

Chapter 2

Advent of the Age of Big Data Utilization

Recent years have seen dramatic growth viable in electronically processed data represented by “big data,” improvement in computer processing capacity and technological innovation in artificial intelligence and other areas. These developments are based on data. It is expected that data utilization will lead to productivity improvement and new demand exploration that have been overlooked, contributing to economic growth and innovation promotion. This chapter reviews the present situation including challenges for data distribution and utilization and project a path for utilizing data while eliminating fears among citizens and promoting companies’ consciousness reform based on questionnaire surveys covering citizens and companies results.

Section 1 Expanding Distribution and Utilization of Data

The utilization of big data holds the key to data-driven economic growth and social reform. This section pays attention to “innovation creation” brought about by data distribution and utilization and outlines initiatives and challenges, the balance between the utilization and pro-

tection of data and international conformity of data utilization. It also covers a wide range of data including business-to-business data, focusing on data categories and sectors in which Japan has competitiveness and sorts out data utilization and industrial competitiveness.

1. Definition and Scope of Big Data

Further progress in digitalization, advanced networks and IoT development through smaller and cheaper IoT devices such as smartphones and sensors are paving the way for us to efficiently collect and share big data including location information and action history provided through smartphones, information on Internet and television watching and consumption behaviors and massive data gained through miniaturized sensors.

Big data has attracted attention in recent years particularly because data for distribution has expanded to cover not only traditional virtual (cyberspace) data in the ICT field but also real data provided through IoT development and new ICT tools, and business-to-consumer and business-to-business data. (Figure 2-1-1-1)

While various views exist about how to classify big data, this paragraph pays attention to data generated by individuals, business and government sectors and classifies big data into the following four broad categories.

1) Government: “Open data” provided by national and local governments

Open data has had a lead as big data. The Basic Act on the Advancement of Utilizing Public and Private Sector Data, described later, calls for strongly opening public information owned by national and local governments as data.

2) Business: Digitalizing and structuralizing knowhow (called “digitalized intelligence”)

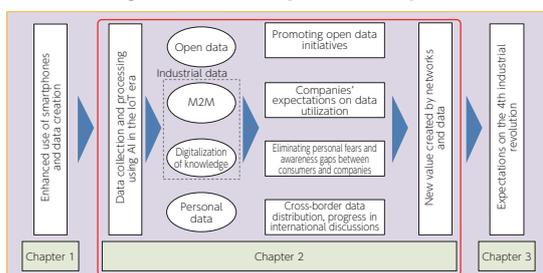
Digitalized intelligence is interpreted as data other than personal data owned by industries or companies from agriculture and infrastructure management to business services. In the future, various knowhow and accumulated knowledge in various areas and industries and familiar personal intelligence are assumed to be digitalized.

3) Business: M2M (Machine to Machine) streaming data (called “M2M data”)

M2M data includes IoT device data in production sites and sensing data (including strains, vibrations, and types and weights of passing vehicles) from IoT devices installed on bridges. M2M data and digitalized intelligence in 2) are positioned mainly as industrial data from the viewpoint of information generation and utilization. Particularly, B2B data is expected to demonstrate Japan’s competitiveness and enhance industrial power.

In this chapter, digitalized intelligence and M2M data are collectively called “industrial data¹⁰.”

Figure 2-1-1-1 Scope of this chapter



4) Individuals: “Personal data” involving attributes

Personal data include personal attributes, movement/action/consumption history, wearable device data and other personal information, as well as human traffic and product information that has been processed to prevent

specific persons from being identified. Therefore, this chapter interprets “personal data” as including not only personal information as clearly defined by law but also other personal related information having close to law-defined personal information.

2. Progress in Data Distribution and Utilization

This paragraph focuses on progress in data distribution and utilization and ongoing structural changes toward the advent of the age of big data utilization.

(1) Explosive Expansion in Data Distribution Volume

Network data traffic volume has dramatically increased. As for data traffic in Japan, broadband service (FTTH/DSL/CATV/FWA) users’ total download traffic has rapidly increased since 2014. The latest available year-on-year growth came to 52%. Japan’s mobile communication traffic has scored a 1.3-fold annual increase, with total download traffic growing 35% year on year.

(2) Progress in Technological Innovation to Increase Data Processing Speed

Digital network development and IoT progress through smaller and cheaper IoT devices such as smartphones and sensors have allowed big data to be efficiently collected and shared. Furthermore, cloud computing has allowed even low-capacity computers to conduct massive data processing, accelerating the creation of added values and innovation through data utilization.

Data flow through the centralization and decentralization of data has made progress in promoting this trend more efficiently. Data centralization includes machine and deep learning of big data aggregated on a cloud-based environment, representing a typical data intensive society in which the aggregation of high-quality data for learning leads to a competitive advantage. Data decentralization mobilizes not only cloud computing but also edge computing using deep learning to process data in

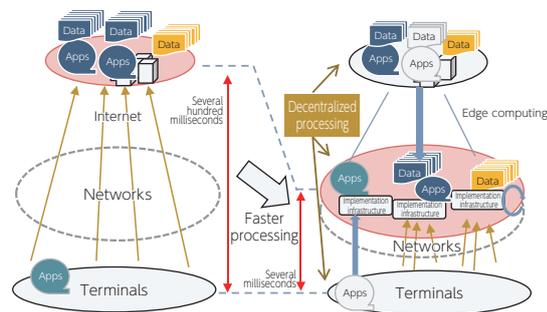
an optimum manner meeting value density in preparation for solving the problem of massive data in the IoT age (Figure 2-1-2-1).

(3) Diversification of Data Categories

As shown above, data are classified into four broad categories. A further breakdown of the four categories indicates very various data. Recently, structuralized data have systematically increased and been used for discovering new scientific knowledge and creating new businesses. In the future, various and massive non-structuralized data will be accumulated on a real-time basis and connected with each other through networks in line with IoT development. It is expected that these data will be analyzed to dramatically change social systems.

