Tentative translation

The Committee on AI Economy
2022 Report (Outline)

December 23, 2022

The Conference toward AI Network Society
Committee on AI Economy

The Committee on AI Economy 2022 Report: Contents

Summary of 2021 Report (Aug. 2021): Analysis of the Economic Value of Data

Following the 2020 report, which found data on par with capital and labor as a production factor, an empirical analysis with a production function model was conducted using a questionnaire survey of enterprises. The results confirmed that the amount of data utilized correlates to the amount of value added, a contribution similar to capital and labor. Further analysis refined these findings and elucidated the value-creation mechanism involved.

Scope of research in the 2022 Report

(1) More inclusive range of fields and industries covered

A deeper, sector-specific evaluation is crucial to producing a more robust analysis of the economic value of data. The 2022 report investigates data utilization in the public and quasi-public sectors, which has become more of a focus area of late, but which was not covered in previous reporting.

(2) Improved survey questions and response analysis;

(3) Consideration for fixed-point observation

The 2022 questionnaire focuses on the use of AI, which was not central to previous surveys. In addition, it more closely investigates **bottlenecks and inhibiting factors in data utilization.**

Consideration is given to how the survey should be conducted in the future, taking the voices of the enterprises surveyed into account.

The 2022 **report summarizes the current status of, and issues in, digitalization and data utilization across business domains**, and **offers recommendations to resolve social issues in using AI and data.** In part it reflects discussion at the hearings and the Global Forum on AI Network Society 2022.

Chapter 2 2.1 Survey for Estimating the Value of Data (1/3)

Questionnaire Survey of Enterprises

- The Committee conducted a questionnaire survey of enterprises, similar in scale to its 2020 survey, in order to ascertain how enterprises collect, analyze and utilize data. Based on the results, the Committee then summarized the status of data utilization by Japanese enterprises in this report.

Survey Overview (2021 Enterprise Survey)

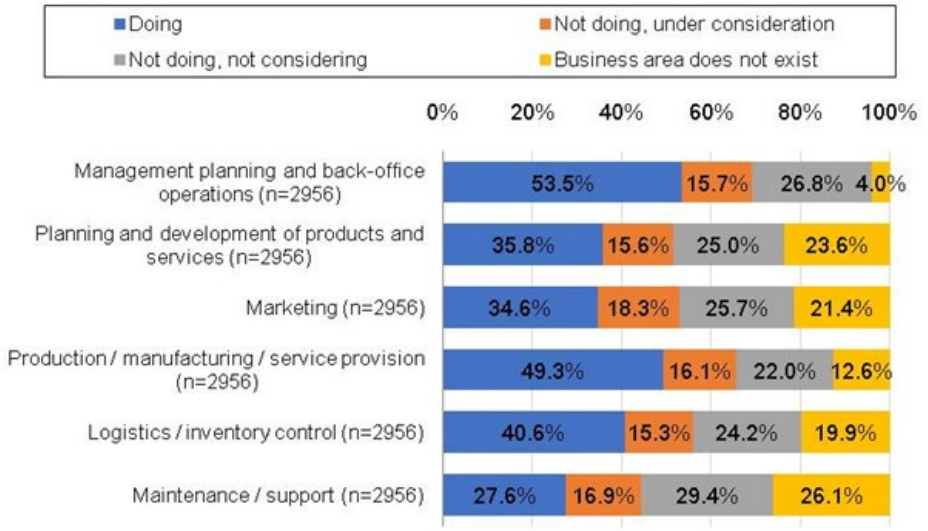
1. Subjects: 15,001 enterprises selected from the 2020 Ministry of Economy, Trade and Industry's Basic Survey of Japanese Business Structure and Activities, by percent of value added in their industries*; and 208 finance and insurance firms which are not covered in the METI Basic Survey.
2. Survey period: January 25 to February 28, 2022
3. Content: Enterprises' data usage (volume and type); analysis structure (environment, personnel); status of AI usage
4. Survey method: Online
5. Responses: 3,329 (2,320 complete responses)

*This roster was determined based on the amount of value enterprises added to their respective industries. Firms actually surveyed were selected from the sample at random.
Note: The questionnaire was primarily distributed to manufacturing, retail, wholesale, and information/telecom enterprises. Consequently, results from the submitted responses focus heavily on these industries. Exercise due caution in extrapolating to interpret overall results.

