablet terminals for displaying electronic health records, ultrahigh-definition endoscopes for surgical operations and other medical purposes. They may also be available for ultrahigh-definition displays for computer-assisted design operations, ultrahigh-definition surveillance cameras for disaster prevention and social infrastructure maintenance, and digital signage systems (Figure 1-2-3-2).

Figure 1-2-3-2 Image of 4K/8K technology expansion



Source: MIC "Survey Research on Higher Resolution and Advancement of Pay Broadcasting" (2013)

Section 3 Growth Potential Coming from Big Data Utilization

1. Big Data bringing about new growth

(1) Concept of Big Data

Big Data features massiveness, diversity and real-time availability. The significance of Big Data utilization is that ICT development has allowed massive, diverse data to be created, collected and accumulated on a real-time basis for analyses to detect abnormal changes, forecast future developments, provide services meeting users' needs, improve business operation efficiency and create new industries.

Big Data components are from various sources and diverse. The recent attention-attracting fact is that massive, diverse unstructured data have rapidly increased and become available for analyses in line with ICT development.

(2) Effects of Big Data utilization on economic growth

a. Growth accounting equation approach (macro viewpoint)

First, an increase in data analysis and other Big Data-related investment can be created as an economic effect since data analyses meeting data characteristics are required for the effective utilization of Big Data for marketing and other operations.

Generally, investment as a demand component can drive present economic growth, and investment accumulation leads to capital stock to prevent a decline in capital productivity and contribute to productivity on the supply side. Given the duality of investment, Big Data-related investment can be expected to generate a productivity improvement effect. Other expected effects include cost cuts, operational efficiency improvements, and productivity improvements through new product development and new information creation and utilization.

Big Data utilization can thus be expected to drive economic growth through the quantitative improvement effect of an increase in data-related investment and investment stock and the qualitative improvement or direct effect of a relevant rise in productivity. New businesses and jobs can also be created to achieve the redistribution of labor resources, further improving overall economic efficiency.

Furthermore, the creation of a virtuous circle of ICT investment and productivity improvement may lead to additional ICT investment. A positive linkage effect of investment and productivity can be expected to create an indirect path to economic growth (Figure 1-3-1-1).

b. Approach based on actual utilization at enterprises and other organizations (micro viewpoint)

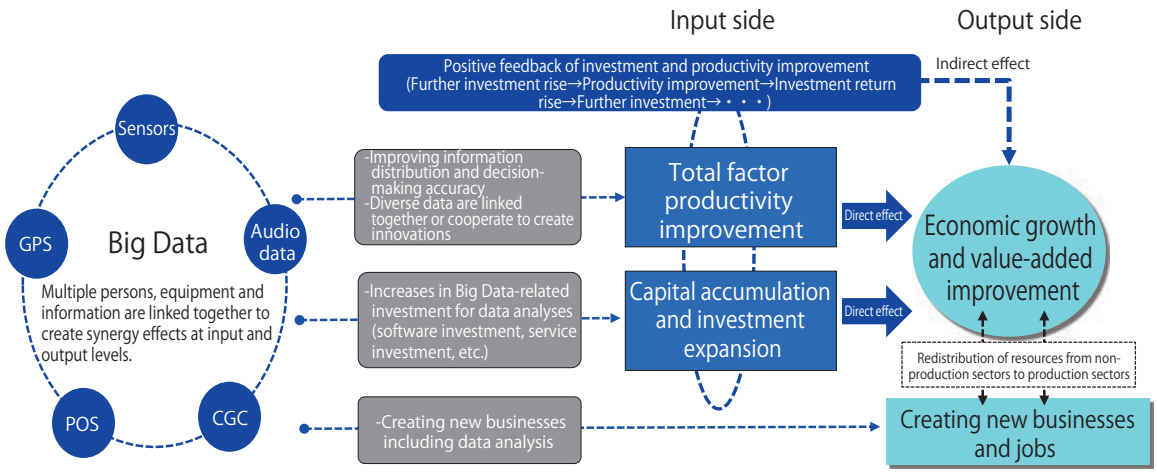
Human and social behaviors are apparently divided into three steps — perception, decision and implementation, which rotate in a cycle. ICT and Big Data utilization can be expected to improve the accuracy and speed of these steps. How the introduction of computers, their networking and the utilization of Big Data have impacted or will impact humans and society is explained below.