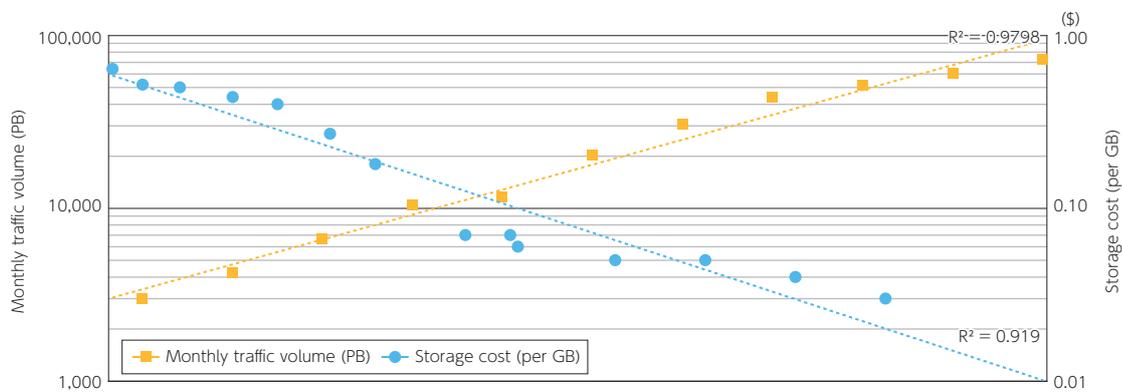
Such expectation is behind the open data policies for opening public sector data, which have made progress

Figure 2-1-2-1 Data centralization and decentralization



(Source) “Survey Research on Secure/Safe Data Distribution and Utilization,” MIC (2017)

Figure 2-1-2-2 Data traffic and storage cost trends



(Source) “Survey Research on Secure/Safe Data Distribution and Utilization,” MIC (2017)

¹⁰ The Report of the Study Group on Data and Competition Policy (July 2017, Japan Fair Trade Commission Competition Policy Research Center, hereinafter referred to as “Study Group Report”) interprets data collected by various sensors on equipment, human bodies, soil and other tangible objects as “industrial data.” <http://www.jftc.go.jp/cprc/conference/index.files/170606data01.pdf>

in the government sector in Japan and other countries. The reduction of data distribution costs has exerted particularly great influences on data processing speed (Figure 2-1-2-2).

(4) Growing value of data distribution and utilization

Finally, this paragraph checks the merit and significance of data distribution and utilization. The merit and

significance are often discussed from the viewpoint of “digital economy” as a new stage of the so-called Internet economy. Digital data is non-competitive and the marginal cost for copying data is close to zero. It does not deplete. Therefore, the accumulation and utilization of data can become a source of competitiveness, making contributions to economy.

3. New Data Distribution and Utilization Trends

(1) Development of New Data Utilization and Distribution Models

Models

Although data have traditionally been distributed mainly from ICT industry business operators to consumers, new relations between ICT utilization industry business operators and consumers will be generated in the future, with various stakeholders mediating services and data distribution. Various “things” belonging to the ICT utilization industry will mediate between consumers and ICT industry business operators through networks, leading to the distribution of M2M and other non-personal data. Such change will dramatically transform data distribution between individuals and companies.

Data distribution can be divided into three stages – data ‘provision,’ ‘distribution’ and ‘utilization.’ At present, data providers usually provide data to user companies directly or through data aggregators. If data are provided through data aggregators, however, data providers may not be able to know final data users. Then, new distribution models are being proposed (Figure 2-1-

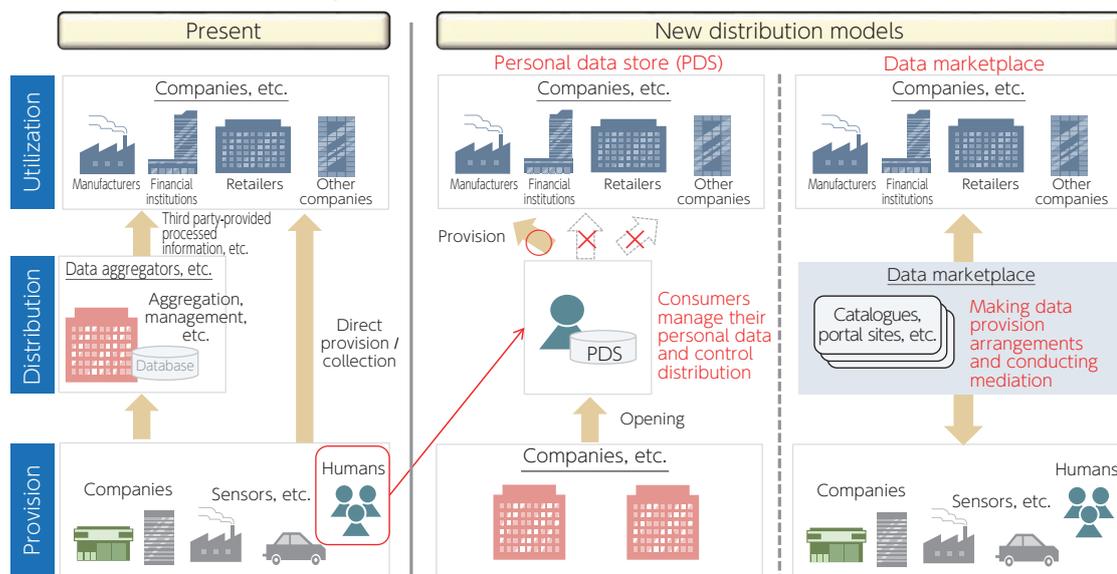
3-1).

Specifically, new approaches for the utilization of personal data including personal information in which personal data providers’ involvement and satisfaction are enhanced are being proposed, including a “personal data store (PDS)¹¹” and an “information bank¹².” In these models, data providers put their data under their own control and provide their data as necessary at their own will. In addition, a “data marketplace¹³” has appeared providing data trade places between data providers and users and places for mediators who aggregate and process information opened by data providers and open or provide processed data to users. These new data distribution and utilization models not only integrate the same type of data dispersed at various industries and companies but also collect data chronologically and combine various types of data horizontally to increase the value of data.

(2) Specific Forerunning Cases for Data Distribution Promotion

A breakdown of the abovementioned present models

Figure 2-1-3-1 Data distribution and utilization models



(Source) “Survey Research on Secure/Safe Data Distribution and Utilization,” MIC (2017)

¹¹ A personal data store is a system for data providers to accumulate and manage their own data and aggregate data owned by others and control the provision of their data (and transfer control on their data) to third parties.

¹² An information bank uses PDS and other systems to manage personal data under contracts with data providers and provide these data to third parties (other business operators) after judging the adequateness of the provision on behalf of the data providers based on conditions designated by the data providers in advance.

¹³ A data marketplace (data trade market) is a system that mediates between possessors of data and those willing to use the data, allowing them to make data trading deals.

