

Present State and the Future of Health Data Utilization NTT DATA Envisions

Co-creation of a “well-being economy” through health data



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Message

Co-creation of a “well-being economy” through health data

The wellness market* is flourishing in response to the rise of health-conscious consumers and increase in health-related social issues such as the spread of lifestyle-related diseases. The wellness market endeavors to address the health issues of consumers, and people’s attention is now placed on the “utilization of health data.” As a result of technological advancement in biosensors, it has become possible for consumers to take their own vital data and lifelogs in their daily life using wearable devices and other health devices. Accordingly, many businesses from various industries are now trying to create new customer experience values utilizing such health data of consumers.

Meanwhile, neither consumers nor businesses are familiar with health data, as such data have been mostly used in public healthcare services to date, and are unable to clearly picture what kind of benefits health data utilization would bring to them. This is creating “problems specific to the dawn” of health data utilization.

“What can we do by utilizing health data?” Our answer to this question is as follows.

To date, businesses have conducted marketing and provided products and services based on consumers’ attribute data, purchase data, online browsing history, and location information. Such data are information that captures the consumers from “the outside.” On the other hand, health data that show the physical and mental conditions of consumers capture the consumers from “the inside.” Businesses gain deeper understanding of the conditions of consumers from health data in addition to conventional information, and provide

products and services that fit the consumers better. Consumers effortlessly find products and services that fit them best, by using their own health data as the “key” for finding such products and services from various options available, and improve their well-being in their daily life. These are good examples of “benefits of health data utilization.”

NTT DATA believes that health data will become a natural part of our daily life, and the “well-being economy”, in which various daily products and services available for consumers are horizontally linked through health data, will become active in the near future.

However, “health data utilization” has just begun. Businesses gather and analyze health data of consumers and generate products and services that fit consumers’ health conditions. Consumers understand their own health conditions by looking at their own health data and find products and services that suit them among those abundantly available to them. To make this positive cycle repeat itself, we have to resolve the “problems specific to the dawn” we are facing now.

NTT DATA aims to achieve early realization of the “well-being economy” in which health data play the core role, by creating “opportunities to benefit from—health data utilization” and by spreading a new norm of “consumers realizing their well being by utilizing their health data” in this world, in cooperation with organizations such as academia, government, and companies, who has the same aspirations.

* A market of services to visualize, learn, and optimize the physical and mental conditions of individuals.

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Chapter 1

Present State of Health Data Utilization



“Health Data” as Quantitative and Qualitative Information of Physical and Mental Health Conditions

Definition of “health data”

Technological advancement in recent years enabled people to easily measure the vital data (e.g., heart rate, breathing rate) and take lifelogs on meals, exercise and sleep using wearable devices and smartphone apps. This is making more and more people interested in the “data that quantitatively and qualitatively show the physical and mental health conditions of individuals.” Various names are given to these data, such as personal health record and healthcare data.

A personal health record (PHR) refers to health, medical, and care information of an individual over their life. Here, it is important to note that the “confidentiality*” and “scope of utilization” of health, medical, and care information of an individual vary depending on the purpose of utilization, by whom it is used, and how the data is used. For

example, on some occasions, blood pressure may be measured by the individual using a home blood pressure monitor as part of self-care. In other occasions, blood pressure may be taken by a physician using a medical blood pressure monitor for the purpose of diagnosis. These are both “blood pressure measurements” but the latter has much higher confidentiality and companies cannot easily gain access to it.

Therefore, among the “data that quantitatively and qualitatively show the physical and mental health conditions of individuals,” NTT DATA defines (1) vital data and lifelogs taken by individuals and (2) results of medical checkups managed by municipalities or employers as part of public healthcare services (“checkup results”) as “health data,” and (3) data measured and generated by health professionals and used at medical sectors as “medical data.”

* Only authorized individuals are allowed to access the information.

Characteristics of “health data”

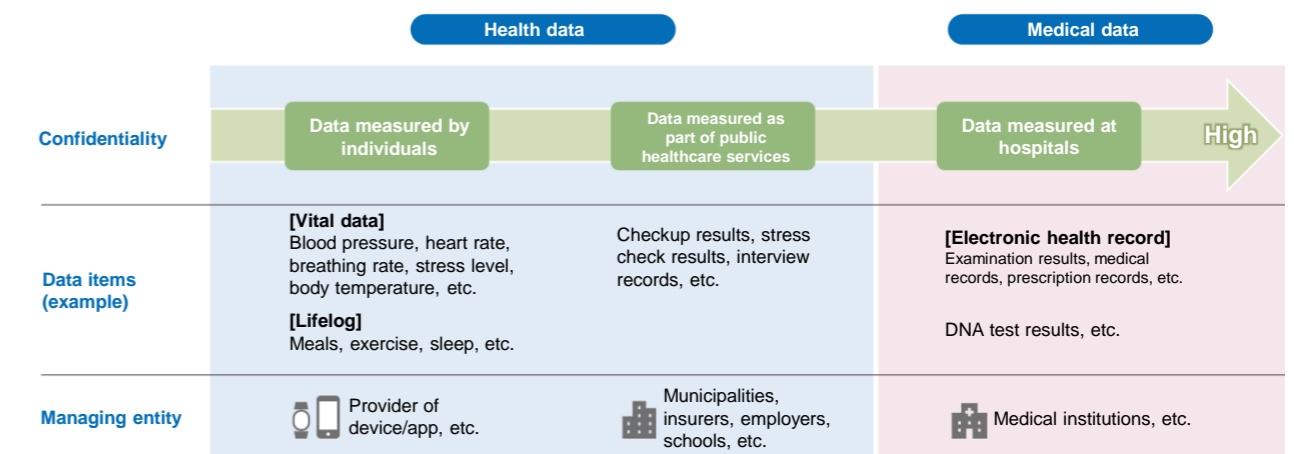
To date, health data have been managed by the “provider.” For example, the checkup results of a person are managed by the relevant municipality or employer, and the vital data measured by the person using a wearable and other health devices are managed by a database provided by the provider of the service. Once

the person leaves the company, or cancels the service, the person loses access to the data. In other words, such data are not at the consumer’s disposal.

In addition, most of health data are not standardized. For example, the data format of checkup results varies organization to organization, and gathering and analyzing checkup results would require pre-processing, like data format conversion and unification.

What is “health data”

The “confidentiality,” “scope of utilization,” and “managing entity” of data that quantitatively or qualitatively show the physical and mental health conditions of individuals vary depending on the purpose of utilization and how the data is used.



Creating New Customer Experience Values Utilizing Health Data

Technological advancement expanded possibilities of health data utilization

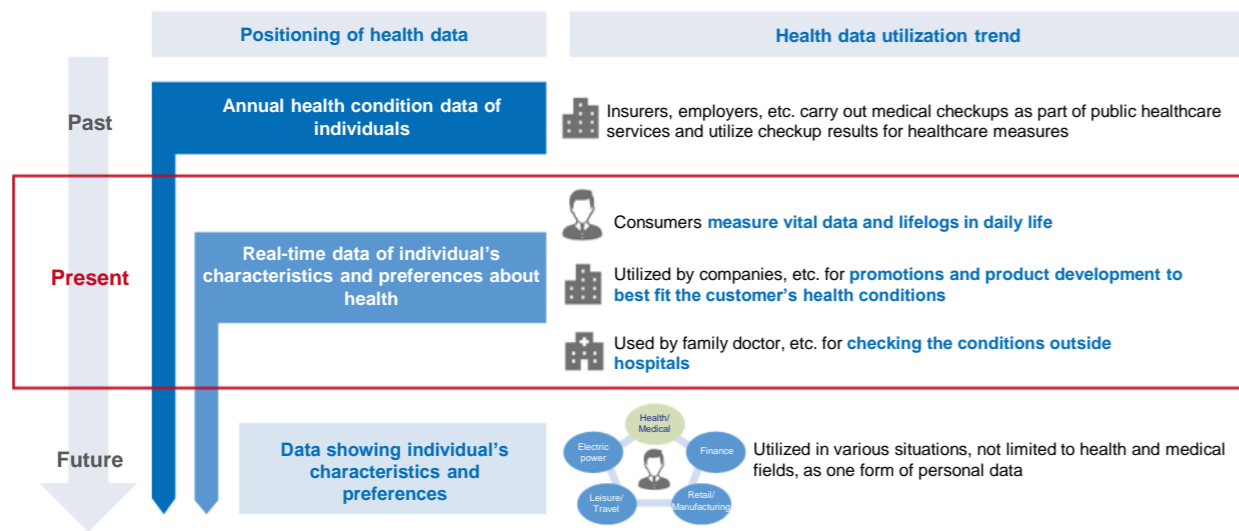
Until now, most of the health data collected and used were results of annual medical checkups carried out by municipalities and employers as part of public healthcare services, which are not particularly easy for the private market to obtain or handle.

Meanwhile, as a result of technological advancement in

biosensors, it has become possible for consumers to take their own vital data and lifelogs in their daily life using wearable devices and smartphone apps. As real-time data depicting individual's characteristics and preferences about health, such health data are highly sought after by companies that are working on the creation of customer experience values, and the possibilities of health data utilization are expanding.

Health market trend

Technological advancement enabled consumers to measure data such as vital data in daily life, expanding the possibilities of health data utilization



Insurance industry working on product development utilizing health data ahead of other industries

In the insurance industry, "health conditions of the insured" are closely tied to the "business profits." For that reason, the insurance industry started the development of products and services utilizing health data ahead of other industries. In 2016, "health-linked" insurance products were introduced into the life insurance and health insurance markets for individuals.

These "health-linked" insurance products offer various

benefits such as discounted premiums based on the health risk of the insured, determined based on their checkup results and other health data. Some insurance products even go further to grant cash back rewards based on the annual checkup results submitted by the insured. In addition, similar to the move made by public health insurers toward ensuring appropriate medical care expenditures, insurance companies started to actively utilize daily vital data and lifelogs of the insureds, not just annual checkup results, to monitor the health conditions of the insureds periodically and encourage improvement for healthy living.