First, stand-alone computers were designed to improve the accuracy of decisions upon their introduction at enterprises and other organizations, contributing to reducing waste in the implementation of these decisions.

In a later stage where computers were networked through the Internet to promote linkage between data, perception grew more rapid and accurate. Cloud computing has diffused to enable distributed processing, substantially improving data-processing capacity in the decision-making stage. In the implementation stage, networking allowed decisions to be conveyed more widely, quickly and accurately.

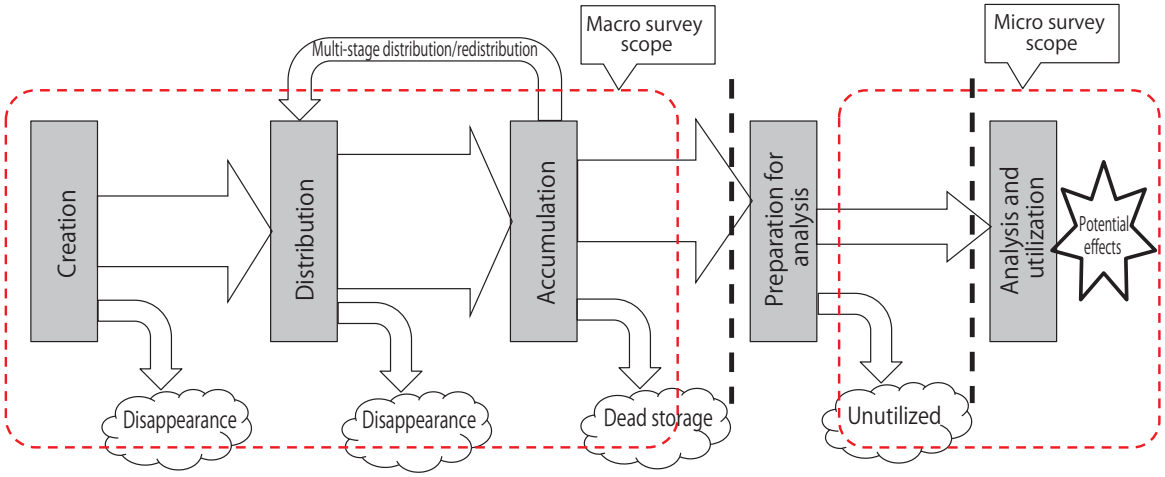
How has ICT advancement including Big Data utiliza-

Figure 1-3-1-1 Economic growth path contributed by Big Data distribution, accumulation and utilization (macro viewpoint)



(Source) MIC "Survey Research on Consideration of Approach for Measuring Information Distribution/Accumulation Volumes" (2013)

Figure 1-3-1-2 Big Data analysis scheme (macro and micro surveys)



(Source) MIC "Survey Research on Impacts of ICT Innovations on Japan's Socioeconomic System" (2013)

tion impacted the perception, decision and implementation? The development of M2M (machine to machine) communications for automatic recognition and control has allowed data acquisition and implementation to be optimized without human labor. In addition, the diffusion of massive data analysis tools has enabled more accurate massive data to be analyzed.

Furthermore, the qualitative improvement and lowered prices of computers, software, storage and networks have allowed more massive data to be created, distributed, accumulated, analyzed and utilized more quickly. The diffusion and lowered prices of broadband networks have enabled users to use faster broadband networks at lower prices.

Although operational decisions had traditionally depended on skilled persons' implicit knowledge, Big Data utilization has also allowed operational decisions to be reflected in operational systems for the explication of knowledge.

(3) Figuring out Big Data realities in Japan

a. Life cycle of Big Data

Big Data is created, distributed, accumulated and made available for analyses before being analyzed and utilized. In this process, massive data may disappear or remain in dead storage. Big Data that is actually analyzed and utilized may be limited to only a small portion of the created data. Some of accumulated data may be redistributed and accumulated for different purposes before being analyzed and utilized.

b. Big Data analysis scheme

We considered two methods for measuring Big Data and actually estimated the data volume and potential effects of Big Data utilization.

(a) In estimating Big Data distribution and accumulation volumes, we calculated data volumes from the creation of original data to the distribution/accumulation stage at macro and industrial levels. (b) In measuring potential effects of Big Data utilization, we analyzed what effects Big Data available for analyses produce on the actual preparation of business strategies and in-house decisions at the corporate level (Figure 1-3-1-2).