Figure 2-1-3-2 Major data utilization cases

Data type, area	Case	Outline
Location information	NTT Docomo Inc. "Mobile Space Statistics"	NTT Docomo's "Mobile Space Statistics" processes its mobile phone customers' location information into anonymous demographic data for provision to business operators, local governments, etc.
Vehicle driving information	Toyota Motor Corp. Telematics Service	The company processes big data, including vehicle locations, speed and driving conditions, collected and accumulated through its telematics service, into traffic information and statistical data that are used for improving traffic, providing map information and preventing disasters.
	Sony Assurance Inc. Telematics Insurance	Since 2014, the company has acquired and analyzed customers' sudden acceleration and braking data to decide whether their driving is safe or not and refund insurance premiums to safer drivers.
Human body information	Docomo Healthcare, Inc. "Moveband 3," Omron Healthcare Co. "Wellness LINK"	These companies collect physical activity data (including travel distance and sleeping hours), and body height and weight data from people wearing wearable terminals for their visualization services, and analyze these data and provide them to medical institutions for lifestyle modification services.
Financial information	Hitachi, Ltd. "Financial API Linkage Service"	The service allows personal asset management service users to use their Internet banking IDs for seeing and controlling information on their multiple bank accounts.

(Source) "Survey Research on Secure/Safe Data Distribution and Utilization," MIC (2017)

by type of data and area indicates that data service providers collect, analyze and process data to add value to

services or pave the way for other companies to provide data (Figure 2-1-3-2).

4. ITAC (IoT Acceleration Consortium) Initiatives

The government, industry and academia sectors have established the IoT Acceleration Consortium (ITAC) to promote their utilization beyond the bounds of companies and industries in response to the advent of the IoT/big data/AI age. ITAC has been developing IoT technol-

ogy, utilizing IoT and implementing proposals for resolving policy challenges. In this respect, it has created a data distribution promotion working group to vitalize data distribution transactions beyond the bounds of areas and industries.

Section 2 Problems in Distribution and Utilization of Data

This section summarizes citizens' consciousness (tolerance and resistance) about data provision, Japanese companies' awareness and their gaps based on recent

cases and questionnaire and interview surveys covering companies and citizens.

1. Need for Developing Environment for Safe/Secure Data Distribution and Utilization

This paragraph outlines legal systems for promoting and paving the way for data distribution and utilization in foreign countries, and the status to develop a data utilization environment in Japan as the revised Act on the Protection of Personal Information, the Basic Act on the Advancement of Utilizing Public and Private Sector Data and other laws.

(1) Institutional Measures in Japan

Japan has continuously considered an institutional environment for data distribution and utilization. ICT development has paved the way for collecting and analyzing enormous data, enabling personal data utilization that had not been assumed at the time of the enactment of the Act on the Protection of Personal Information.

This has led to three challenges – (1) the emergence and expansion of so-called gray zone data that is difficult to be classified as personal information or other data, (2) the need for developing an environment for the adequate utilization of big data including personal data, and (3) the cross-border distribution of massive data amid the globalization of business operations. In response to these challenges, the Act on the Protection of Personal Information was revised in 2015 and the revised act was put into force in May 2017. Later, the Basic Act on the Advancement of Utilizing Public and Private Sector Data was enacted to set forth basic principles for promoting the utilization of public and private sector data. On open data, its Article 11 provides: "The State and local public entities are to implement necessary measures to enable

citizens to easily use Public and Private Sector Data held by themselves via the Internet or any other advanced information and telecommunications network while ensuring that the rights and interests of individuals and corporations, national security, etc. are not damaged.” Under this law, more data is expected to be made open to public.

A. Revised Act on the Protection of Personal Information

In September 2015, the revised Act on the Protection of Personal Information was enacted. The revisions include the clarification of the definition of personal information, the introduction of an anonymously processed information system, a requirement for confirming and recording the provision of personal information to third parties, the establishment of the Personal Information Protection Commission and the addition of new provisions on the provision of personal data to third parties in foreign countries. Although Japan had not had any independent specialized organization empowered to supervise the handling of personal information, competent ministers’ authorities to supervise personal information handling business operators have been unified and transferred to the Personal Information Protection Commission, resolving such problems as overlapping supervision and unclear competent agencies. Another key point is that the revised law defines personal information processed into anonymous data as “anonymously processed information” and allows the anonymous data to be utilized for purposes other than originally intended ones or provided to third parties without consent from original data providers. The anonymously processed information system aims to promote personal data utilization including data transactions between business operators and linking data and is expected to contribute to creating new businesses and services and improving the convenience of people’s life.

B. Basic Act on the Advancement of Utilizing Public and Private Sector Data

In December 2016, the Basic Act on the Advancement of Utilizing Public and Private Sector Data was enacted, promulgated and implemented. Under the recognition that Japan should further develop the environment that contributes to solving problems faced by Japan, such as responses to rapid progress in the decline of birth rates and the aging of population, by utilizing a wide variety and a great deal of information that is circulated via the Internet and other advanced ICT networks, the law aims to comprehensively and effectively promote measures for the appropriate and effective promotion of public and private sector data utilization and thereby contribute to realizing a society in which citizens can safely live free of anxiety and in a comfortable living environment.

(2) Present Domestic Discussions and Government Policy

In line with the abovementioned legislative actions, Japanese government agencies have proceeded with discussions on data distribution and utilization.

A. Declaration to be the World’s Most Advanced IT Nation and Basic Plan for the Advancement of Utilizing Public and Private Sector Data

On May 30, 2017, the Declaration to be the World’s Most Advanced IT Nation and Basic Plan for the Advancement of Utilizing Public and Private Sector Data was formulated. This document covers the earlier Declaration to be the World’s Most Advanced IT Nation and a basic plan as stipulated in the Basic Act on the Advancement of Utilizing Public and Private Sector Data, calling for promoting priority measures toward 2020 for eight priority areas – electronic administration, health/health-care/nursing care, tourism, finance, agriculture/forestry/fisheries, manufacturing, infrastructure and disaster prevention/reduction, and transportation.

B. Growth Strategy 2017

On June 9, 2017, the Cabinet decided on the Growth Strategy 2017 as a new strategy. The strategy points out that thorough data utilization is one of the keys to putting technology innovation achievements of the fourth industrial revolution into society to dramatically increase productivity and that future investment should be accelerated in developing data infrastructure as new social infrastructure. It thus calls for developing data utilization infrastructure. The strategy also refers to the Basic Act on the Advancement of Utilizing Public and Private Sector Data and the Basic Plan for the Advancement of Utilizing Public and Private Sector Data, seeking to comprehensively and effectively promote the utilization of public and private sector data mainly in the abovementioned eight priority areas.