Retail industry taking up the challenge of creating new customer experience values utilizing health data

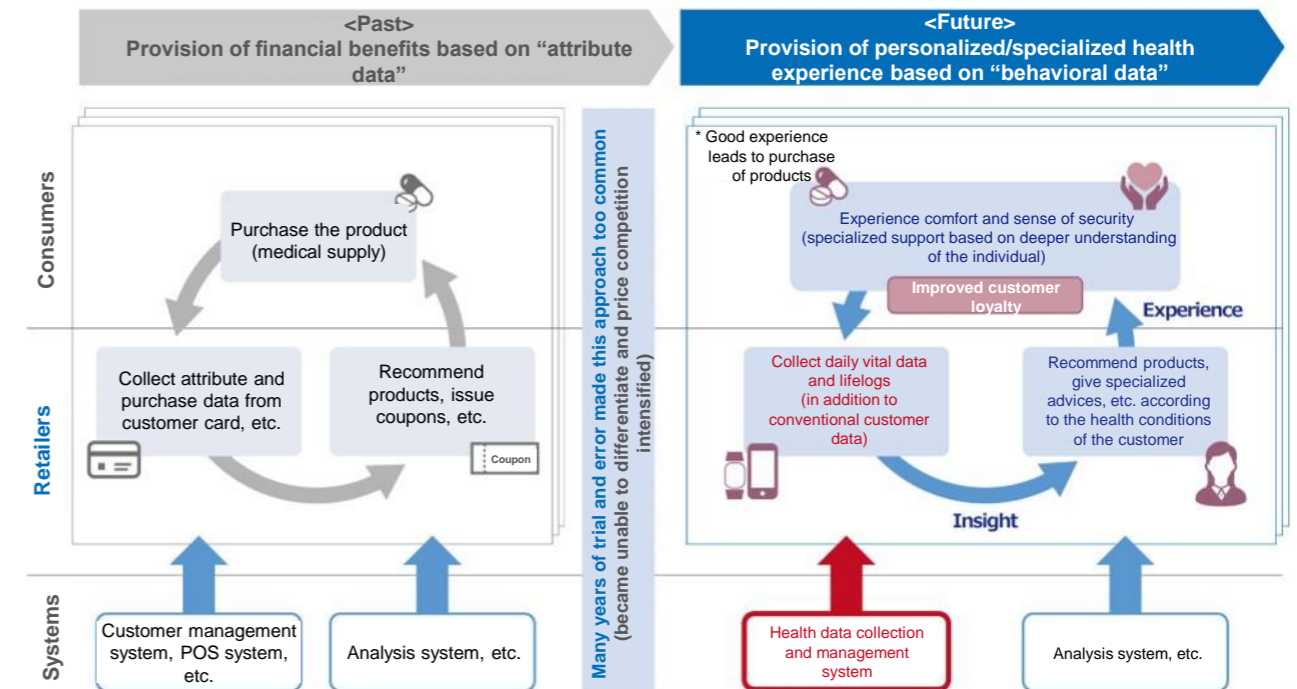
The retail industry is currently undergoing a paradigm shift from "sell product based on attribute data" to "provide customer experience values based on behavioral data." Marketing in the retail industry used to be mainly based on analysis of "purchase data" (e.g., purchased products, prices) and "attribute data" (e.g., age, sex, residence, occupation) obtained from shopping cards, etc. However, as a result of continued trial and error by many companies, it became more and more difficult for the companies to differentiate themselves from their competitors. Fortunately, advancement in the IoT and sensing technologies has made it possible to obtain "behavioral data" such as online browsing history (e.g., number of visits, browsed pages, duration of stay),

actions taken on SNS, and location information. By adding this "behavioral data" to the conventional data, one can understand "for what reason, and through what process the person bought (or did not buy) the product, while being in what kind of conditions." Advanced companies are attempting to gain a deeper understanding of customer's buying behaviors by analyzing behavioral data and create a new form of differentiation (i.e. provision of customer experience values).

The wellness market is expanding in response to the rise of health-conscious consumers and an increase in health-related social issues such as the spread of lifestyle-related diseases. Amid such a situation, vital data and lifelogs are attracting attention as one of "behavioral data" for understanding the "real-time health conditions" and "characteristics and preferences about health" of customers.

Trend of retail industry: paradigm shift to "provision of experience based on behavioral data"

Advanced companies started "provision of customer experience based on behavioral data" as a new differentiation strategy. Associated with the growth of the wellness market, vital data and lifelogs that can grasp information on the "current health conditions of consumers" are attracting attention



< Changes in value provision at drugstores (example) >

Problems specific to the “dawn of health data utilization”

Businesses

While the opportunities of health data utilization are expanding, both consumers and businesses are not familiar with health data, as such data have been mostly used in public healthcare services to date. This fact is creating “problems specific to the dawn” of health data utilization, like uneasiness about the safety and security of health data utilization and being unable to clearly picture what kind of benefits health data utilization would bring.

“Incident risks” and “cost increase” that come with handling of health data

According to the 2021 White Paper on Information and Communications in Japan issued by the Ministry of Internal Affairs and Communications (MIC), the number of enterprises utilizing personal data was 49.3% (actively utilizing: 16.0%, utilizing to a certain extent: 33.3%) in FY2020, doubled from 25.1% in the previous fiscal year.

In the list of challenges for data utilization, “Magnitude of incident risks and social responsibilities that come with data management” and “Increase in the cost on data collection and management” were ranked high. Among personal data, health data contain “special care-required personal information”* and require compliance with various rules and guidelines issued by relevant ministries and agencies under the provisions of the Act on the Protection of Personal Information. Because of that, the number of businesses that utilize health data is expected to become further smaller in the future.

Two barriers hindering health data utilization by advanced companies

Companies that started utilizing health data ahead of others have already been working on the first step, “building the infrastructure for gathering and managing health data.” However, most of them are having a difficulty in complying with rules and guidelines that need to be followed when handling health data. As stated above, handling of health data requires complying with various rules and guidelines issued by relevant ministries and agencies, and such rules and guidelines are constantly updated in line with the progress of medical DX initiatives conducted by them. “It takes a substantial amount of efforts to build the infrastructure for gathering and managing health data.” This is the first barrier.

The second barrier is “no clear pathway is in sight on how to interpret and utilize health data.” NTT DATA often hears from its clients saying like, “The infrastructure has been made. But, we cannot come up with any good idea about how to utilize the data gathered using the infrastructure and how to generate added values from it.”

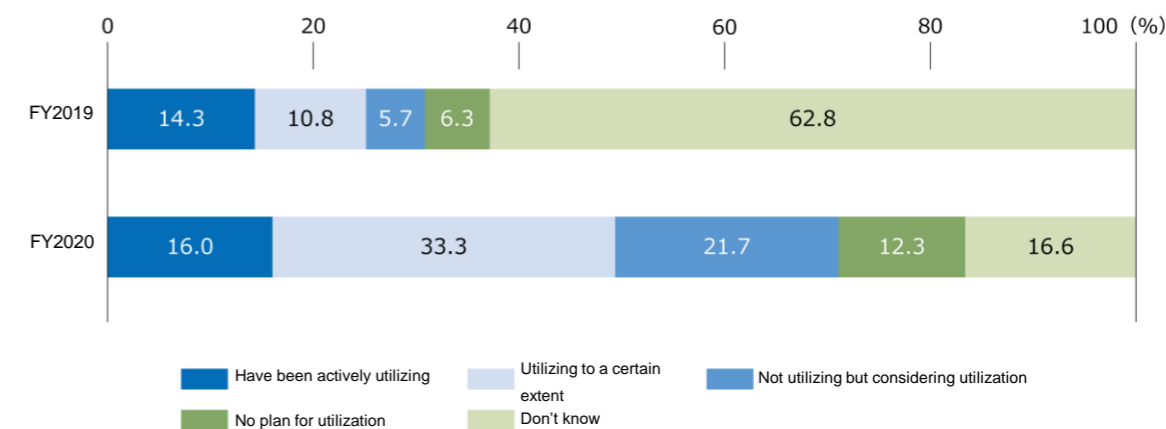
On October 11, 2022, a Cabinet decision was made on the establishment of the Headquarters for Medical Digital Transformation (DX) Promotion to promote medical DX toward improved health of the people and the promotion of the establishment of the infrastructure for realizing optimal health care. Under the Headquarters, the relevant ministries and agencies (Digital Agency, Ministry of Health, Labour and Welfare, MIC, and Ministry of Economy, Trade and Industry) are to plan and implement specific measures. For the handling of health data, the relevant ministries and agencies are expected to establish more specific rules and guidelines in line with the progress of medical DX initiatives, and businesses utilizing health data need to keep a close eye on such legislative movements.

* Certain personal information of which the handling requires special care so as not to cause unfair discrimination, prejudice or other disadvantages to the principal, as stipulated in the Act on the Protection of Personal Information

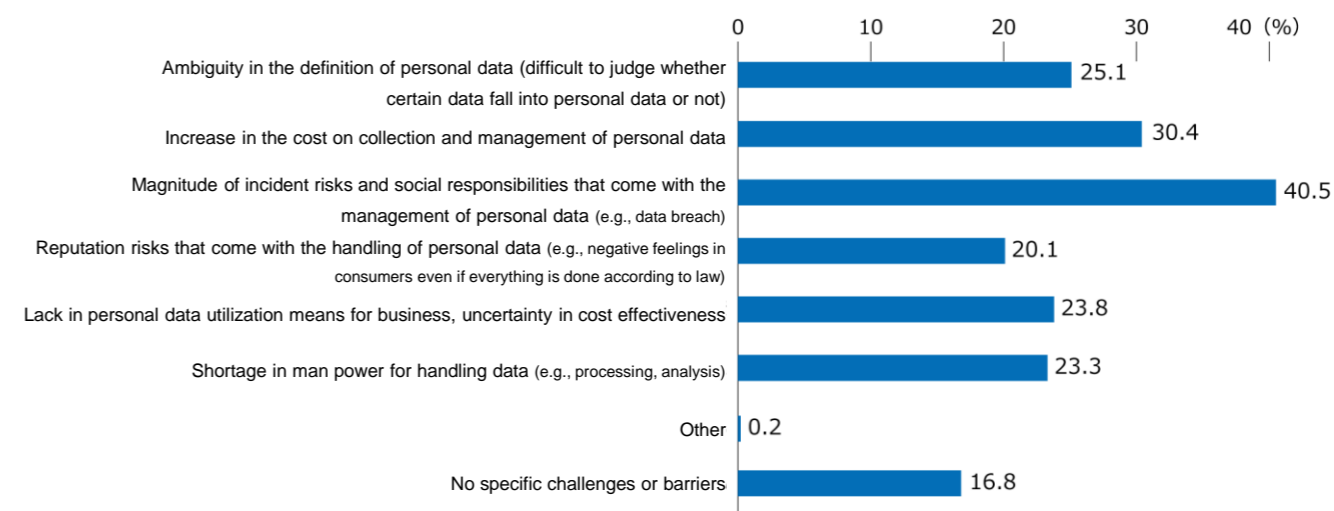
When people hear the term “health data,” they often imagine “blood pressure,” “heart rate,” and “blood oxygen level.” In the medical sector, for example, “blood pressure” is assigned with “standard values to determine whether the patient has hypertension that requires medical treatment.” Such standard values stand on the achievements of studies in which data on “blood pressure” and “illness occurred” accumulated over many years were analyzed to discover the correlation between the two.

When “blood pressure” is to be utilized in the private business sector, similar to the “standards for requiring treatment” in the medical sector, “standards according to the purpose and method of use” will have to be established. That requires deriving the correlation between “blood pressure” and “products and services of the company,” but health data utilization in the private business sector just started and the amount of data being collected is far from enough for conducting a meaningful study. Amid the situation where the correlation between “health data” and “products and service of the company” is unclear, most companies just don’t know how to utilize health data to their benefits.

State of utilization of personal data by enterprises



Current and possible future challenges and barriers regarding handling and utilization of personal data (multiple choice)



Source: MIC (2021) “Survey Study on the Impact of Digital Transformation on Economy”

Problems specific to the “dawn of health data utilization”

Consumers

Japanese peoples’ tendency of having less health awareness compared to other countries due to the national health insurance system

In Japan, everybody is covered by the national health insurance system and able to receive necessary medical services anytime, anywhere, just by showing the insurance card and paying a small out-of-pocket cost. This is so natural to Japanese people, but the situation is quite different in other countries.