2. Measuring Big Data information distribution and accumulation (macro survey)

(1) Framework

a. Measurement targets

Given that the corporate sector is a major economic agent that utilizes Big Data for creating social and economic values, we limited measurement targets to enterprises and data that enterprises receive electronically, before considering a framework and trying the measurement.

b. Compiling data creation/distribution/accumulation process concept

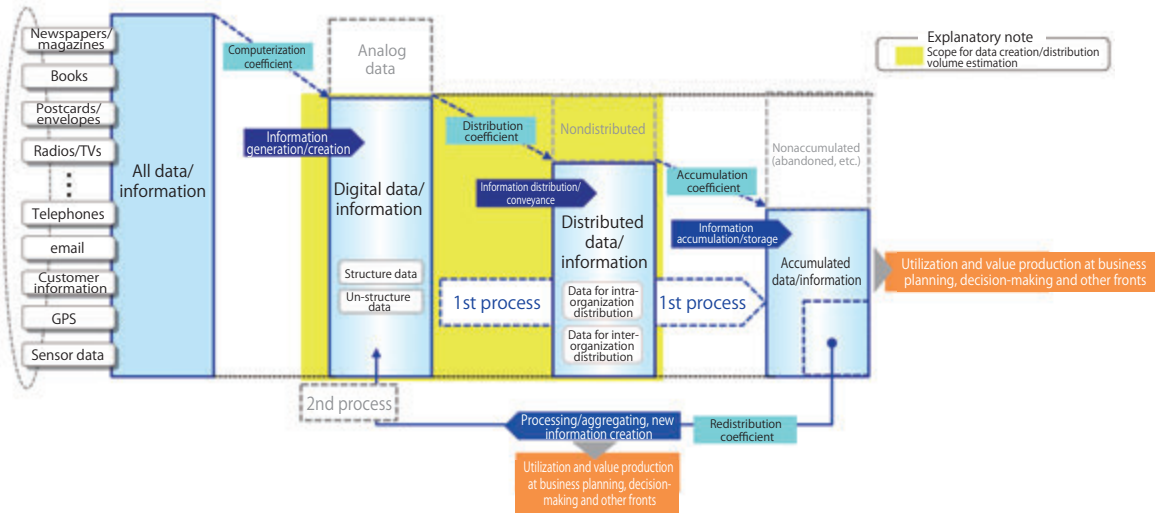
In the process of data creation, distribution or accumulation, digital data created at some point may be distributed to individual economic agents through communications networks and accumulated. The first cycle of data creation, distribution and accumulation may be completed here. In this process, all or some of the created data may be distributed and accumulated depending on the characteristics (the first data distribution process).

Digital data's major feature is that accumulated data are recreated through copying, processing and aggregation into new data that may be distributed and accumulated. Digital data may thus be recreated, redistributed and reaccumulated (the second data distribution process).

c. Data distribution/accumulation volume estimation scope and estimation target data

Given the accelerated data volume expansion of digital data through a multi-stage repeat of the data cre-

Figure 1-3-2-1 Data distribution volume estimation scope



(Source) MIC "Survey Research on Consideration of Data Distribution/Accumulation Volume Measurement Approaches" (2013)

ation/distribution/accumulation process, it is very difficult to estimate data volumes after the first data distribution process while taking all data distribution cycles into account. In estimating the data distribution volume, therefore, we limited estimation targets to data volumes in the first data distribution process (Figure 1-3-2-1).

d. Big Data distribution/accumulation volume estimation approach

(a) Big Data distribution volume estimation approach

In estimating data distribution volumes, we selected nine industries (services, information and communications, transportation, real estate, finance and insurance, commerce, electricity/gas/water, construction and manufacturing) and 17 categories of data as estimation targets. We used the following model to estimate a data distribution volume for each industry and aggregate industry-wise volumes into a macro data distribution volume. In the distribution volume estimation, we retroactively estimated past distribution volumes as far as possible, building time-series data distribution volume data (for 2005, 2008, 2011 and 2012).

(b) Big Data accumulation volume estimation approach

In estimating data accumulation volumes, we focused on data stored on servers installed inside or outside enterprises. Therefore, data for the estimation were not limited, while targets for the data distribution volume estimation were limited. All data stored on servers were subjected to the estimation. Attention should be paid to the difference in estimation scopes.