Key Findings: Current Status of Data Utilization

- More than 50% of respondents run data analysis in "management planning and back-office operations".
- Nearly half the enterprises surveyed report that they do not use external data.

<Status of Data Analysis Implementation (by business area)>



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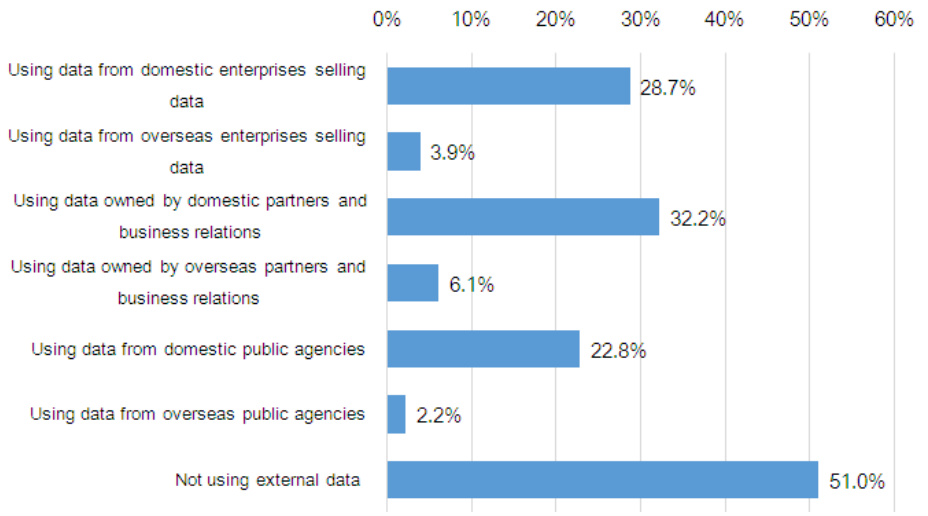
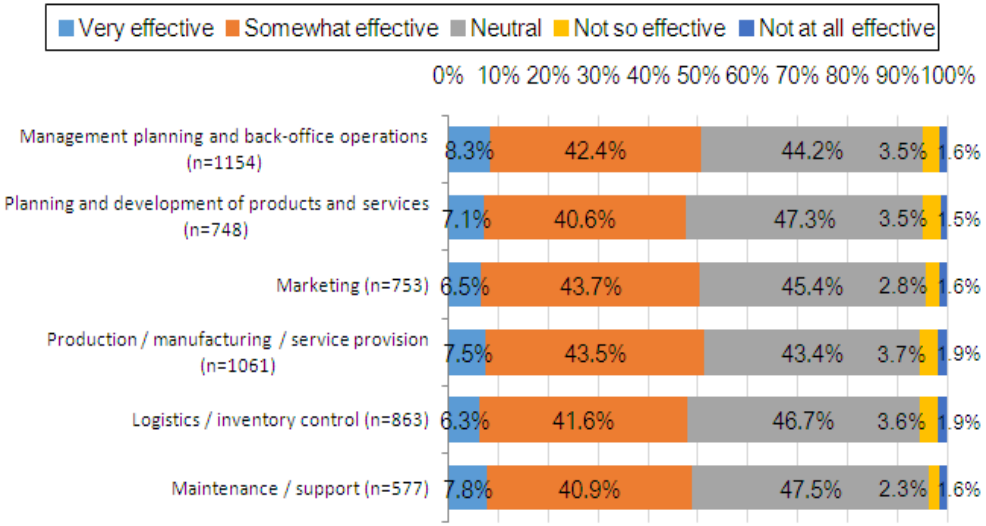


Chapter 2 2.1 Survey for Estimating the Value of Data (2/3)