For example, in the case of the US, the only public health insurance systems available are Medicare for people aged 65 or older or with disabilities, and Medicaid for low income earners. Americans who are not eligible for Medicare or Medicaid are to purchase private health insurance, but medical institutions covered by the health insurance may be limited, and some people may decide

to stay uninsured. As such, medical services people can receive are significantly different from person to person, mostly depending on their income levels. In addition, medical costs are higher in the US than in Japan; treatment for cold would cost several hundred dollars and tens of thousands of dollars for a surgery.

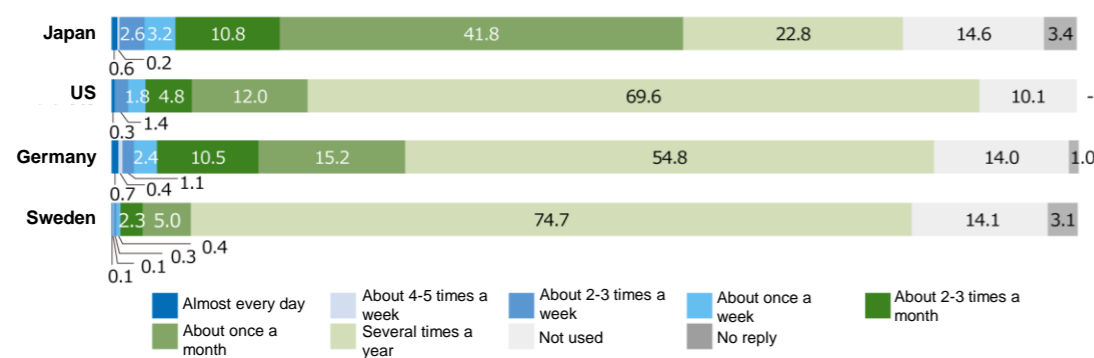
Owing to the national health insurance system ensuring every citizen to receive medical services as needed, consumers in Japan tend to have lower health awareness than consumers in other countries. For example, according to the 9th International Comparison Survey concerning the Daily Life and Awareness of the Elderly (2020) issued by the Cabinet Office, the percentage of Japanese people taking action to improve their health is lower than that of people in other countries, even among persons in their 60s and older, who are considered to have higher health awareness than other generations.

Awareness of elderly (60 years and older) of health and medical services

Things done for better health (2020)

	Take enough rest and sleep	Live a regular life	Have a well-balanced diet	Take supplements	Receive medical checkups regularly	Refrain from alcohol and cigarettes	Take a walk or exercise	Participate in local community activities	Stay positive as much as possible	Have a hobby	Go outdoors when possible	Other	Nothing in particular	No reply
Japan	66.2	61.3	58.3	9.8	51.1	15.4	51.9	15.9	41.3	38.8	26.4	1.7	3.1	2.3
US	86.4	79.3	75.6	18.0	84.0	48.1	72.4	45.8	88.0	76.6	64.5	5.8	1.8	-
Germany	73.3	76.3	65.5	42.0	65.2	23.2	58.4	32.9	72.3	50.3	13.6	1.7	3.7	0.4
Sweden	68.8	73.4	72.5	15.7	37.8	12.8	76.0	17.7	52.5	40.1	57.6	5.4	2.0	0.7

Medical service use state (2020)



Source: Cabinet Office “9th International Comparison Survey concerning the Daily Life and Awareness of the Elderly 2020”

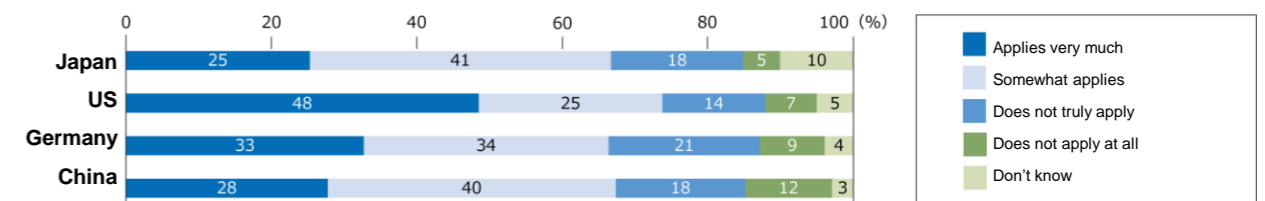
Uneasiness about safety and security of providing data to companies

According to the 2021 White Paper on Information and Communications in Japan issued by the MIC, the percentage of consumers who are feeling uneasy about providing personal data to services and applications provided by companies is gradually reducing each year, but still at 66% (feel very uneasy: 25%, feel a little uneasy: 41%) as of 2021. The reasons for the uneasy feeling ranked higher in the list were about the safety and security, such as “Leak to third party” and “Privacy

protection.”

Though it has become possible for consumers to casually measure their own health data using wearable and other health devices, it is quite unlikely that consumers with not very high health awareness would provide data to companies while feeling uneasy about the safety and security. The Survey on the Awareness of General Consumers about Utilization of Personal Data (2022) conducted by NTT DATA INSTITUTE OF MANAGEMENT CONSULTING, Inc. (IMC) also saw slightly less than 70% of respondents selected “Never used, and don’t want to use in the future either” about personal data utilization services.

Uneasiness about providing personal data when using services/applications



Source: MIC (2021) “Survey Study on State of Digital Utilization with Corona and Changes in Users’ Awareness”

Low unwillingness to “providing data to medical services”

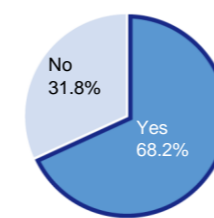
Currently, the majority of companies working on health data utilization provide a “health data measurement function” on their app and offer “exit services” utilizing health data such as recommendation of optimal products and issuance of discount coupons. However, not many people are showing interest in such apps.

Does that mean consumers are not interested in utilizing their health data? No, that is not true. In the Survey on the Awareness of General Consumers about Health Data Utilization (2022) conducted by NTT DATA, 70% of the

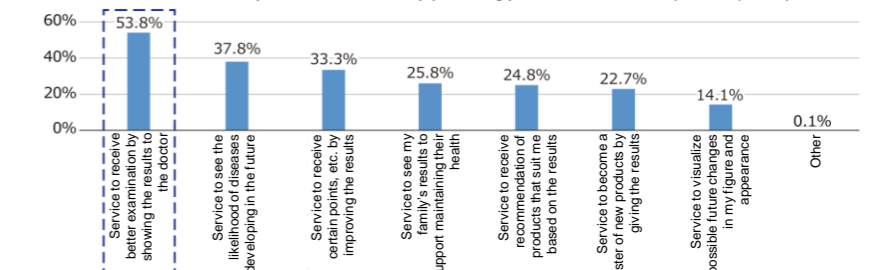
respondents selected “I will provide health data if I feel merits or financial benefits.” and “Service to receive better examination” and “Service to see disease risk” were ranked higher in the list of services they wanted to receive. Also in the awareness survey conducted by NTT DATA IMC mentioned above, 60% of the respondents who selected “Used a personal data utilization service in the past, and want to use them in the future as well” selected “Service to share health data with doctors and pharmacists” as a service they want to use in the future. These results suggest that consumers’ unwillingness to providing data is low when it is for receiving medical services.

Consumers’ awareness on “health data provision”

Do you want to receive services by providing your own health data? (N=2,033)



Service that you want to receive by providing your own health data (N=1,386) Multiple selection



Source: Questionnaire survey on health care using Human Information Database (NTT DATA IMC) Survey date: March 2022, number of respondents: 2033 (not stratified by sex, age, marital status, or income level)

Chapter 2

Pathway to the Future of Health Data Utilization

Environment Changes by 2030 according to NTT DATA's Point of View

Our life in 2030 would be completely different from now as a result of social environment changes and technological advancements. NTT DATA organizes such environmental changes in the entire society into the following five pillars:

- (1) People are able to select optimal products and services based on predictions.
- (2) Personalization through data interpretation has become available.
- (3) AI has replaced human labors, extending 24/7/365 services, and humans do new forms of work.
- (4) People are freed from various restrictions such as time, location, and languages.
- (5) Humans, things, companies, etc. are inter-connected, and the convenience of consumers has been significantly improved.

These changes would greatly affect the utilization of health data, and health data utilization in 2030 is expected to be nowhere near what it is now.

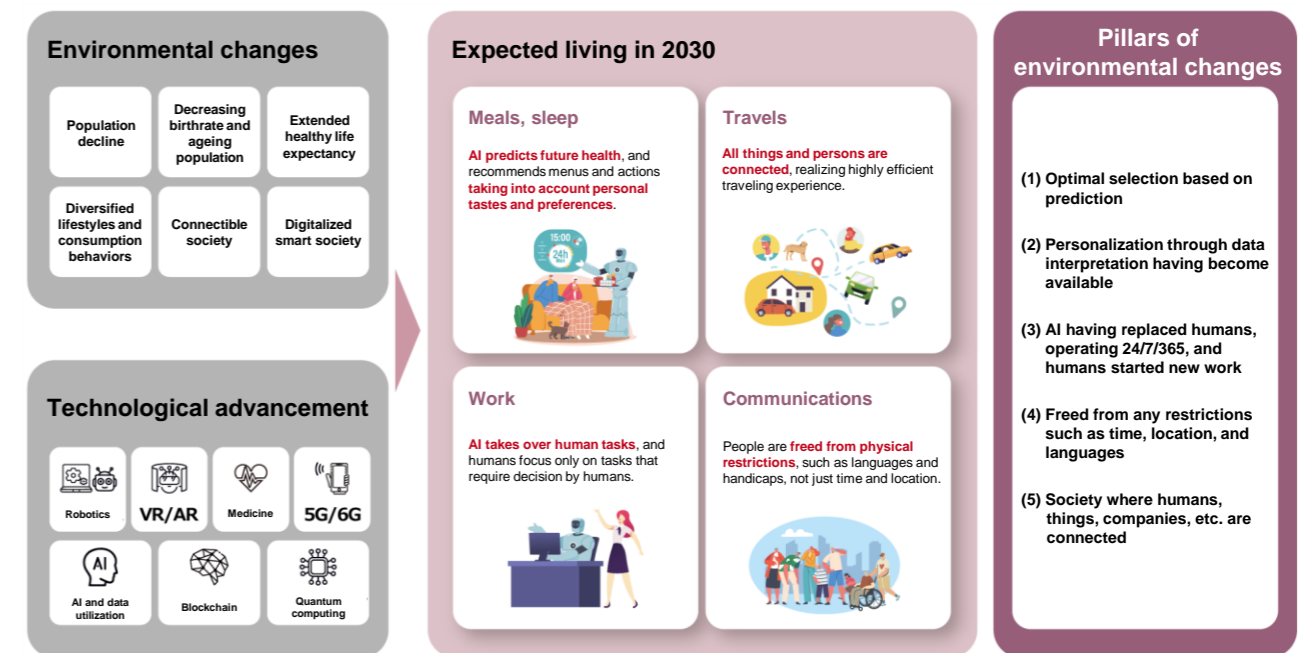


Figure: Expected Living in 2030 from "NTT DATA Healthcare Foresight 2030"