(2) Big Data distribution and accumulation volume estimates

As a result of the Big Data distribution volume estimation, we estimated the total Big Data distribution volume for the nine industries in 2012 at about 2.2 exabytes. The time-series data indicate that the Big Data distribution volume increased about 5.2-fold in seven years from about 0.4 exabytes in 2005 to about 2.2 exabytes in 2012 (Figure 1-3-2-2).

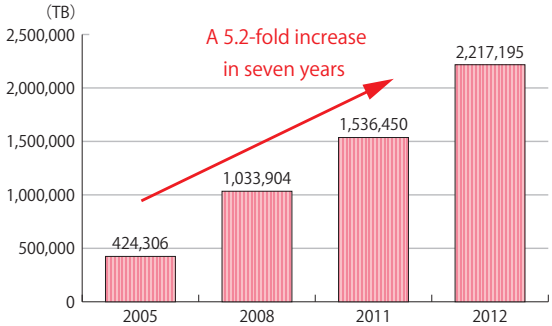
The Big Data accumulation volume (for the nine industries) in 2012 was estimated at about 9.7 exabytes for 2012. Among the industries, the commerce and services industries posted greater data accumulation volumes than the others. The finance/insurance and services industries logged higher outside server accumulation shares than the others (Figure 1-3-2-3).

(3) Analyzing relations between data distribution volumes and macroeconomic indicators

In order to assess impacts of an increase in data that enterprises receive electronically on economic performances, we analyzed relations between growth rates for the data distribution volume per employee and for labor productivity (real gross domestic product per employee) between 2005 and 2011.

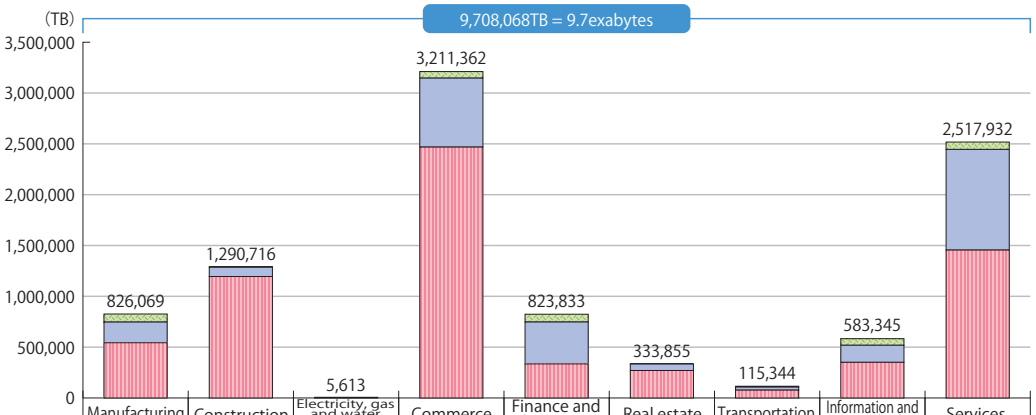
Figure 1-3-2-4 shows average annual growth rates (from 2005 to 2011) for the data distribution volume per employee on the horizontal axis and average annual growth rates (from 2005 to 2011) for labor productivity on the vertical axis, indicating their correlations. As far as other factors influencing the correlations are deemed constant, the data distribution volume and labor productivity have positive correlations.

Figure 1-3-2-2 Trend of Big Data distribution volume (total for 9 industries)



(Source) MIC "Survey Research on Consideration of Approach for Measuring Information Distribution/Accumulation Volumes" (2013)

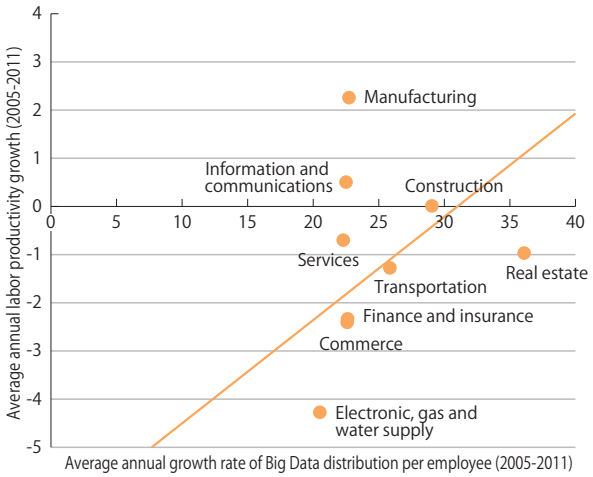
Figure 1-3-2-3 Big Data accumulation volume (by industry, in 2012)