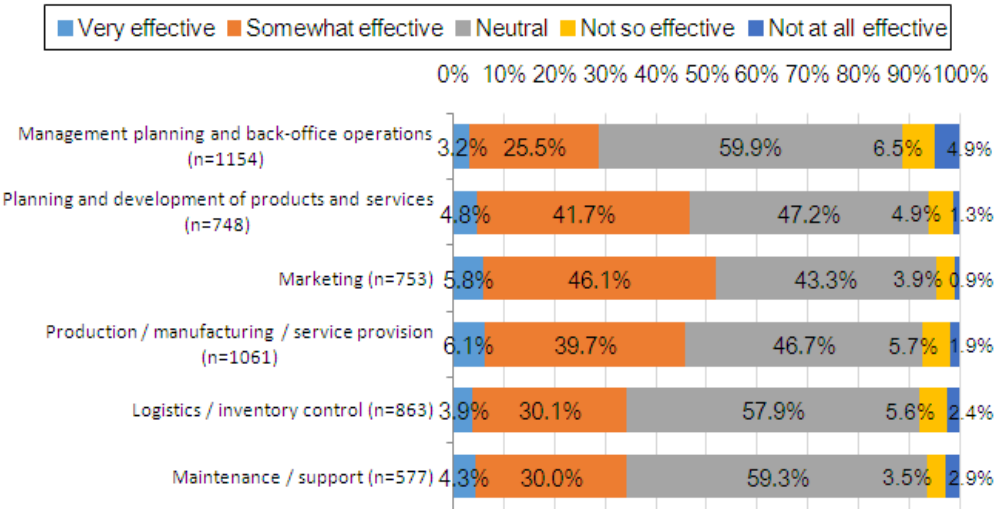
Key Findings: effectiveness of data utilization

Roughly half of all enterprises surveyed reported utilizing data effectively as an input resource. While fewer enterprises overall said that data utilization powers the output of goods and services, within the “marketing” and “planning and development of products and services”, the figure rose to nearly 50%.

<Effect of Data Utilization on Inputs>



<Effect of Data Utilization on Outputs>



Key Findings: issues in data utilization

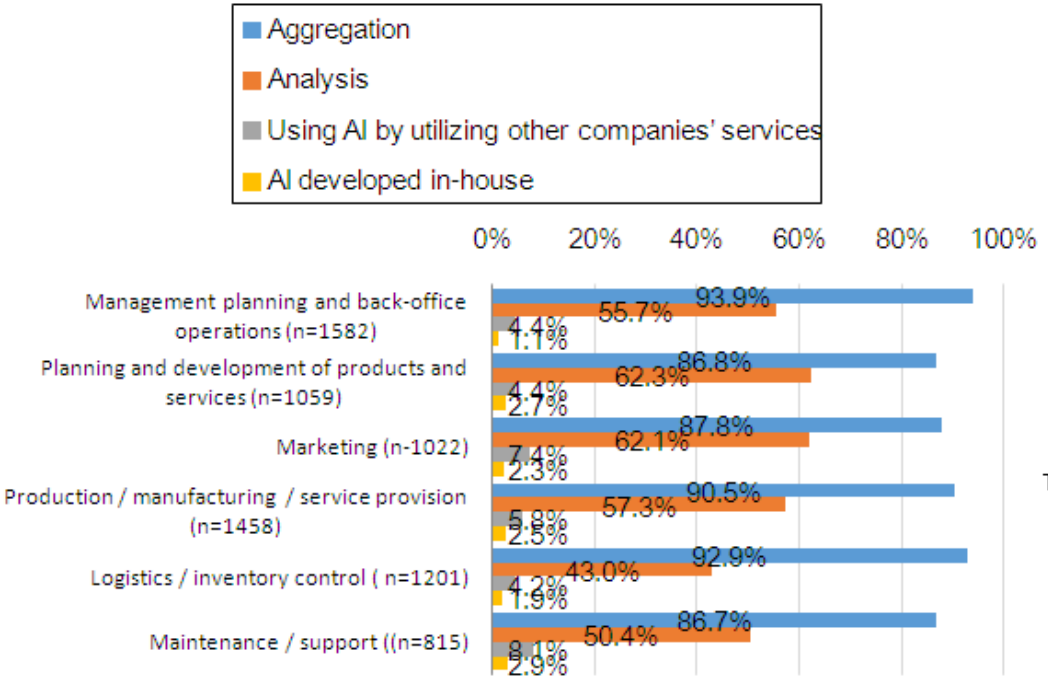
Enterprises’ top internal issue was "Human resource barriers, e.g. lack of employees with know-how," while the most commonly reported external issue was "Concerns about data protection and security."