Outlook of Health Data Utilization in 2030

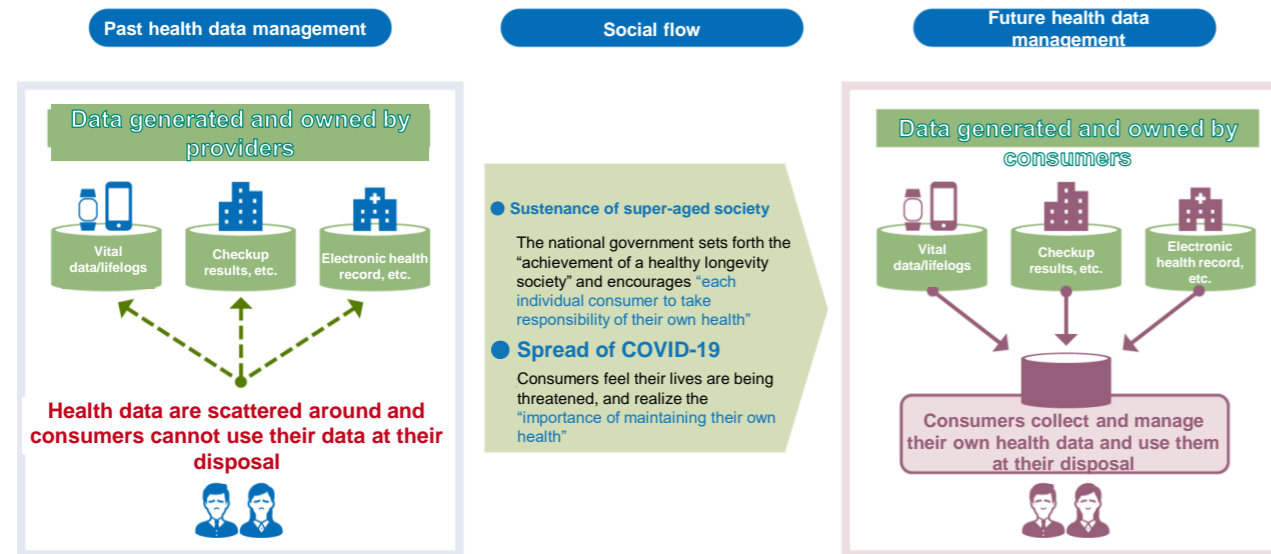
Protecting one's own health on one's own initiative - Management of consumer-generated health data -

COVID-19 told us that the society and systems that we have grown accustomed to can completely change at any moment. One forecast says one in three persons will be aged 65 years or older in 2030 in Japan. The increasingly ageing society automatically means ever-increasing medical and care expenses, and it will be

more important in the future for each individual consumer to understand the need to "protect one's own health on one's own initiative" without ignoring the social issue of "whether Japan's social security systems can accommodate this demographic change." NTT DATA thinks that, in 2030, the society will need "management of consumer-generated health data" where each consumer manages their own health data, checks the data for any abnormality, and discloses the data to their regular doctor or other healthcare service providers on their own accord to achieve well-being.

Health data management transitions from "provider-oriented" to "consumer-oriented"

To achieve a healthy longevity society, a framework for consumers to manage and use their own health data will be required



All health aspects are being visualized without thinking - Further technological advancement of biosensors -

Technological advancements have a huge impact on health data utilization as well. Especially, biosensors are the heart of health data collection technologies and their downsizing, improved usability, noncontact and noninvasive measurement would enable gathering every sort of health data in daily life, including vital data, behavior, mind, and emotions. Blood pressure

measurements using smart watches and blood sugar monitoring without finger pricks are already being put to social implementation. Further, the health industry is working on the development of "technologies to obtain data from other than human body," such as estimating physical conditions using sensors installed in a bathroom and calculating nutrition information from a photograph of a meal.

NTT DATA predicts that, in 2030, we will come to see "a world where all health aspects are visualized without the consumers ever thinking about it" as a result of further technological advancements of biosensors.

Finding best products and services using health data as the "key" and living comfortable lives - Formulation of "well-being economy" through health data -

Health data are used as the "key" to match "consumers" and "various products and services available in their daily life." By that, consumers find products and services that fit themselves the best and live a comfortable life. NTT DATA believes this is one of "benefits of health data utilization" obtainable by consumers.

For example, our blood has various blood types. In present times, it is common for people to know their own blood types. However, the notion of blood types didn't exist a long time ago, and many people lost their lives due to mismatching transfused blood types. That all changed when ABO blood types were found in the early 20th century. This discovery transformed blood transfusion from "something to leave in god's hands" to "scientifically based safe action." Studies on blood types further progressed thereafter, and nowadays blood transfusions have become much safer by utilizing Rh blood types and HLA blood types in addition to ABO blood types. Here we used blood transfusion as an example, but in the medical sector where a decision can determine life or death, it has become common nowadays for people to find medicines and treatments best suited for them based on their own medical and health data.

Gluten-free. We see this term very often lately. This means "a diet free of gluten, which is one of the proteins contained in wheat." It's been long known that some people have wheat allergy. However, studies have found that many people actually have "gluten intolerance,"

which causes malaise or headache after intake of gluten, and they continue living without knowing that fact because the reactions are not as severe as the allergic reactions. After knowing that gluten could be the cause of chronic discomfort, a lot of people tried a gluten-free diet and found themselves feeling better or having better skin, and the gluten-free diet became very popular. Like this example, while it may not be particularly life-threatening, in our daily life, we are likely selecting products and services that do not actually suit us and are reducing our own well-being unknowingly to us. Like it has become a commonplace to know one's blood type and to receive safe blood transfusion, consumers understand their "own physical and mental health conditions" from health data and find products and services that suit them best from various options available and improve their well-being in their daily life. This is an example of "benefits of health data utilization."

Businesses gather and analyze health data of consumers and generate products and services that fit consumers' health conditions. Consumers understand their own health conditions by looking at their own health data and find products and services that suit them among those abundantly available to them. In 2030, this cycle repeats itself as a matter of course, health data would have become a natural part of our daily life, and the "well-being economy" in which various foods, clothing, housing, medical, transport, communication, education, and leisure products and services for consumers are horizontally linked through health data would have been formed. And consumers effortlessly find products and services that suit them best and have a lifestyle characterized by well-being. That's what NTT DATA envisions as the future environment surrounding health data.

Outlook of health care in 2030

Environmental changes and technological advancements enable spontaneous data collection and analysis in ordinary life, realizing a future healthcare society where people can effortlessly maintain their own healthy youthful lifestyles



Figure: Outlook of Health Care in 2030 from "NTT DATA Healthcare Foresight 2030"

Three Propositions toward Resolving “Problems Specific to the Dawn”

As stated in Chapter 1, both consumers and businesses are not familiar with health data, as such data have been mostly used in public healthcare services to date, and that is creating “problems specific to the dawn” of health data utilization. Toward the establishment of a “well-being economy,” these problems need to be resolved to generate many positive cycles such as (1) businesses gather and analyze health data of consumers and generate products and services that fit consumers’ health conditions and (2) consumers measure their health

data in their daily life to understand their own health conditions and find products and services that suit them among those abundantly available to them. NTT DATA has involved with the “creation of the new normal” in various industries. Based on that experience, as the pathways for resolving the “problems specific to the dawn” we are facing now and forming a “well-being economy,” we would like to offer the following three propositions to businesses engaged in health data utilization.

Proposition 1

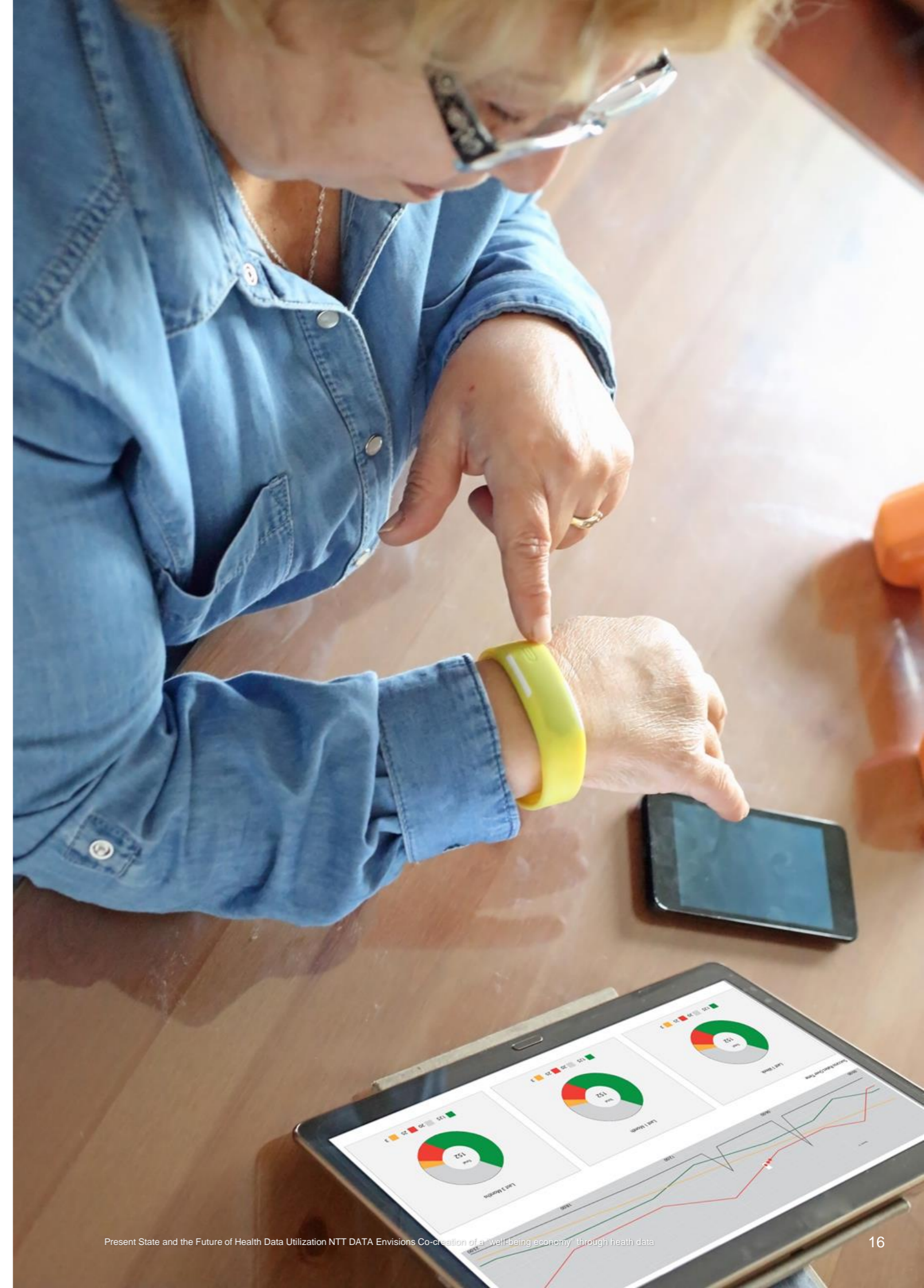
Solution for “issues pertaining to health data handling by businesses”:
Separate health data utilization into “noncompetitive area” and “competitive area”

Proposition 2

Solution for “consumers’ unwillingness to providing health data”:
Incorporate “medical aspects” into company services

Proposition 3

Cooperate with like-minded companies to work on co-creation and spreading of “well-being economy”



Solution for “issues pertaining to health data handling by businesses”:

Separate health data utilization into “noncompetitive area” and “competitive area”

In the near future, “health data gathering” will belong to “noncompetitive area”

A typical procedure for health data utilization by a company can be divided into the following three steps: (1) gather health data of consumers, (2) gain deeper understanding of consumers (consumer insights) by analyzing the health data (and data owned by the company), and (3) provide added values (products, services, experience, etc.) tailored to each individual consumer.