	Manufacturing	Construction	Electricity, gas and water supply	Commerce	Finance and insurance	Real estate	Transportation	Information and communications	Services
Accumulation inside enterprises	543,156	1,194,956	3,722	2,468,219	334,843	270,270	76,887	350,485	1,455,067
Accumulation outside enterprises, inside Japan	203,562	90,900	1,376	678,545	412,397	63,237	30,258	167,949	990,394
Accumulation outside enterprises, outside Japan	79,350	4,860	515	64,598	76,594	348	8,199	64,911	72,472
Total	826,069	1,290,716	5,613	3,211,362	823,833	333,855	115,344	583,345	2,517,932

(Source) MIC "Survey Research on Consideration of Approach for Measuring Information Distribution/Accumulation Volumes" (2013)

Figure 1-3-2-4 Relations between growth rates for data distribution per employee and labor productivity



(Source) MIC "Survey Research on Consideration of Approach for Measuring Information Distribution/Accumulation Volumes" (2013)

Next, we built industry-by-industry panel data for 2005, 2008 and 2011, for which data distribution volume and labor productivity data are commonly available, and conducted a panel data analysis on the impact of data distribution volume growth on labor productivity improvement to statistically verify the impact. As a result, we found that data distribution volume growth and labor productivity improvement have a significantly positive relationship.

3. Big Data utilization cases and potential effects (micro survey)

(1) Framework

a. Survey scope

We collected information including Big Data utilization cases introduced in various literature since 2011. Therefore, we imposed no limits on information for the collection in regard to industrial categories or areas, enterprise sizes, data usages or categories of utilized data.

Subject to the information collection were cases for the utilization of massiveness, diversity or real-time availability representing the characteristics of Big Data.

b. Analysis approach for this survey

In this analysis, we paid attention to industrial, business method and operational categories of specific cases for information collection. We thus analyzed cases after specifying industrial, business method and operational categories in which Big Data were utilized.

Based on collected information, we first specified mechanisms for Big Data utilization to produce effects for specific operational categories (effect-producing mechanisms).

Next, we estimated potential economic effects of Big

Data utilization in specific industrial categories, based on quantitative and qualitative effects found in specific cases. Using quantitative effects found in specific cases as estimation parameters, we conducted the extrapolation for operational and business method categories where Big Data may be utilized in similar ways.

(2) Big Data used for various social areas

a. Expanding horizons for Big Data utilization

Big Data has begun to attract public attention only recently. Even since earlier days, however, various data have been created, distributed, accumulated and utilized as far as possible.

In the distribution industry, point-of-sale systems for cash registers diffused in the1980s, allowing retailers to growingly use sales or POS data for making decisions on product purchases. When enterprise-by-enterprise point cards were introduced around 2000, point card numbers were linked to POS data (to produce ID-POS data), enabling retailers to figure out customer-by-customer purchasing behaviors. These cards developed into common point cards or electronic money cards around 2010, prompting retailers to base their sales promotion on customers' purchase records covering multiple enterprises. Over the past several years, information handled by the distribution industry has substantially increased in variety and volume.

Next, the manufacturing industry began to share sales data with distributors in the latter half of the 1990s for the so-called supply chain management to avoid inventory surpluses or shortages. In the 1990s, machine builders began to mount sensors on their machinery products to figure out operation conditions for rationalizing maintenance operations. Since around 2000, remote surveillance data have been used for new services.

In the early 2000s, the utilization of data spread to cover transportation, infrastructure, agriculture and other various areas.

b. Expanding ranges of industrial and operational categories utilizing Big Data

While a growing number of cases for the utilization of structured data emerged in the distribution and financial industries, the range of industrial categories or areas using Big Data has expanded, including the infrastructure area using data from sensors, as well as agricultural and medical areas where ICT utilization had failed to make progress. The range of operational categories using Big Data has also expanded, covering from product development, production and other earnings-oriented operations to business planning, as well as administrative operations and infrastructure maintenance beyond corporate business operations.

c. Expanding range of sizes of enterprises using Big Data

A survey of enterprises on whether they are interested in Big Data utilization indicated that shares for enterprises considering utilizing Big Data are higher among enterprises with greater sales sizes. But those considering Big Data utilization accounted for a half of even smaller enterprises.

d. Expanding range of Big Data utilization purposes

A survey of enterprises on operational categories where Big Data utilization was considered or implemented found that market and business planning were frequently cited and that they were considering or implementing Big Data utilization for various operational categories. Questioned about operational categories where future Big Data utilization is promising, enterprises cited various categories, indicating that they are considering utilizing Big Data for a wide range of operations.