Internal issues (ranked by percentage of enterprises reporting)	External issues (ranked by percentage of enterprises reporting)
1 Human resource barriers, e.g. lack of employees with know-how (78.0%)	1 Concerns about data protection and security (46.9%)
2 Financial difficulty with the cost burden (45.2%)	2 Used by recipients for purposes other than intended (abusive use) (35.9%)
3 Concerns about data protection and security (38.4%)	3 Unable to receive full revenue generated from the data provided to external parties (31.5%)
4 Lack of external resources, e.g. appropriate consulting or software (27.5%)	4 Our intellectual resources may be used by our competitors (24.6%)

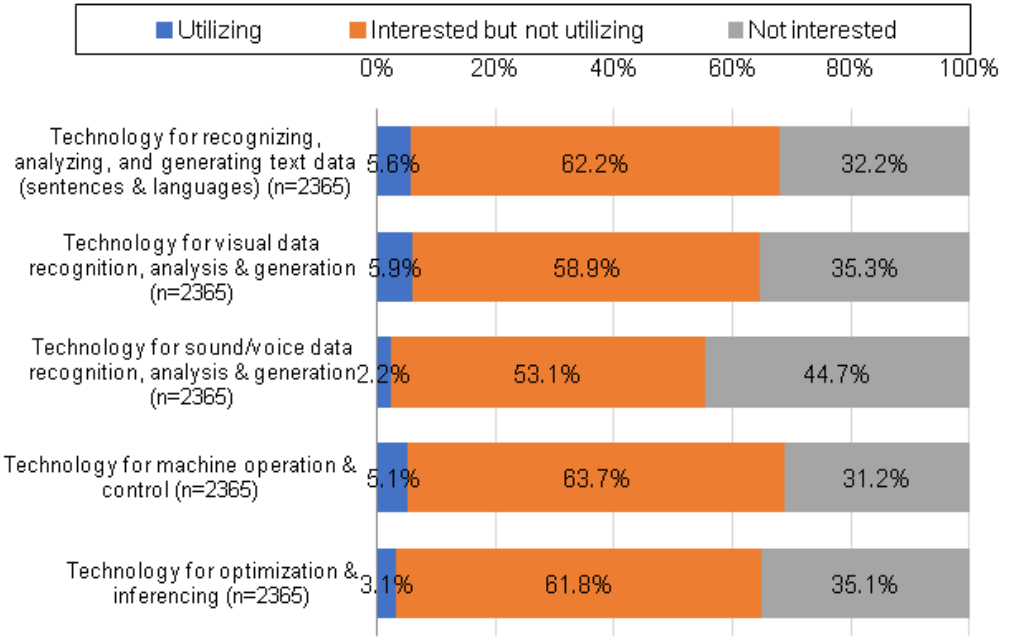
Key Findings: current Status of AI adoption

- The most common means of data processing across all business domains is data aggregation. However, only about 10% of all businesses have adopted AI.
- More than half of enterprises surveyed reported being “interested, but not utilizing” AI technology in any form.

<Data Processing (by business area)>



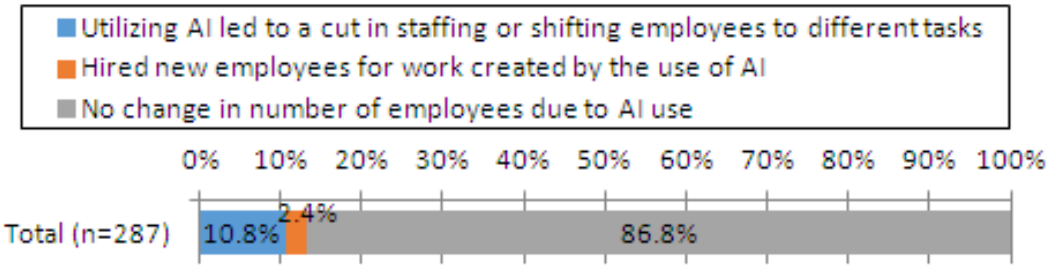
<Status of AI Utilization (by type of AI technology>)



Key Findings: headcount changes due to AI utilization

- Nearly 90% of enterprise payrolls were unchanged due to AI utilization. However, more enterprises that adopted AI reduced staff than increased it.