As stated in Chapter 1, companies that started utilizing health data ahead of others have already been working on the first step, “building the infrastructure for gathering and managing health data.” However, most of them are having a difficulty in complying with rules and guidelines that need to be followed when handling health data.

And, for consumers, it is frustrating and burdensome having to register similar data into a health data collection function provided with such services. According to the Survey on the Awareness of General

Consumers about Utilization of Personal Data (2022) conducted by NTT DATA IMC, what current and past users of personal data utilization services wanted the most as a feature of such services and apps was “being interlinked with many other services and apps, so that the burden of inputting data for using them will be reduced, and all the data generated through use of such services and apps can be checked in one place, like an information bank,” ahead of “safety and security.”

In the “dawn” stage we are currently in, “whether health data can be gathered or not” directly translates into competitive advantage or disadvantage, and that is why companies are now working on the development of their own “health data collection and management infrastructure.” However, as the medical DX promoted by the government of Japan and further technological advancement of wearable devices progress, in the near future, “health data collection” will be in the “noncompetitive area” similar to ordering, settlement, and logistics such as product shipping. NTT DATA is sure of it.

Continue to funnel management resources into “gaining insights” and “creating added values” in the “competitive area”

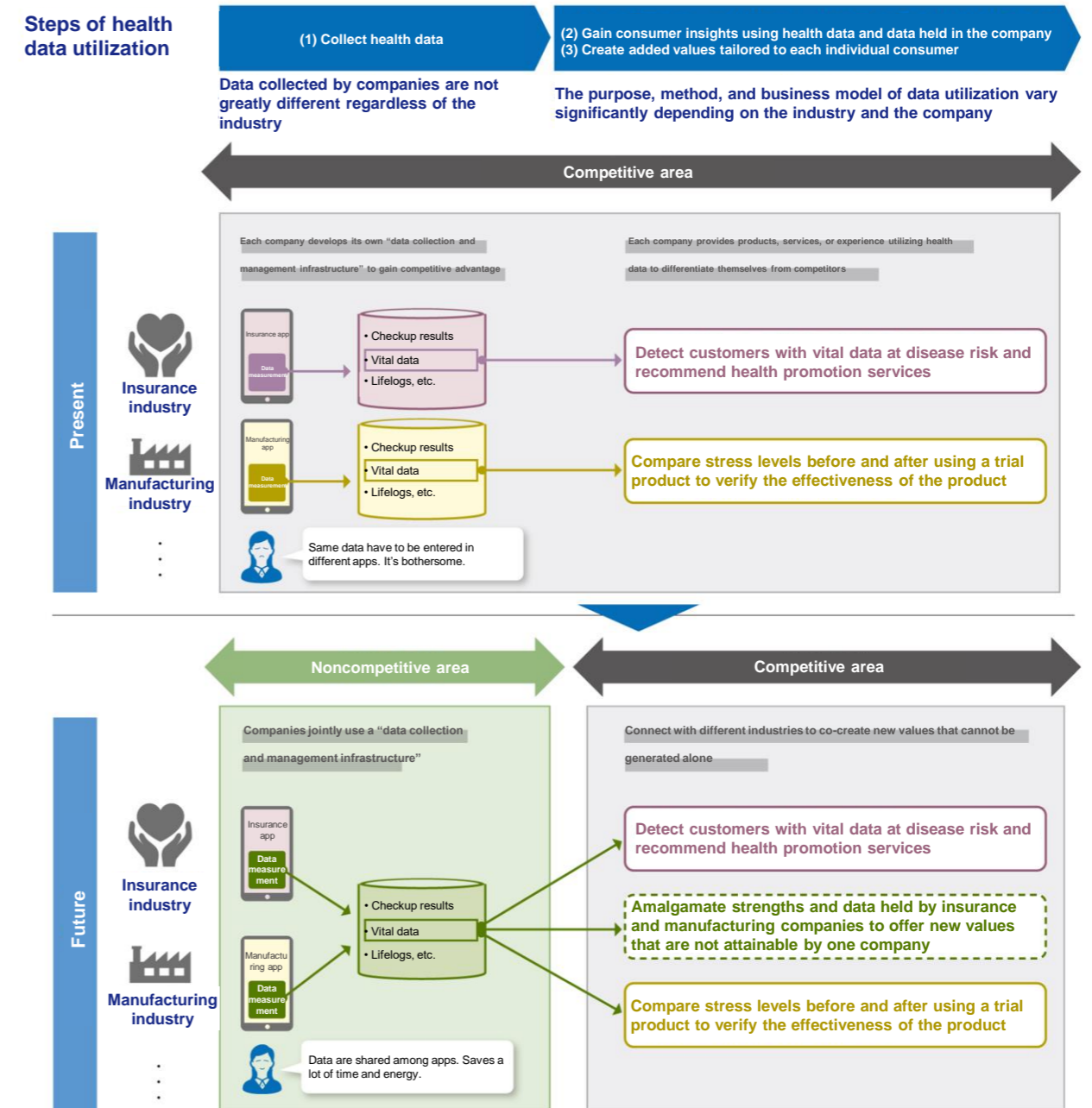
On the other hand, “to gain deeper understanding of consumers by analyzing their health data (and data held by the company) and offer added values tailored to each individual consumer” will remain the “competitive area,” and each company will have to continuously inject management resources into it. Especially in the current stage, many companies haven’t found any clear transition to “how to interpret and utilize health data,” and are struggling to come up with ideas of incentives (added values) for consumers to keep providing health data to them. For a company to get ahead in the competition, it is imperative that the company discovers the correlation between “health data” and “products and services of the company” and find “data utilization method suited for the purpose of the company” first.

Looking at some companies that use the “cloud-based health management solution Health Data Bank® offered by NTT DATA (its details are provided in Chapter 3), health data items collected by companies do not vary very much. Meanwhile, the purpose and methods of data utilization are vastly different from company to company, where the companies are

fumbling for their own “path to victory.” For example, “stress level” is currently attracting the attention of many companies as a health indicator with potential various uses, such as “to detect customers with high stress levels and lead them to products claiming effects to relieve stress” in the retail industry, “to compare stress levels of trial users before and after using the product to verify the effectiveness of the product” in the manufacturing industry, and “to control air conditioning and music volume interlinked to the stress level of workers in the office” in the building management industry. And, as stated in Chapter 1, “how to interpret stress levels” depends on the purpose and method of utilization, and relevant parties are trying to establish new standards that are different from the standards used in the medical sector.

With all these in mind, NTT DATA believes companies working on health data utilization best (1) recognize that “health data gathering” belongs to the “noncompetitive area” in an early stage and minimize investment into it by utilizing a general solution such as the Health Data Bank® and sharing a framework with other companies, and (2) direct management resources to activities in the “competitive area” of health data utilization such as “gaining consumer insights” and “creating added values (e.g., products, services, experience).”

“Noncompetitive area” and “competitive area” in health data utilization



Proposition
2

Solution for “consumers’ unwillingness to providing health data”:

Incorporate “medical aspects” into company services

In the current stage, the majority of consumers are feeling uneasy about the safety and security of health data utilization, and are negative about providing data to products and services provided by companies. To break through this situation, it is essential that consumers experience and feel the benefits of utilizing health data and understand the merits of providing health data.

The majority of companies working on health data utilization provide health data-based added value services such as recommendation of optimal products and issuance of discount coupons through their apps and other means. The problem is, however, not many people are showing interest in such services, indicating that these services are not attractive enough for consumers to keep providing their health data.

On the other hand, as stated in Chapter 1, we know that consumers’ unwillingness to providing data is low when it comes to medical services such as those to share health data with doctors and pharmacists. In fact, the “service for outpatients to measure their vital data on a daily basis and share them with their regular doctors” provided by NTT DATA are voluntarily and actively used by the patients.

From these analyses, NTT DATA thinks that adding medical aspects such as “able to share health data collected and stored using the app with regular doctor” to apps provided by companies as one of “exit services” of such apps will improve app usage and become an opportunity for consumers to feel the “benefit of health data utilization.”



Proposition
3

Cooperate with like-minded companies to work on co-creation and spreading of “well-being economy”

Changing the mindset of consumers who are not really high in health awareness would be quite difficult. As stated in Proposition 2, it is essential that consumers experience and feel the “benefits of health data utilization,” and to that end, businesses have to conduct activities to create many opportunities for consumers to get benefits and to make the merits of health data utilization known to people. And, to accelerate such activities, it is important for companies not only to individually implement initiatives but also to cooperate with like-minded companies to create a large movement.

For example, as stated in Proposition 1, companies cooperating on “health data collection,” that would belong to the “noncompetitive area” in several years, from an early stage would lead to solving issues consumers and businesses are currently facing. By multiple companies sharing a framework of “health data collection,” companies will be able to reduce the cost and labor on “health data collection” and inject their resources into “gaining consumer insights” and “creation of added values,” while consumers will be freed from troubles and burdens of health data

provision.

Of course, in the current stage, it is undeniable that “whether health data can be gathered or not” determines competitive advantage or disadvantage and it may be difficult to cooperate with competitors. However, cooperating with like-minded companies in other business sectors and industries would not pose too much of a hurdle to overcome and would be worth considering.

Looking at the cases of companies NTT DATA is doing business with, health data gathered by companies are not greatly different regardless of the business type, and we believe sharing of a “health data collection” framework is feasible and only rational. Further, companies in different business sectors forming a bond and fusing their own strengths and data held would warrant creation of new added values that a single company will never be able to attain. NTT DATA believes that cross-sectorial cooperation will improve the competitive advantage of all parties involved, as well as enable provision of “unprecedented experience values.”



Chapter 3

NTT DATA's Solutions for Co-creating the Future of Health Data Utilization

Proposition 1 Solution for supporting activities in the “noncompetitive area” of health data utilization

Health Data Bank® for safe and secure health data gathering and management

Cloud-based health management solution Health Data Bank®

As one of the solutions to support «Proposition 1 Solution for “issues pertaining to health data handling by businesses”: Separate health data utilization into “noncompetitive area” and “competitive area”» stated in Chapter 2, we would like to introduce our “cloud-based health management solution, Health Data Bank®.”

NTT DATA has long been engaged in the development and operation of various shared infrastructure systems in the medical sector, such as local healthcare network systems and online billing system. Health Data Bank® (HDB) was developed by applying the special experience and knowledge accumulated through these activities, and started operating in 2002 as a “cloud-based service for assisting companies with employee health management.”