(3) Big Data utilization and its effects in major industrial categories

a. Specifying Big Data utilization patterns and effect-producing mechanisms in specific categories

(a) Distribution industry

In the distribution industry, data originate mainly from sales and include sales records. The industry has long utilized POS data to optimize product purchases.

The recent utilization of Big Data has apparently produced the following five new effects:

First, retailers may add geographical and time data to sales data in order to figure out details of consumer needs and develop new products meeting consumption scenes.

Second, retailers have long depended on sales data for developing and procuring products. In order to reduce sales opportunity losses or dead stock to maximize profit, however, they have recently launched efforts to collect more demand data on a real-time basis for figuring out and forecasting demand.

Big data utilization has produced effects in sales planning and promotion operations as well. Retailers analyze customer-by-customer data (ID-POS data) on point cards and comments on SNS and other websites to improve the accuracy of their sales promotion. Mail-order retailers have attempted to improve catalogue production and distribution efficiency by producing and distributing catalogues meeting consumer needs. Utilizing common point cards that have emerged recently, retailers have launched cooperation with other industries to attract customers that they had failed to attract in the past.

(b) Manufacturing industry

Big Data utilized frequently in the manufacturing industry represents operation conditions for products manufacturers have delivered. In many cases, they collect information from sensors mounted on products they delivered and manage and analyze operation data as Big Data to create new values.

In many cases, manufactures analyze machine operation data for improving the efficiency of their after-sale services. Through their Big Data analysis, they conduct preventive maintenance operations without any specific troubles in a systematic manner to improve their business efficiency. They can also improve customer satis-

faction by preventing the nonplanned suspension of machines that could bring about losses to customers. Even if troubles occur, they can now promptly identify the causes of troubles and take countermeasures to minimize customers' losses. Furthermore, they build on operation and trouble data to find components vulnerable to troubles and revise product designs and production control to reduce maintenance burdens.

Manufacturers also provide services to help customers save electricity and prolong the service lives of machinery products by analyzing their operation data for proposing optimum operation measures to minimize load. These services represent their new value-added services.

(c) Agriculture

In some cases, distribution and sales data are used for agricultural production. Big Data has just begun to be utilized for research on breeding and production of seedlings. But the entire agricultural sector has failed to make progress in ICT utilization or introduce Big Data on a large scale.

At present, data are used for production relatively frequently. Environmental, plant growth and soil component data are collected and analyzed to compute appropriate work, fertilizer and chemical volumes. These data are used for controlling vegetable factories and optimizing instructions to workers to increase yields, improve and stabilize product quality and optimize costs.

(d) Infrastructure (road traffic)

As for infrastructure, we take up road traffic particularly. Statistical surveys had traditionally been used for figuring out traffic demand and preparing road development plans. Recently, however, mobile terminals and geographical information systems have been made available for figuring out dynamic demand and preparing more accurate road development plans. Car navigation data can be used for finding locations for improvements. Dynamic data are utilized for real-time traffic information services to help avoid traffic congestion.

Sensors are installed on roads to measure load on infrastructure and relevant changes and reduce road maintenance costs over a medium to long term.

b. Estimating potential economic effects based on specific cases (Figure 1-3-3-1)

(a) Distribution industry

In the distribution industry, an analysis of specific cases has made the improved efficiency of sales promotion and the optimization of orders as effects available for estimation. The former effect is estimated at about 989.4 billion yen and the latter at about 163.5 billion yen.