C. Comprehensive IoT Strategy¹⁴

The Information and Communications Council of the Ministry of Internal Affairs and Communications compiled a comprehensive IoT strategy¹⁵ in January 2017. It points out that Japan should learn lessons from its failure to get on the wave of the ICT revolution as the third industrial revolution and achieve such economic growth as seen in the United States through ICT investment expansion and should take all possible policy measures to survive global competition under the ongoing fourth industrial revolution. The strategy then summarizes measures for four layers – terminals, networks, platforms and services (data distribution).

¹⁴ In addition, the Industrial Structure Council of the Ministry of Economy, Trade and Industry released an interim report by a decentralization strategy working group of its information economy subcommittee in November 2016, citing the realization of hybrid data distribution systems under data portability, information bank and other approaches as one of the major issues and calling for initiatives to create a new data distribution system based on individuals and promote data collaboration through the clarification of data ownership.

¹⁵ The third interim report by the Information and Communications Council on “new information and communications policy toward the IoT/big data age” (the 23rd request for recommendations in 2015).

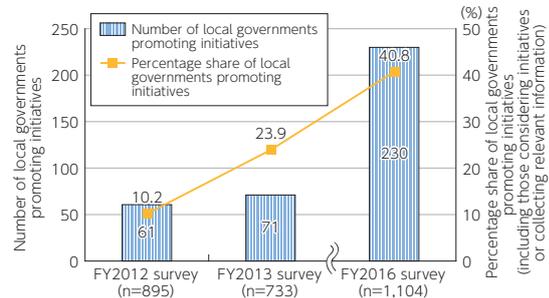
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2. Open Data Initiatives and Problems at Local Governments

(1) Open data initiatives and challenges

Local governments that have already been promoting open data initiatives have been increasing. In the latest survey, 230 (20.8%) of 1,104 local governments answered that they were promoting such initiatives. If those considering such initiatives or collecting information on them are included, the percentage share rises to 40.8%¹⁶(Figure 2-2-2-1). Among types of data being provided or considered for provision, public facility information was cited most frequently (by 68.3% of respondents). Those citing information on disaster prevention, tourism, education and healthcare/nursing care/welfare areas increased substantially from three years earlier. As problems with promoting open data efforts, the clarification of specific use images and needs was cited by 69.2% and the materialization of data providers' effects and advantages by 61.5%, indicating increases from three years earlier.

Figure 2-2-2-1 Implementation of open data initiatives at local governments



(Source) "Survey Research on Present Status of Regional ICT Utilization," MIC (2017)

3. Present Situation and Problems for Companies

(1) Data Utilization Situation and Problems

A. Industrial Data¹⁷

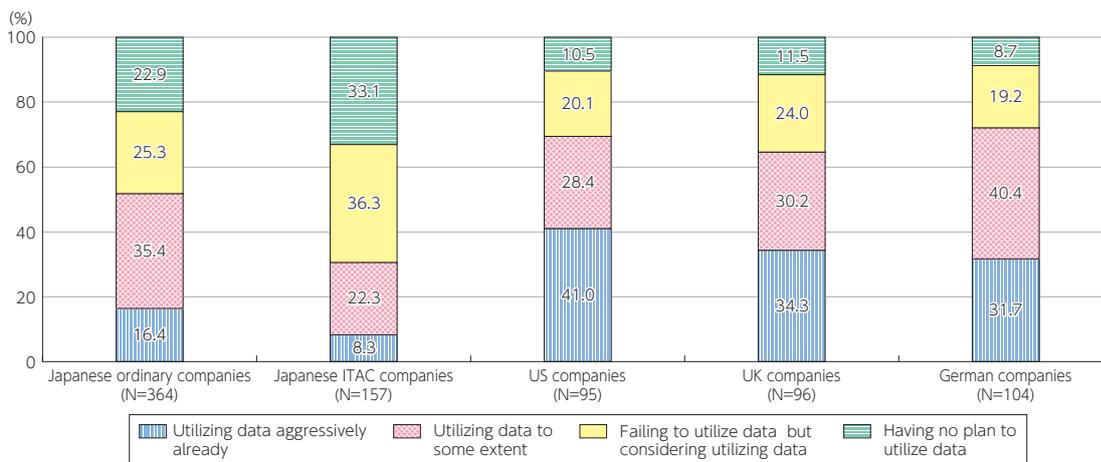
Japanese companies lag behind foreign firms in utilizing industrial data aggressively or to some extent for developing or providing services. Among the four countries, the United States indicates a particularly high percentage share of companies utilizing industrial data (Figure 2-2-3-1).

B. Personal Data

Next, companies' utilization of personal data for service development and provision has made less progress than their utilization of industrial data in all four coun-

tries, indicating that personal data utilization is still in transition (Figure 2-2-3-2). Japanese companies utilize slightly less personal data than foreign companies. Among challenges and barriers against handling and utilizing personal data at companies, the most frequently cited challenge is great incident risks or social responsibility accompanying personal data management. Particularly, Japanese companies cite the challenge more frequently than foreign firms, indicating their sensitivity to the challenge. Japanese companies also cite shortage of data handling human resources far more frequently than foreign firms.

Figure 2-2-3-1 Data utilization for service development and provision (industrial data)



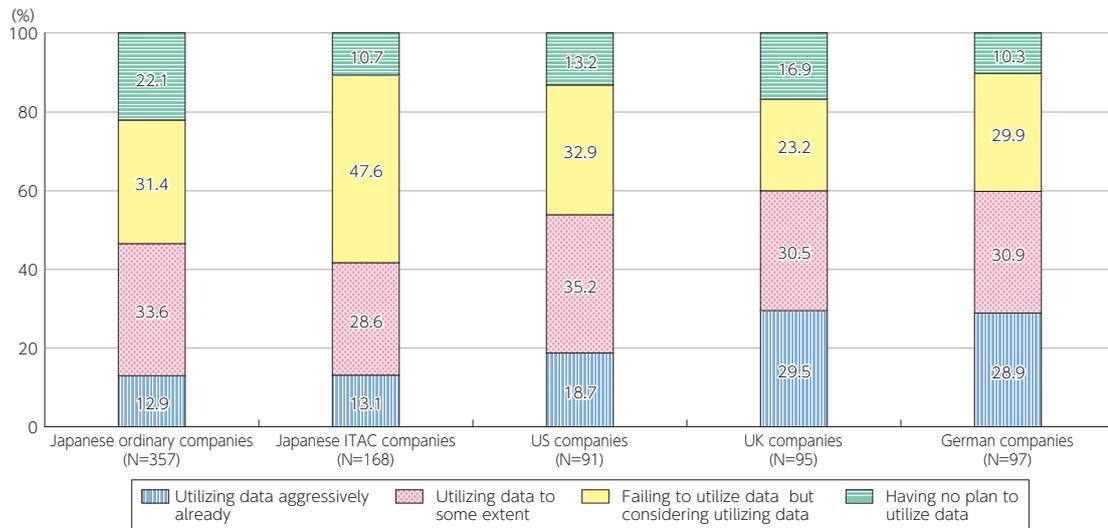
(Source) "Survey Research on Secure/Safe Data Distribution and Utilization," MIC (2017)

¹⁶ According to a survey by the Cabinet Secretariat, local governments implementing or planning open data initiatives accounted for about 32% of the total (as of February 2017) (reference data for the second meeting of the open data working group of the data distribution environment development study panel)

¹⁷ The Report of Study Group on Data and Competition Policy (July 2017, Japan Fair Trade Commission Competition Policy Research Center, hereinafter referred to as "Study Group Report") interprets data collected by various sensors on equipment, human bodies, soil and other tangible objects as "industrial data."