In HDB, checkup results of employees are directly received from medical checkup institutions, and data that come in different formats depending on the institution are converted into the same format and stored in a health data management database. In addition, through cooperation with various business operators that provide wearable devices and smartphone apps, HDB collects vital data and lifelogs of employees. Companies implement industrial healthcare operations and health management

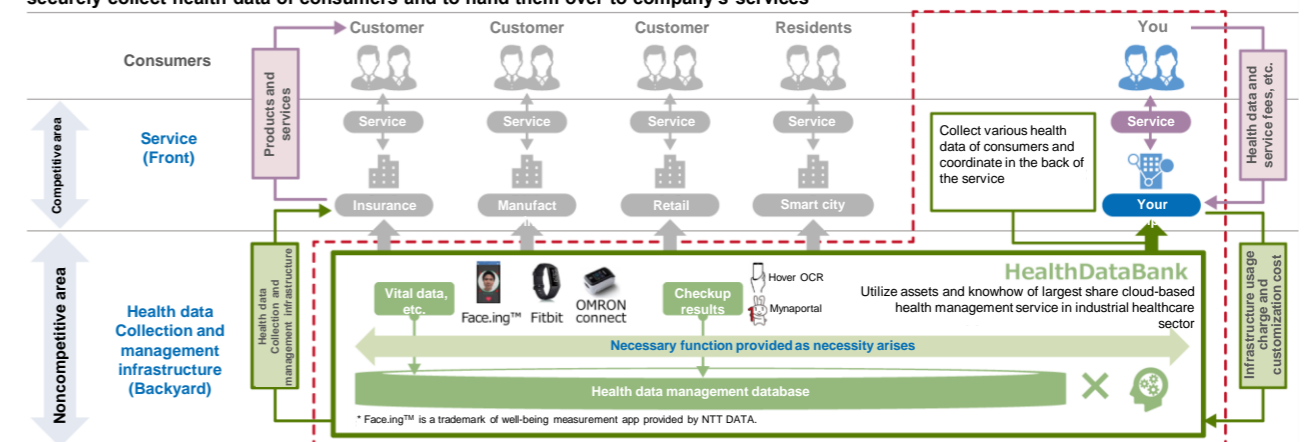
measures utilizing the vital data and lifelogs stored in the database. Now, 20 years after its release, HDB is used by more than 3000 companies (organizations) and 4 million persons, holding the largest market share in the industrial healthcare sector as a cloud-based service.

As the private markets are taking a growing interest in health data utilization, we are receiving inquiries from various companies asking whether they can use the assets and knowhow of HDB in their services. In response to that, NTT DATA started providing companies working on health data utilization with the assets and knowhow of HDB attained through its operations in the industrial healthcare sector as a “backyard framework to safely and securely collect health data of consumers and to hand them over to services provided by companies” several years ago.

When handling health data, companies need to comply with various rules and guidelines issued by relevant ministries and agencies, and the companies have to pay extra attention since such rules and guidelines are constantly updated in line with the progress of medical DX initiatives promoted by the national government. Companies that newly take on the challenge of health data utilization find “incident risks” and “cost increase” that come with handling of such data problematic, and the assets and knowhow of HDB are well accepted as one of means to solve these problems.

Overview of Health Data Bank (B2B2C model)

Assets and knowhow attained through operations in the industrial healthcare sector provided as a “backyard framework to safely and securely collect health data of consumers and to hand them over to company’s services”



Collect various health data and coordinate in the background of client's services

HDB utilization case

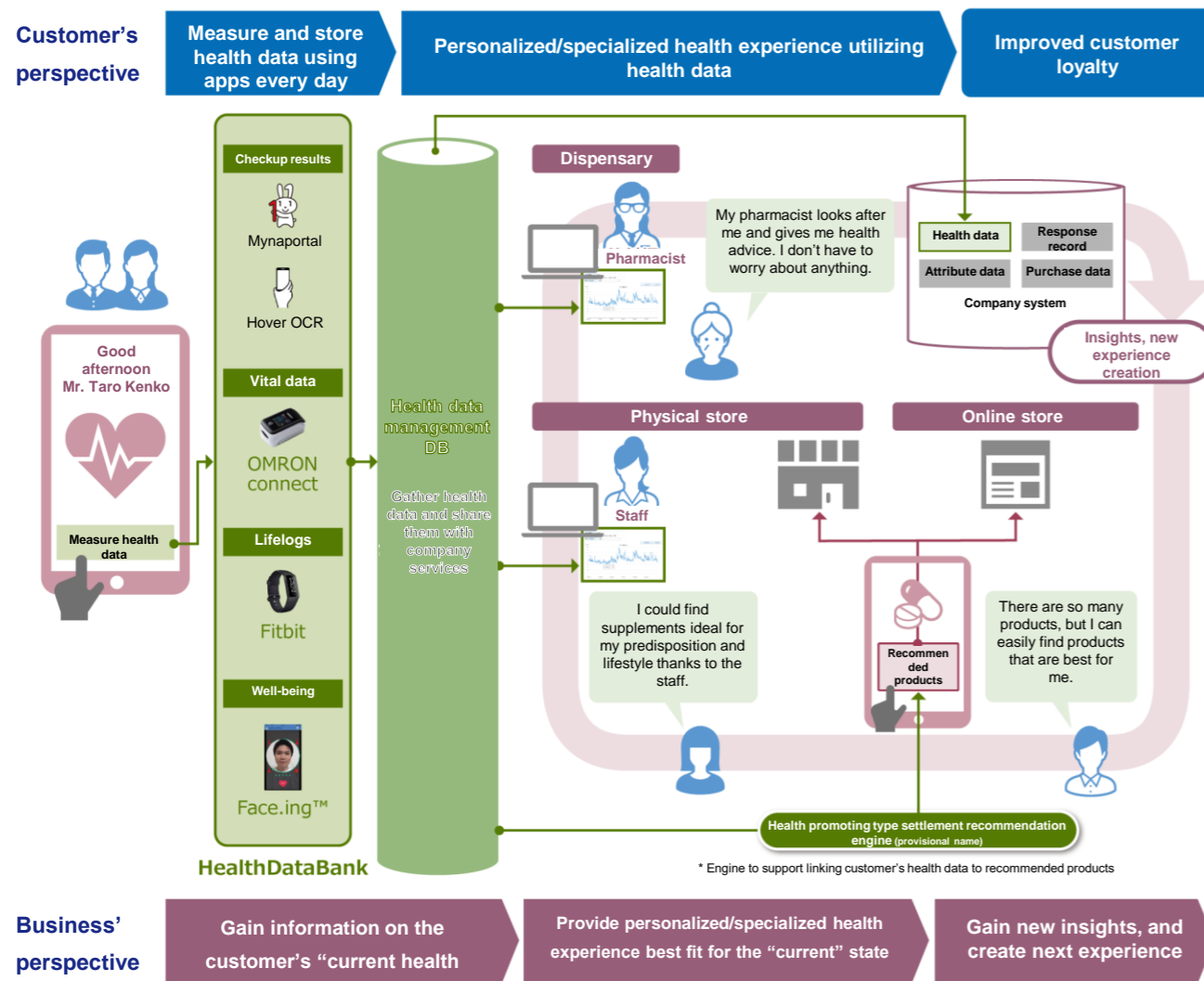
Drugstores trialing provision of personalized/specialized experience by linking own app to HDB

Our client drugstores are considering gathering various health data and providing personalized and specialized health experience by linking their own consumer apps to HDB. Customers of drugstores use

consumer apps to store paper health checkup results and vital data measured using a blood pressure monitor and body composition monitor at home. Then, the customers can send the stored data to their regular pharmacists for specialized counseling, and efficiently find products that suit their health conditions, from an abundant product lineup, or have advanced health experience using the consumer app.

Enhancement of personalized/specialized health experience utilizing Health Data Bank® (at drugstores)

Legend: ■ Scope of HDB ■ Scope of company system



* Face.ing™ is a trademark of well-being measurement app provided by NTT DATA.

HDB utilization case

Kashiwa-no-ha Smart City where various business sectors co-create values using HDB as a health data utilization hub

Under the concept of "the city that creates a vision of the global future," the Kashiwa-no-ha Smart City in Kashiwa, Chiba, Japan is engaged in solution of various problems through public-private-academia collaboration based on three themes "environmental harmony," "health and longevity," and "new industry creation."

NTT DATA provides HDB connected to the Kashiwa-no-ha Data Platform that does individual consent management and ID coordination and management. The Kashiwa-no-ha HDB collects and manages health data of consumers with their consent, and share the data with other healthcare services connected to the Kashiwa-no-ha Data Platform, new product and

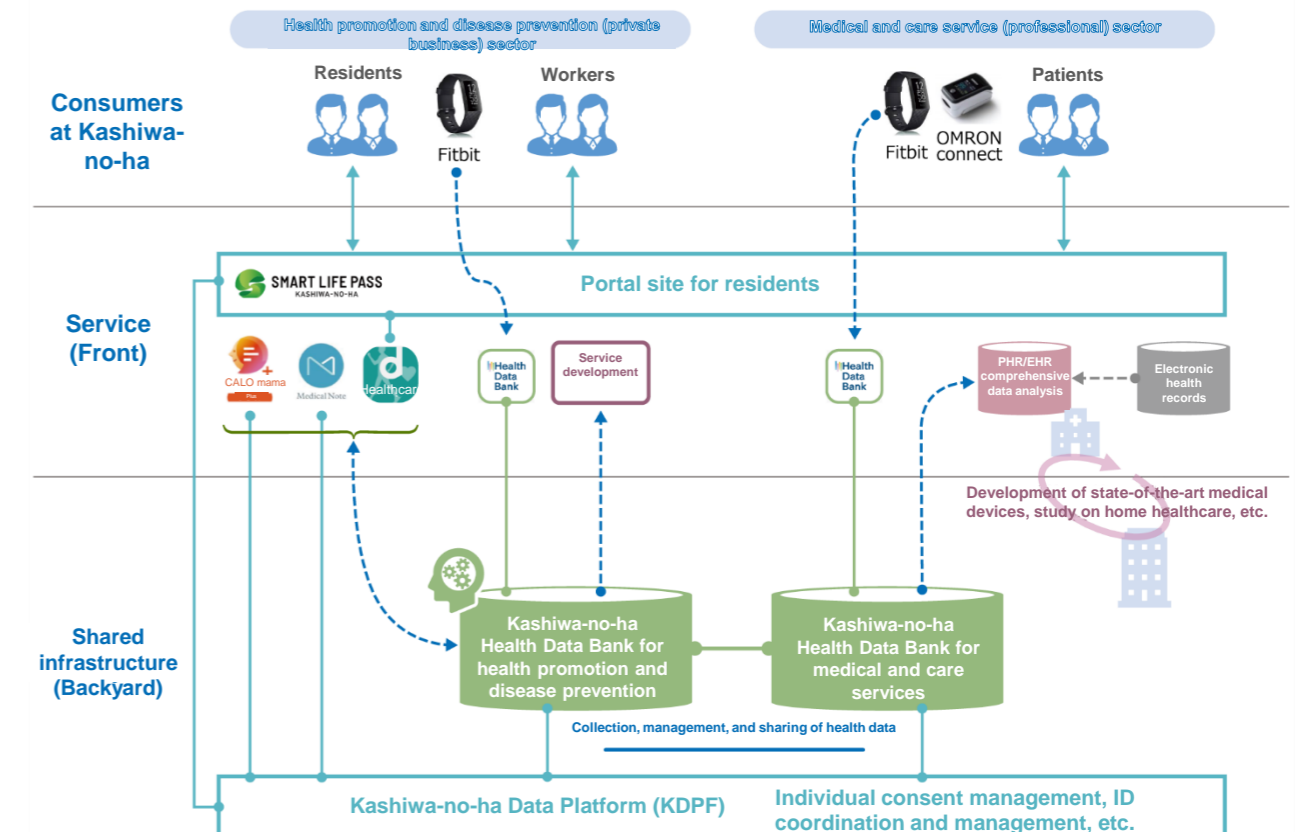
service development projects, and medical and care service providers, practically functioning as a hub of health data utilization.