(b) Manufacturing industry

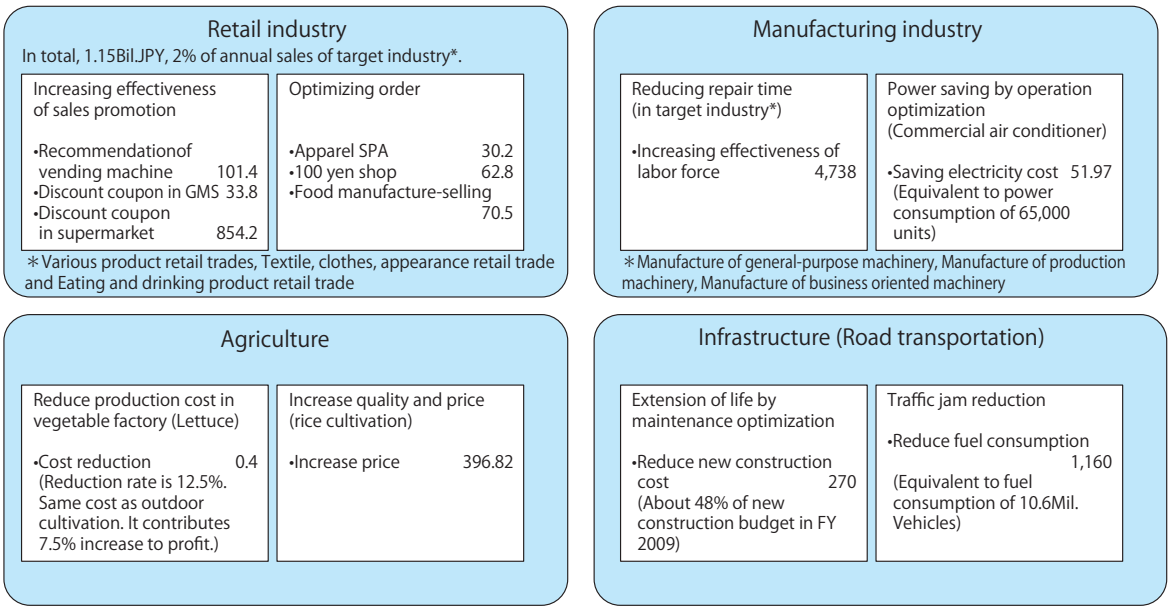
The effect of maintenance personnel cost cuts (worth 4,738 billion yen) through remote surveillance on machines amounts to 15.5% of shipments (2010) from manufacturers of general-purpose, production and business oriented machineries. Electricity savings (worth 51.97 billion yen) through remote surveillance on industrial air-conditioners amount to electricity charges for 65,000 commercial air-conditioners.

(c) Agriculture

As for agriculture, we estimated potential effects based on a case where the rice price rose by 29,000 yen per 60 kilograms due to synergy effects of quality control improvement through remote sensing and a brand-oriented marketing strategy. At vegetable factories, production costs are estimated to decline 12.5% to narrow the cost gap with outdoor cultivation.

Figure 1-3-3-1 Estimated potential economic effects based on specific cases

(in billion yen)



(Source) MIC "Survey Research on Impacts of ICT Innovations on Japan's Socioeconomic System" (2013)

(d) Infrastructure (road traffic)

Preventive bridge maintenance to prolong service lives can reduce annual costs by about 270 billion yen, equivalent to 48% of bridge development costs (570 billion yen in 2009). The effect of annual fuel savings through the Probe traffic information service to reduce traffic congestion is estimated at 1.16 trillion yen, equivalent to fuel consumption by about 10.6 million vehicles in Japan.

(4) Big Data utilization to create new values

Big Data reportedly features "almost comprehensive massiveness," "inclusion of unstructured data" and "inclusion of real-time data." Advanced computer networks including distributed cloud computing systems for high-speed processing of massive, diverse data have been developed to analyze Big Data.

As a result, enterprises can now figure out customer tendencies and trends that they had failed to fully understand. They can also obtain analysis results faster due to the reduction of analysis time consumption. Nearly comprehensively, massive data can be analyzed along with qualitative information to improve the accuracy of mathematical models indicating real phenomena. This has made it easier to find abnormal readings and improved the accuracy of future projections. In another major achievement, the real-time data acquisition and high-speed data processing have allowed us to figure out conditions on a real-time basis.

Big Data analyses can be used to improve the quality and speed of decision-making and daily business decisions at enterprises. Big Data has visualized invisible tendencies and trends, allowing enterprises to bring buried needs to the surface for developing and launching new products and services. In this way, Big Data has produced various positive effects allowing enterprises and society to improve efficiency and explore new markets.

Given the above, Big Data utilization is expected to exert various positive impacts on business operations and the society and economy, contributing to the revitalization of the Japanese economy.