<http://www.jftc.go.jp/cprc/conference/index.files/170606data01.pdf>

Figure 2-2-3-2 Data utilization for service development and provision (personal data)



(Source) "Survey Research on Secure/Safe Data Distribution and Utilization," MIC (2017)

4. Awareness Gaps between Consumers and Companies

This paragraph looks into factors for worries about the provision of consumers' personal information or data and analyzes awareness gaps between individuals and companies based mainly on their surveys.

(1) Factor Analysis of Consumers' Insecurity

We collected and analyzed comments on companies' utilization of personal information for Internet services and found numerous key words and their relevance (Figure 2-2-4-1). Remarkable words related to the key word of "insecurity" include "leaks," "outflow" and the meaning of "worries," indicating consumers' general worries about information leaks as incidents. Many consumers call for enhancing companies' security control, some of which are deleting information after a certain period of time and providing veto power to consumers, suggesting needs for data deletion rules and an opt-out system.

Meanwhile, respondents who tolerate companies' utilization of personal information to some extent say they tolerate such utilization in order to receive more convenient, better services. Indications are that they decide on their provision of personal information or data based on benefit they receive in exchange for the provision.

Consumers' comments are accompanied by preconditions including the provision of necessary information such as purposes for data utilization, advanced notification and confirmation to users, and companies' security and data control, suggesting that personal data utilization is established under confidential relationships between consumers and companies. Remarkable key words in comments on the provision of personal information in exchange for services include "no choice" and "unavoidable." Out of 1,438 comments, 339 comments or 24.6% contained such key words. These comments indi-

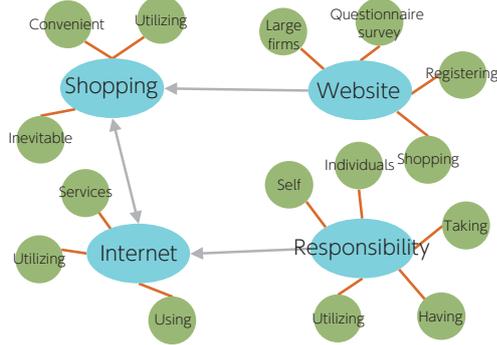
cate that consumers, while being "insecure," use services under the awareness that they "inevitably" provide their personal information.

(2) Comparison between Individuals' Awareness and Companies' Awareness

Matching between individuals' and companies' views about the handling of personal information or personal data may be important for developing their confidential relationships. In the big data age, however, companies utilizing personal information tend to view such information as their proprietary asset, and consumers generally interpret personal information as their personal asset. Consumers and companies thus have an awareness gap (Figure 2-2-4-2).

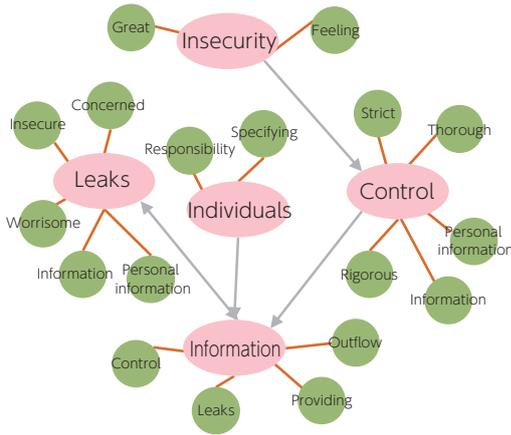
Comparison between key points given priority by individuals providing personal information to companies and by companies acquiring such information from individuals indicates that individuals emphasize "ensuring security." Research results in present and past white papers on information and communications in Japan show that individual attention has grown more interested in ensuring security. Companies for their part give priority to acquiring appropriate consent to data provision. Companies are thus required to increase their accountability in response to consumers' requests. How about information companies should provide to individuals when providing and collecting personal information or personal data? There is also a gap on this point between individuals and companies, as is the case with the abovementioned priorities. Generally, both companies and individuals frequently cite "purposes for data utilization," while individuals growingly give priority to "means to ensure security," "method to delete data" and "opt-out policy" (Figure 2-2-4-3).

Figure 2-2-4-1 Awareness about services utilizing personal information (text analysis results)



Comments (positive attitude toward information provision)

- ✓ I am concerned about the provision of personal information, but I think that the convenience of **using the Internet** surpasses any negative aspects.
- ✓ In the case of online **shopping sites**, etc., information provision is unavoidable to some extent. I do not care if the company takes security measures to avoid information leakage.
- ✓ We provide personal information and receive **services**. It is just a game of give and take.
- ✓ I think as the provision of personal information depends on confidential relationships, any decision on what **Internet service** to use is up to consumers. If I use a service at my own **risk**, the utilization of personal information may be natural.
- ✓ As far as we use services, some risks may be **inevitable**.