Participants for the development of Kashiwa-no-ha Smart City from various industries and business sectors connect to the Kashiwa-no-ha Data Platform and Kashiwa-no-ha HDB to jointly use the system of health data collection and management, and combine their technologies, services and held data to co-create new added values that cannot be generated individually. For example, the AI health app "CALO mama Plus" provided by Link & Communication Inc. offers nutrient guidance based on disease risk of consumer by collaborating with the disease risk prediction technology of HDB.

Residents of the Kashiwa-no-ha Smart City can gain various experience values without feeling any annoyance or burden of registering similar data to services as health data stored in the Kashiwa-no-ha HDB can be shared to these services.

Overview of Kashiwa-no-ha Smart City x Health Data Bank®

With individual consent, consumers' health data are centralized in the Kashiwa-no-ha HDB and shared with providers and developers of medical and care services.



Health Data Bank[®]

for sharing health data with medical sector

In this section, we are going to introduce our activities for «Proposition 2 Solution for “consumers’ unwillingness to providing health data”: Incorporate “medical aspects” into company services» stated in Chapter 2.

Knowing that consumers’ unwillingness to providing health data is low when it comes to medical services such as a service to share health data with doctors and pharmacists, NTT DATA is proceeding with the development of a function to share health data held in HDB. Also, we are working on the establishment of a system that allows hospitals not using HDB to view patient data stored in HDB through collaboration with

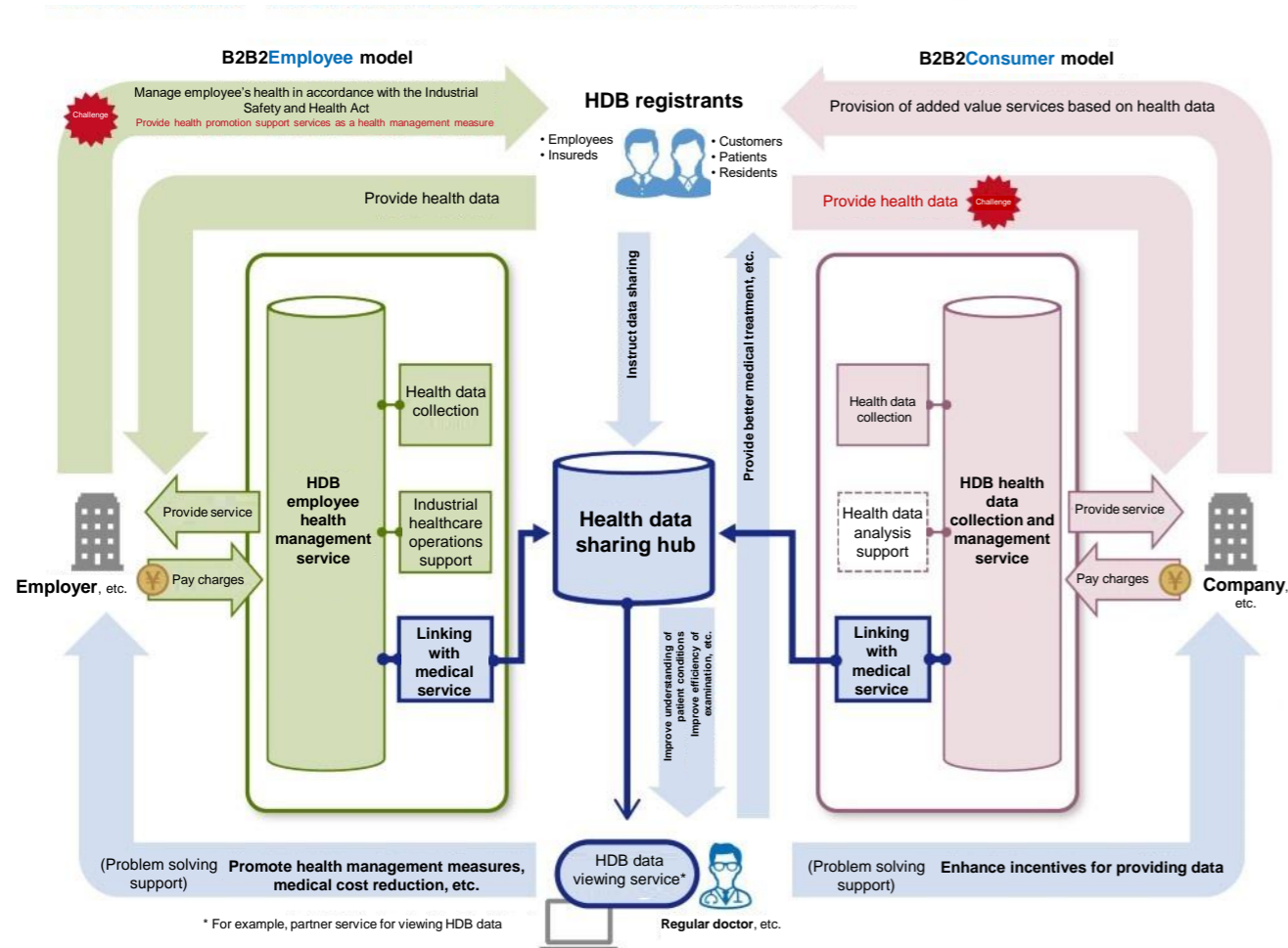
medical business of the NTT group and medical services that have a function to share PHR of patients with health professional.

We are now seeing an increasing number of inquiries from our clients stating that a data collection and storage infrastructure has been established but not many users use it and not much data have been gathered. HDB has a function to share health data with the medical sector. Using this function as one of “exit services” of company’s consumer apps would be a key to solve such a problem companies are facing.

Sharing of health data with regular doctors and pharmacists

Based on consumer needs for receiving better medical service by sharing health data with doctors and pharmacists, measures to enhance the system to share health data held in HDB with regular GPs, etc., at the instruction of consumers are being implemented.

Legend:
■ HDB-B2B2E model
■ HDB-B2B2C model
■ System to share HDB data with regular doctor, etc.



HDB utilization case

Vital data management service for cancer patients at hospital-affiliated hotel

Under the cooperation of the Hospital East of the National Cancer Center (NCC) located in Kashiwa, NTT DATA is providing a vital data management service for cancer patients at the Mitsui Garden Hotel Kashiwa-no-ha Park Side (hereinafter referred to as the “hotel”).

NCC is in charge of more than 90% of clinical trials of cancer drugs in Japan, and patients who desire to receive state-of-the-art treatments need to visit a hospital of NCC located in Tokyo or Kashiwa. The hotel that started operating in July 2022 on the premises of the Hospital East provides outpatients and their family members a number of services that reach out to the patients.

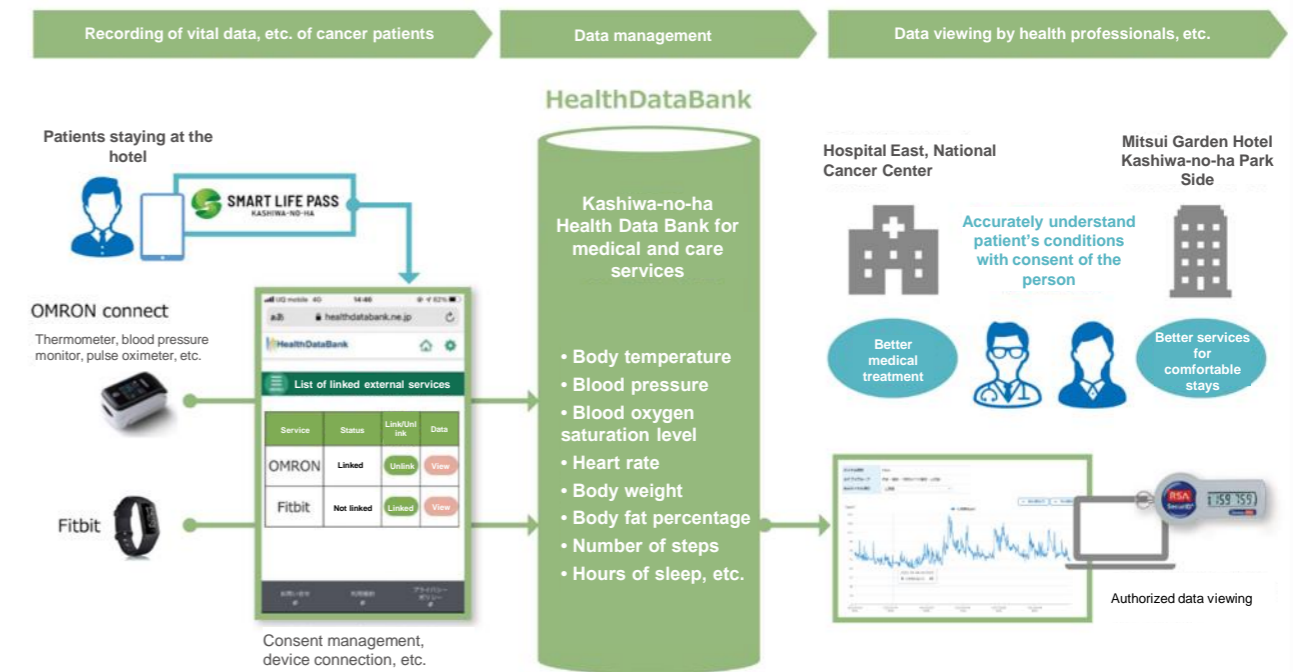
The vital data management service is one of them. Patients staying at the hotel use this service via the portal site for residents called SMART LIFE PASS which is provided by the Kashiwa-no-ha Smart City. Patients can store and check their health data in HDB, such as vital data measured using a thermometer,

blood pressure monitor, pulse oximeter, etc. borrowed from the hotel, number of steps measured using a wearable devices, and hours of sleep. Also, with the consent of the person, the data stored in HDB can be shared with health professionals of the Hospital East and staff of the hotel for the purpose of receiving “better medical treatment” and “better services for comfortable hotel stays.” In conventional medical practice, health professionals needed to hear stories from the patient during examination to guess the condition the patient was in prior to visiting the hospital or clinic. However, this service allows health professionals to gain more accurate information on the patient’s conditions by looking at the daily changes in the vital data of the patient on the patient data display window of the service to select and perform better medical treatment for the patient.