<Headcount Changes Due to AI Adoption



Key Findings: analysis of data value/effectiveness (production function analysis using pooled data)

- As in 2021, the study positioned data as a production factor, as with other production factors (capital and labor), and conducted empirical analysis with this production function model*:

$$V = A_o K^{\alpha} L^{\beta} Data^{\gamma} e^{dmy}$$

* *V* is value added, *K* is capital (tangible fixed assets + intangible fixed assets), *L* is labor (number of full-time employees). *Data* is a data variable. The *dmy* (dummy variable) is assigned as a manufacturing dummy and a large enterprise (more than 300 full-time employees) dummy.
* Raw data was used for each variable.

- In addition to the 2021 Report, data sources analyzed include the 2020 METI Basic Survey of Japanese Business Structure and Activities*, and the 2021 Enterprise Survey. Two years' data rather than one was employed, to obtain a larger sample size, and due to difficulties comparing analyses involving different sample populations.

* Because the financial and insurance industries were not covered in the METI Basic Survey, their data is not included in the analysis in this section.

- In the pooled data analysis, the data variable had a positive significant relationship to value added, and the coefficient for externally acquired data volume was larger than for internally acquired data. Applying linear homogeneity to the estimation suggests that data utilization may accelerate productivity growth.

- The year dummy variable (0=2019 data,1=2020 data) exhibits negative significance. Value added trended higher in 2019.

<Nonlinear homogeneous>

Data variable	Condition	n	Adjusted R^2	*K* (Capital)	*L* (Labor)	Data	Manufacturing dummy	Large enterprises dummy	Year dummy
Utilized data volume	–	2652	0.5594	0.40 ◎	0.55 ◎	0.03 ◎	0.02	-0.11	-0.33 ◎
Internally acquired utilized data volume	–	2652	0.5592	0.40 ◎	0.55 ◎	0.02 ◎	0.02	-0.11	-0.33 ◎
Externally acquired utilized data volume	–	2652	0.5588	0.40 ◎	0.56 ◎	0.04 ○	0.02	-0.12	-0.33 ◎

<Linear homogeneous>

Data variable	Condition	n	Adjusted R^2	*K* (Capital)	*L* (Labor)	Data	Manufacturing dummy	Large enterprises dummy	Year dummy
Utilized data volume	$\alpha+\beta=1$	2652	0.2533	0.40 ◎	(0.60)	0.02 ○	0.01	-0.19 ◎	-0.32 ◎
Internally acquired utilized data volume	$\alpha+\beta=1$	2652	0.2531	0.40 ◎	(0.60)	0.02 ○	0.01	-0.19 ◎	-0.32 ◎
Externally acquired utilized data volume	$\alpha+\beta=1$	2652	0.2525	0.40 ◎	(0.60)	0.04 △	0.02	-0.18 ◎	-0.32 ◎

* Externally acquired utilized data volume used the variable as 1+ externally obtained data volume.
Enterprises with utilized data volume equaling 0 are excluded from the analysis.

Note ◎: Significance level 1%, ○: Significance level 5%. △: Significance level 10%

Key Findings: analysis of data value/effectiveness (production function analysis using panel data)

- A production function analysis was conducted with a fixed effects model on a panel data set. Two years of data were used, to account for factors specific to enterprises that responded to the survey for two consecutive years. Results generally echoed the pooled data analysis: both data variables were positively significant for all enterprises, while the year dummies were negatively significant.

Results of the analysis, based on responses to both the 2020 Enterprise Survey and the 2021 Enterprise Survey (Results from a fixed effects model on panel data in a production function analysis, no linear homogeneity.)

Subject of analysis	Data variable	Sample size	Adjusted R^2	*K* (Capital)	*L* (Labor)	Data	Manufacturing dummy	Large enterprise dummy	Year dummy
Enterprises that responded two years in a row	Utilized data volume	276	0.4955	0.34 ○	0.004	0.02	-0.17	0.41	-0.05
All enterprises	Utilized data volume	2652	0.5821	0.40 ◎	0.54 ◎	0.02 ○	0.04	-0.05	-0.35 ◎
	Internally acquired utilized data volume	2652	0.5820	0.40 ◎	0.54 ◎	0.02 ○	0.04	-0.05	-0.35 ◎
	Externally acquired utilized data volume	2652	0.5815	0.40 ◎	0.55 ◎	0.03 △	0.04	-0.05	-0.35 ◎

* This analysis excludes enterprises with added value or data utilized volume ≤ 0.