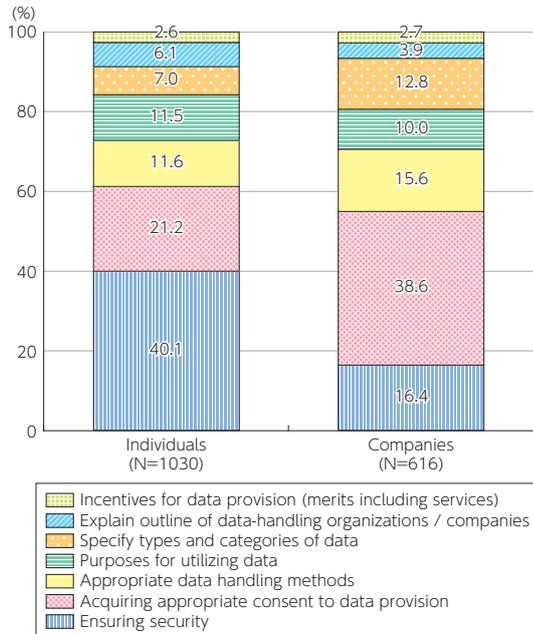


Comments (negative attitude toward information provision)

- ✓ It may be unavoidable to provide personal information to some extent, but I am afraid that the information I provide may be used illegally for advertisement mails or otherwise **leaked**.
- ✓ Although services are convenient, I am concerned that my information might have been **leaked**.
- ✓ I feel **anxious** because I cannot check how strictly our personal information is **managed**.
- ✓ It depends on what kind of **personal information** is utilized for what purposes, but I fear any wrongful use.
- ✓ No one may be able to **identify** specific **individuals** with name and age information alone. If I am requested to provide my address and telephone number, however, I may be very **insecure** in consideration of **leaks** or resale.
- ✓ Security should be carefully **controlled**.
- ✓ While the provision of information may be inevitable, I am worried about leaks. I want personal information to be deleted after some period of time.
- ✓ I am very **insecure**. I want to have the right to veto the utilization of my personal information.

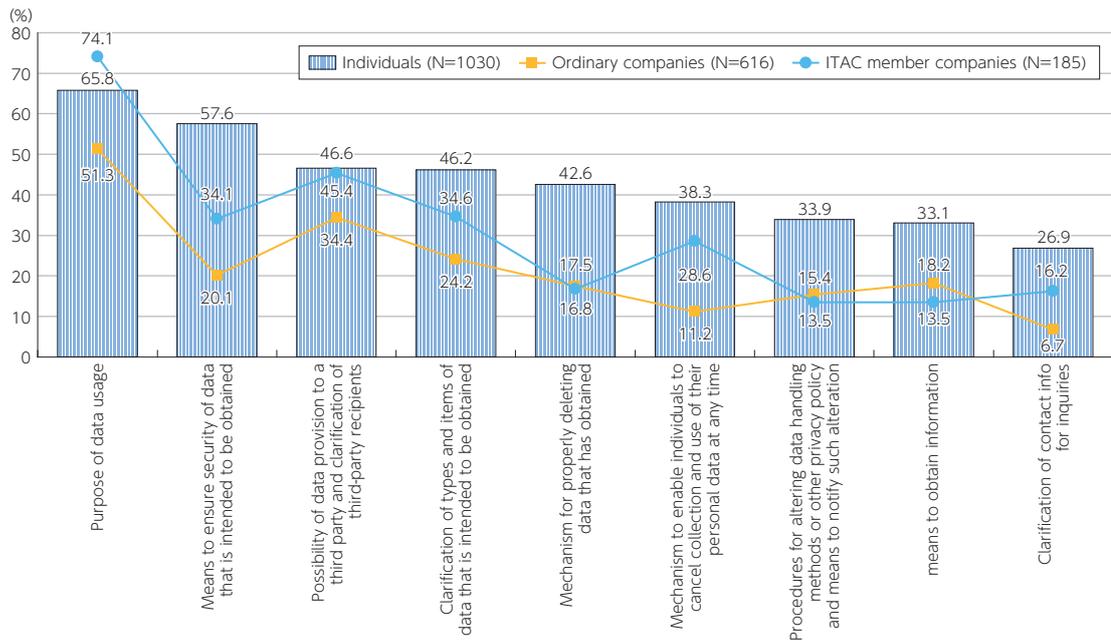
(Source) "Survey Research on Secure/Safe Data Distribution and Utilization," MIC (2017)

Figure 2-2-4-2 Key points given priority for data collection and provision (Japan/comparison between individuals and companies)



(Source) "Survey Research on Secure/Safe Data Distribution and Utilization," MIC (2017)

Figure 2-2-4-3 Information given priority for consent to personal data provision and utilization



(Source) "Survey Research on Secure/Safe Data Distribution and Utilization," MIC (2017)

Section 3 Broadening International Discussion

The previous section reviewed Japanese challenges focusing on the awareness of local governments, companies and consumers about data distribution and utilization. As noted in Section 1, data distribution and utilization have become a global trend. As cross-border data

distribution increases, international discussion on data distribution and utilization is making progress. This section overviews the present and future situations of such international discussion.

1. Current Status and Problems for Cross-border Data Distribution

This paragraph summarizes the present situation and problems for cross-border data distribution.

(1) Growing Cross-border Data Distribution

The cross-border distribution of data is attracting attention in addition to that of humans, goods (trade) and money (finance). Border-crossing data here widely range from information to search, communication, transaction, videos and business-to-business data. According to an analysis by the McKinsey Global Institute, cross-border data traffic has explosively grown thanks to the construction of the web linking countries, companies and individuals. From 2005 to 2014, cross-border data traffic increased some 50-fold from 4.7 terabits per second to 211.3 Tbps, according to the institute.

As for data traffic across the Japanese border, both inward and outward traffic between Japanese and foreign Internet service providers has increased dramatically. Particularly, inward traffic expanded some 50-fold from 2004 to 2016, scoring the same growth as the abovementioned global traffic (Figure 2-3-1-1).

An international questionnaire survey covering companies indicates that those implementing outward data provision account for about 70% of U.K. and German companies, for about 60% of U.S. companies and for

about 40% of Japanese companies. Particularly, more European companies' provide data outward (Figure 2-3-1-2).

(2) Regulations and Other Legal Systems Regarding Cross-border Data Traffic

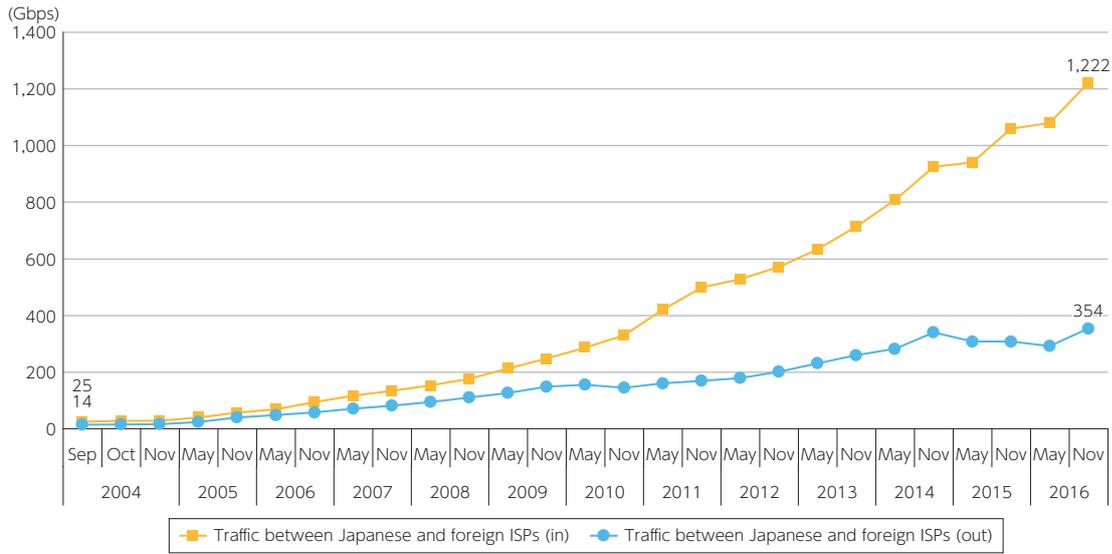
While massive data are distributed across borders amid the globalization of companies' business operations, some foreign countries have established and implemented legal systems for data localization to regulate cross-border data distribution for such purposes as (1) privacy protection, (2) domestic industry protection, (3) national security and (4) law enforcement and crime investigations.