Use of this service is currently being considered by hospitals in other regions and drugstores that are planning to set themselves up as “regular pharmacist and drugstore” for consumers. NTT DATA is also thinking to apply the HDB in the pharmaceutical industry, like for clinical trials of drugs and post-marketing surveillance, although that requires obtaining pharmaceutical approval first.

Vital data management service at hospital-affiliated hotel

Service to support cancer patients is provided at Mitsui Garden Hotel Kashiwa-no-ha Park Side with cooperation of Hospital East, National Cancer Center



Solution to promote co-creation and spreading of “well-being economy”

“Co-creation Demonstration Lab” simulating society in not too distant future

In this section, we would like to show some of our activities on «Proposition 3 Cooperate with like-minded companies to work on co-creation and spreading of “well-being economy”» stated in Chapter 2.

NTT DATA does business in various sectors and industries including public, corporate, and finance. And now, our Industry Division engaged in business in these sectors and industries and Healthcare Division specialized in medical and health care are joining forces to explore the future possibilities of health data utilization together with our clients.

Health data utilization is drawing attention in many industries, and companies are trying to picture a future image of health data utilization. However, “problems specific to the dawn” like below are stalling these companies, which we are also made aware of.

- A data collection and storage infrastructure has been established but not many users use it and not much data have been gathered.
- Companies are not able to come up with good ideas on how to utilize health data.
- There are not data scientists, business analysts, or any person who can analyze and put such data to good use in companies.

To address these problems, NTT DATA opened the Co-creation Demonstration Lab that simulates a not-so-distant-future society as a place for companies to realistically verify their ideas of services.

The Co-creation Demonstration Lab offers a framework

of “health data management starting from consumers” in which employees of NTT DATA (hereinafter referred to as “Lab residents”) can store their checkup results and the results of health data measured using Fitbit etc. in the “HDB for co-creation demonstration” and share such health data, on their own accord, with products and services provided by companies using the Lab.

By utilizing a wide range of health data and results of questionnaire surveys to Lab residents, the companies can more realistically verify their products and services that have stayed in the desktop verification stage and conduct marketing research. It is also possible to verify the possibility of linking with services provided by other companies, provided that an agreement has been reached by the parties involved.

In addition, to companies that are having a difficulty in coming up with concrete ideas on how to utilize health data, we offer support for advent and manifestation of breakthrough ideas by cooperation of the Industry Division familiar with the latest industry trends and the Healthcare Division specialized in medical and healthcare.

Through the Co-creation Demonstration Lab, NTT DATA is aiming to co-create “services for consumers to experience and feel the benefits” with companies that are working on health data utilization, and actively make the experience values known to others to spread a new norm “it is just natural for consumers to utilize their health data to realize their well-being” in this world.

Activity Example

Food & Wellness platform for solving problems common in the food industry

The Food Industry Division of NTT DATA provides a Food & Wellness 500-person PoC environment service for the food industry in collaboration with the Co-creation Demonstration Lab.

In recent years, due to changes in the state of society and transformations in the personal lifestyle and values, consumer’s sense about food is further diversifying.

To accommodate that, the food industry has started to (1) enhance consumer contacts through D2C (Direct to Consumer) (2) gain deeper understanding of consumers by gathering and analyzing personal data of consumers, and (3) create and provide new personalized consumer experience.

Also, the wellness market is flourishing in the food industry in response to the rise of health-conscious consumers and an increase in health-related social issues such as the spread of lifestyle-related diseases. The wellness market endeavors to address the health issues of consumers, and health data are attracting attention as one of personal data for understanding

consumers.

Based on such trends in the food industry, NTT DATA has conceived the Food & Wellness platform toward realization of “food personalization.” This platform is a system to collect and consolidate health-related data scattered around in the society, such as checkup results and diet, exercise, sleep, and genetic data, and provide the data to food manufacturers who desire to use such data. The ultimate goal of the platform is to circulate a wide variety of data among industries across the boundaries and thereby contribute to improved health of consumers.

The Food & Wellness 500-person PoC environment service for the food industry is provided as the first step of the Food & Wellness platform, and can provide genetic data highly sought after in the food industry, in addition to checkup results and other health data of Lab residents shared by the Co-creation Demonstration Lab. Through these data and questionnaire surveys to Lab residents, the food industry can validate the research and development and marketing measures utilizing health data, including consumer analysis and product effectiveness verification, in a speedy and secure manner.

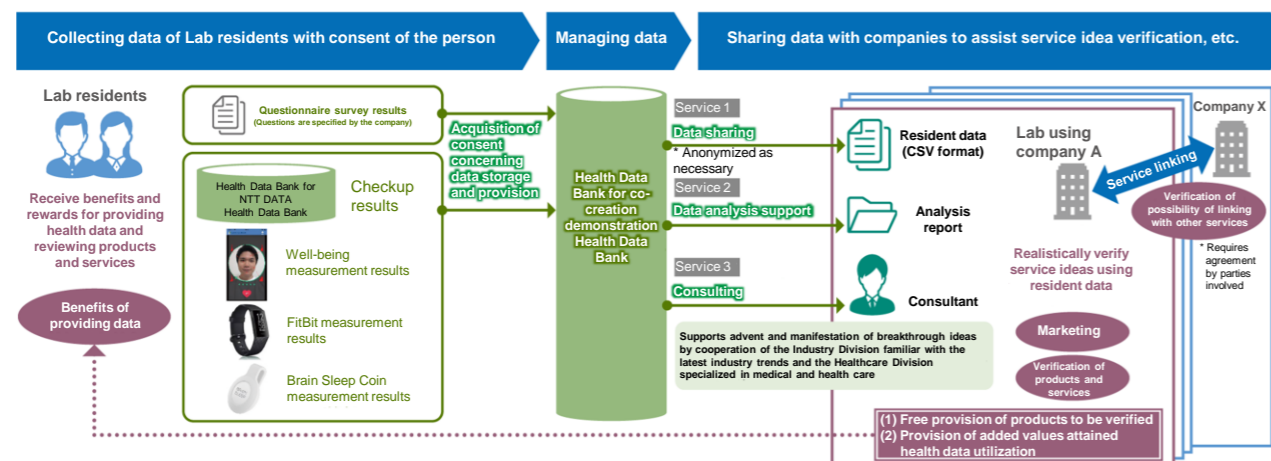
“Food & Wellness 500-person PoC environment service”

Provides anonymized health and questionnaire survey data of 1,200 employees of NTT DATA to assist research and development and marketing measures

Overview of Health Data Bank® Co-creation Demonstration Lab

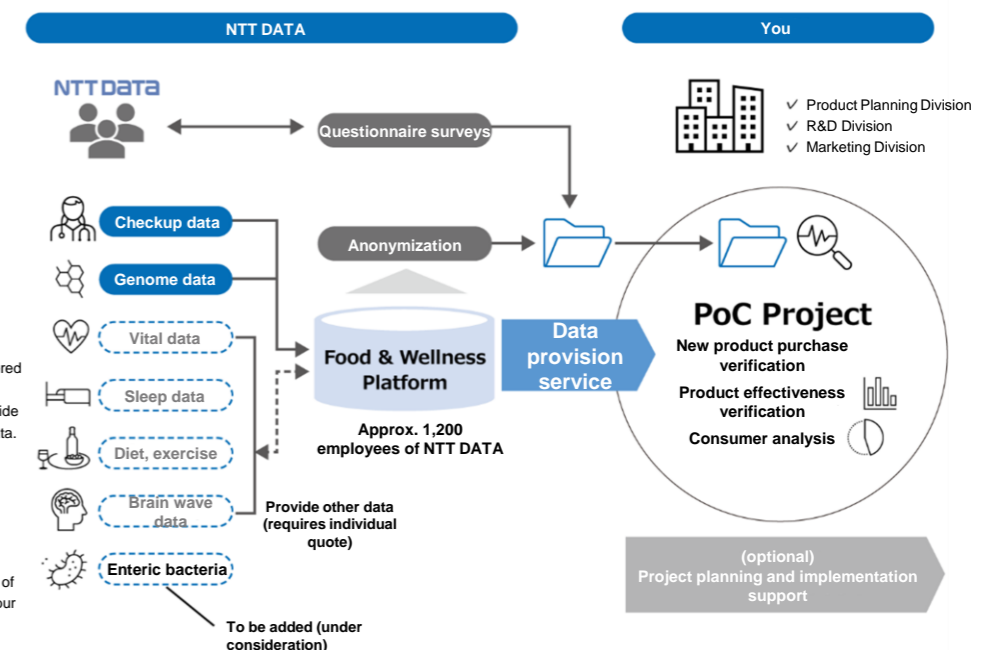
Provides a system to store health data of Lab residents in the “HDB for co-creation demonstration” and share them with companies with consent of the person, as a place for companies to realistically verify their ideas of services

Legend: ■ Scope of Health Data Bank Co-creation Demonstration Lab ■ Scope of company’s activities



Environment with health data of 1,200 employees of NTT DATA

NTT DATA holds up the concept of Food & Wellness platform to realize providing food most suitable for the person (= personalized food), namely, food personalization. This is a system to collect and consolidate health-related data scattered around in the society, such as medical checkup, diet, exercise, sleep, and genome data, and provide the data to companies who desire to use such data. The ultimate goal of the platform is to circulate a wide variety of data among industries across the boundaries and thereby contribute to improved health of consumers. NTT DATA can provide you with anonymized medical checkup and genome data of its 1,200 employees, as well as questionnaire survey data of applicable employees for you to utilize them at your analysis team and R&D department. We trust you find this platform useful in research and development and marketing measures utilizing health data, including consumer analysis and product effectiveness verification.





Carving out the future of health data by utilizing the strengths of NTT DATA

In the last two years, NTT DATA exchanged opinions with close to 100 companies. After many years of business development, we now feel that the “first year of health data utilization” is finally upon us, arrived in the form of soaring needs for health data in the private market.

NTT DATA believes that health data will become a natural part of our daily life, and the “well-being economy”, in which various daily products and services available for consumers are horizontally linked through health data, will become active in the near future. However, the development and expansion of “well-being economy” can occur only when consumers experience and feel the benefits of health data utilization and it becomes natural for them to keep sharing their health data for health products and services provided by companies. Changing the mindset of consumers who are not really high in health awareness would be quite difficult.

About the health data utilization for which solid pathways of implementation are still not in sight, companies who are actively working on it as an investment into the certain future exude the spirit “we are the ones to create the future norm”, with no exception. NTT DATA believes companies with the same spirit need to join forces to take on the challenge of changing the mindset of consumers, or the “well-being economy” will never become a reality and Japan will not see any major transformation.

Individual services utilizing health data may be created one after another by various market players such as startup companies that have cutting-edge technologies. Meanwhile, the “well-being economy” for accommodating such services requires more than just some establishment in the IT aspect for the services and infrastructure to function. It requires building up the framework with unwaveringly looking at the future image of health data utilization, respecting the values and manners of various stakeholders, and keeping everybody on the same page. And, this “creation of a system for various stakeholders to link to each other” is exactly what NTT DATA is good at.

Carve out the future of health data utilization together with companies that have the spirit “we are the ones to create the future norm”, while respecting them and thanking them for being able to share this moment of the beginning of a new era. That is what NTT DATA desires to achieve.

NTT DATA Corporation

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