Note ◎: Significance level 1%, ○: Significance level 5%, △: Significance level 10%

Note: Findings in the production function analysis reflect current initiatives in data utilization, and do not necessarily indicate that further increasing the volume of data used would further increase added value. Also, to the extent that results are averages for enterprises that use data effectively and those that do not, they should be thought of as normalized.

Key Findings: analysis of data value and effect (production function analysis factoring in use of AI)

- Various synergies were analyzed using pooled data in order to determine the key factors in effective implementation of AI. The results showed a significant positive relationship for four combinations: "AI utilization × employee in charge," " AI utilization × enterprise-wide environment built," " AI utilization × analysis done by dedicated department for data analysis," and “AI utilization × joint analysis involving other enterprises such as alliances and consortia.” Thus, these synergies are considered crucial to increasing added value through the adoption of AI.

Key Findings: analysis of data value/effectiveness (by industry, size of enterprise and type of data)

- Pooled data was analyzed by industry, size of enterprise, and data type. By industry, the data volume used showed significance in non-manufacturing sectors, notably services; by size, data utilization was significant for enterprises of any scale; while by data type, only "other than customer-related" data utilization was significant.
- These results suggest that data utilization effectively increases added value, regardless of the size of the enterprise. Thus, small and medium-size enterprises as well as large enterprises can be expected to increase their data utilization. Meanwhile, among non-manufacturing industries, the service sector boasts the most effective gains in added value through data utilization.
- However, in manufacturing, and in non-manufacturing other than services (wholesale and retail trade, information and communications*, etc.), utilized data volume did not show significance. Enterprises in these areas may need to improve their approach to data utilization in order to gain more added value.

* Information and communications includes telecommunications, broadcasting and newspapers.

<Results of Production Function Analysis, by Industry, Enterprise Size and Data Type>

Subject	Data variable	n	Correction R^2	K (Capital)	L (Labor)	Data	Manufacturing dummy	Large enterprises dummy	Year dummy
Manufacturing	Utilized data volume	1089	0.6797	0.54 ◎	0.55 ◎	0.01	-	-0.04	-0.38 ◎
Non-manufacturing	Utilized data volume	1563	0.4855	0.36 ◎	0.53 ◎	0.03 ◎	-	-0.20 ○	-0.25 ◎
Large enterprises	Utilized data volume	892	0.5855	0.53 ◎	0.44 ◎	0.03 △	0.22 ◎	-	0.04
SMEs	Utilized data volume	1760	0.3150	0.29 ◎	0.62 ◎	0.02 ○	-0.08	-	-0.50 ◎
Total	Volume of customer data utilized	2453	0.5573	0.41 ◎	0.56 ◎	0.01	0.02	-0.13 △	-0.34 ◎
Total	Utilized data volume other than customer-related data	1953	0.5852	0.41 ◎	0.55 ◎	0.03 ◎	-0.01	-0.08	-0.30 ◎

<Analysis of non-manufacturing segment in greater detail>

Subject	Data variable	n	Correction R^2	K (Capital)	L (Labor)	Data	Manufacturing dummy	Large enterprises dummy	Year dummy
Wholesale, Retail	Utilized data volume	958	0.4329	0.24 ◎	0.61 ◎	0.02	-	-0.14	-0.28 ◎
Information, communication	Utilized data volume	156	0.6771	0.37 ◎	1.00 ◎	-0.04	-	-0.66 ○	-0.25
Services	Utilized data volume	254	0.5071	0.34 ◎	0.38 ◎	0.08 ○	-	-0.25	-0.64 ◎
Other than the above	Utilized data volume	195	0.6604	0.55 ◎	0.39 ◎	0.04	-	-0.18	-0.22

Note ◎: Significance level 1%, ○: Significance level 5%, △ :Significance level 10%

Findings of the Empirical Analysis – Highlights

- The empirical analysis in FY22 confirmed the significance of three points that the 2021 Report cited as key to enterprises increasing data utilization and reaping its benefit. These are **the importance of**: (1) **creating an environment for data utilization enterprise-wide**; (2) **developing human and organizational resources**; and (3) **forming external** (data and organizational) **collaborations**.
- Since **these factors are** not only key to benefiting from data use, but also **crucial to creating synergy as enterprises implement AI**, they are expected to continue driving new initiatives.