Data localization is designed (1) to restrict data transfer themselves or (2) to control data transfer for possessing it domestically and keeping data collected from customers (including company-owned data) (Figure 2-3-1-3).

(3) Companies' Responses to Data Localization

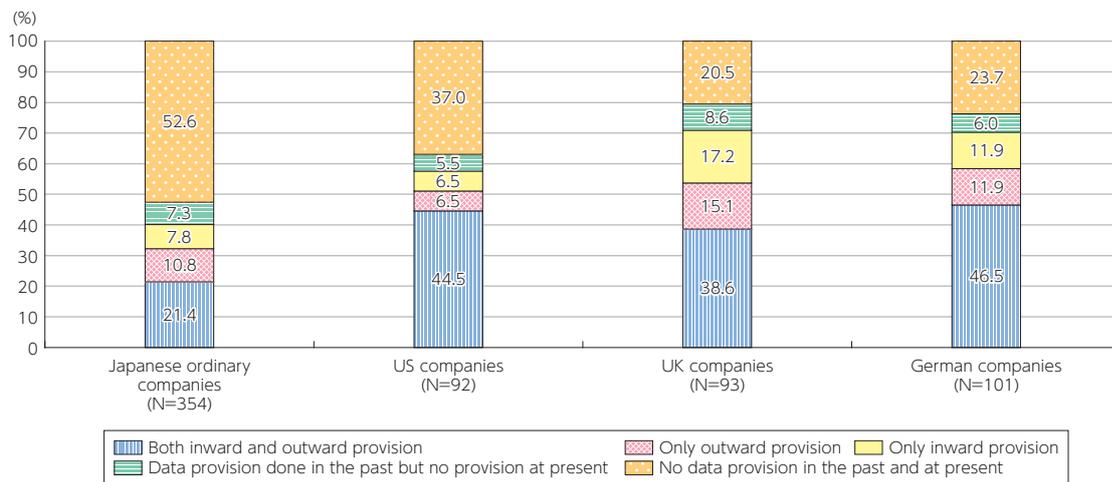
While data localization regulations have been introduced in some countries for their respective purposes or reasons, any new regulations seriously affect companies' global business operations. Companies are re-

Figure 2-3-1-1 Data traffic between Japanese and foreign ISPs



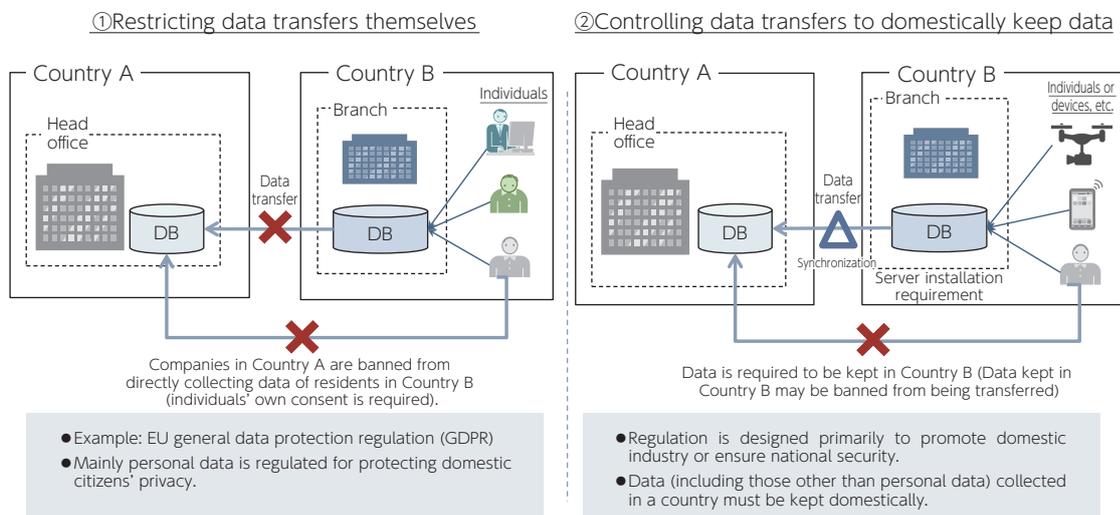
(Source) Prepared from "Japanese Internet Traffic Aggregation and Estimation," MIC

Figure 2-3-1-2 Companies' cross-border data provision



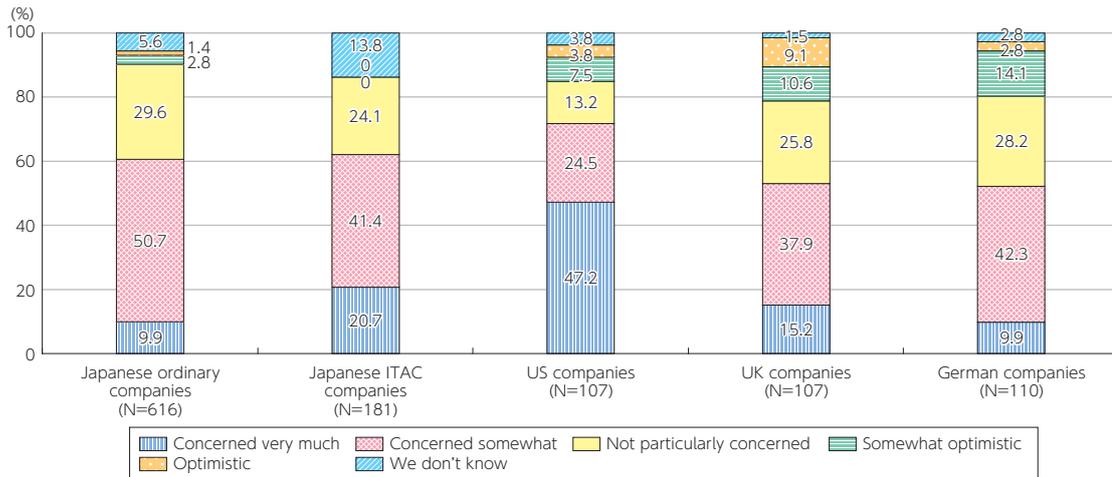
(Source) "Survey Research on Secure/Safe Data Distribution and Utilization," MIC (2017)

Figure 2-3-1-3 Data localization



(Source) "Survey Research on Secure/Safe Data Distribution and Utilization," MIC (2017)

Figure 2-3-1-4 Companies' awareness of data localization



(Source) "Survey Research on Secure/Safe Data Distribution and Utilization," MIC (2017)

quired to improve their awareness of such data localization regulations as the European Union's general data protection regulation (GDPR) and take responses to them.

An international questionnaire survey on companies' awareness of data localization effects on their business operations indicates that more than a half of companies

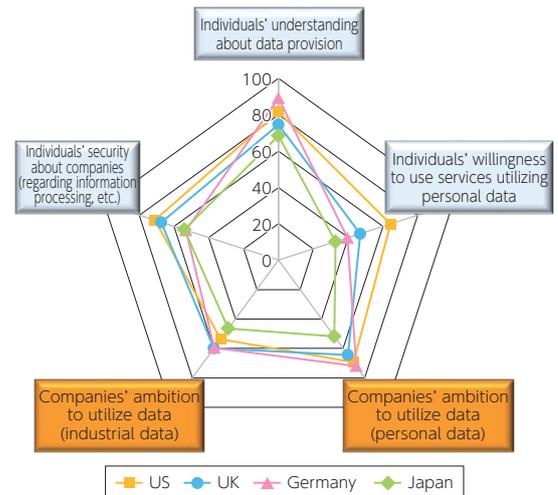
including Japanese firms are concerned about such regulations (Figure 2-3-1-4). Particularly, nearly 50% of U.S. firms are concerned very much, suggesting their strong attention on these regulations from the viewpoint of business continuation. Given that the GDPR is limited to the EU, nearly 20% of U.K. and German companies are optimistic.

Section 4 Future Outlook Compilation and Recommendations

1. Comparing International Infrastructure for Data Distribution and Utilization

We here understand Japan's position from the viewpoint of international comparison anew and summarize relevant challenges. We have assessed Japan's position from the viewpoints of individuals and companies. The assessment is based on three indicators for individuals – "individuals' understanding about data provision," "willingness to use services utilizing personal data," and "individuals' security about companies"¹⁸ – and two indicators for companies – "ambition to utilize industrial data" and "ambition to utilize personal data" (Figure 2-4-1-1). Indicators for Japan are lower than for other countries. Japan's gap with other countries is particularly wide for individuals' "willingness to use services utilizing personal data" and companies' "ambition to utilize personal data." These indicators may be interdependent, suggesting that Japan's gap with other countries may narrow as consumers' interest in such services and willingness to use such services grow in line with progress in companies' positive utilization of data.

Figure 2-4-1-1 International comparison regarding data distribution and promotion environment



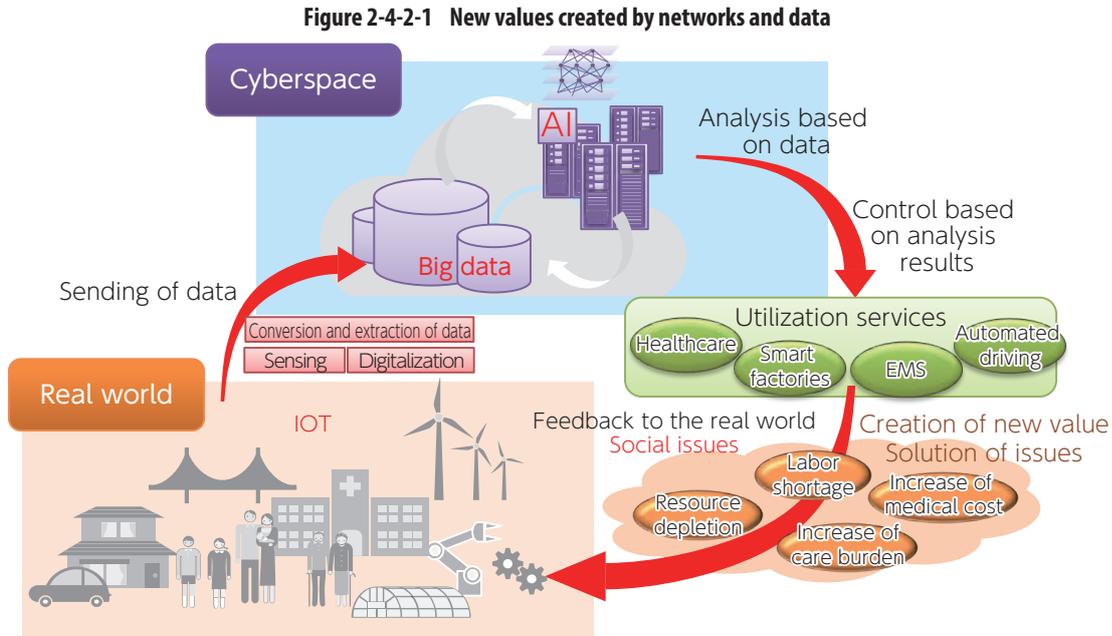
(Source) "Survey Research on Secure/Safe Data Distribution and Utilization," MIC (2017)

¹⁸ Individuals were questioned about how they feel about a case in which companies utilize personal data for service provision after processing data provided by individuals in anonymous data. They were asked to select one from five alternative answers – "very secure," "relatively secure," "not so secure," "not secure" and "uncertain."

2. Recommendation Regarding Future Outlook

International comparison regarding data distribution and utilization in the previous paragraph allowed us to know Japan's position among developed countries and find challenges for Japan. Given that data distribution has various aspects, it is important to measure indicators quantitatively from multiple viewpoints. Progress in frameworks and international talks to quantify the eco-

nomonic value of cross-border data distribution taken up in Section 3 may be interpreted as the first step to this end. Such viewpoints and initiatives are expected to increase understanding about new values created through the combination of networks, data and industrial competitiveness and promote economic contributions (Figure 2-4-2-1).



(Source) White Paper on Information and Communications 2016