<Main results of the empirical analysis>

- The FY22 empirical analysis employed data from the last two years. In elucidating the **positive relationship between data utilization and value added**, and suggesting that the **use of data may accelerate productivity growth**, the findings generally echo the previous year.
- Results indicate that **leveraging data is an effective way for enterprises of any size to add more value**, and that among non-manufacturing businesses, **data utilization is particularly effective in the service sector**. However, in other non-manufacturing areas (wholesale and retail trade, information and communications, etc.), and in manufacturing, firms may need to improve their approach to data utilization.
- Analysis of synergies created by adopting AI suggests that the **keys to adding more value by leveraging AI are: the right staff leading data operations; creating a corporate environment that facilitates data utilization; establishing a dedicated data analysis section; and a system for joint analysis with external partners, such as enterprises, alliances and consortiums**.
- The analysis found negative significance associated for the year dummy. One possible explanation is the impact of the Covid-19 pandemic on enterprises' added value.

Note: The Committee believes enterprises' comments in response to open-ended questions in the 2021 Enterprise Survey should be carefully considered in developing future surveys.

Chapter 3 Issues Related to Data Utilization in Medical Care

Medical care is expected to drive digitalization and data utilization. The Committee heard case studies of advanced data initiatives in medical care, clarified their effectiveness and identified issues involved.

Digitalization and data utilization initiatives in the medical care industry

(A) Major initiatives in digitalization and data utilization at medical facilities

- [Strategic Innovation Program (SIP) of the Cabinet Office] : "AI Hospital" system that supports highly accurate diagnosis and treatment. Designed to develop and improve medical technology through digitalization and data utilization by research institutions and ICT service providers..
- [Ubie, Inc.] : Medtech startup whose Ubie AI Interview, Ubie AI Consultation* and Ubie Link services are designed to support digitalization and reduce paperwork at medical facilities.

* Currently named “Ubie", a Symptom Search Engine

- [Sumitomo Mitsui Financial Group, Inc.]: Medical information bank mobile app “decile”. Efforts to improve the simplicity of management of personal medical and health information by using Personal Data Trust Bank technology.

(B) Developing medical and health information-sharing networks

- Linking and integrating regional medical information networks (case studies by ASONUMA Motohiro, Visiting Professor, Juntendo University; Member, WG on National Strategic Special Zones; and Super City Initiative expert).

Effectiveness of digitalization and data utilization initiatives in medical care

<Results of medical care data initiatives, as identified at the hearings>

● More accurate patient assessment ● Shorter time per office visit ● Shorter treatment times
● Increased patient convenience ● Reduced medical staff workload ● Reduced administrative workload

Issues Related to Data Utilization in Medical Care

- It is difficult to openly share medical and health information data between different data management entities such as medical institutions and governments.
- There is a great deal of concern about the use of personal information by individuals, and the use of information for research with high public interest by research institutions, government agencies, and companies is not progressing
- Digitalization and data utilization are unlikely to lead to profits for medical institutions

Businesspeople and relevant experts at the hearings delved into the status of digitalization and data utilization. Participants offered examples of current initiatives in a variety of fields, summarized here.

Initiatives in the financial industry (Financial APIs)

* Presentation by TAKI Toshio, Representative Director of the Japan Association for Financial APIs and Group Executive Officer, Money Forward, Inc.

- It will be important to provide open banking, including a mechanism called embedded banking (banking tools embedded in non-financial mobile apps), in a more secure and convenient form for the consumer. Japan has near total connectivity between financial institutions, because industry groups have been working to standardize contracting procedures, thus enabling access to nearly every bank. This is currently done via read-only API's, which only fetch account information, such as balances and bankbook entries.
- Key challenges include: the limited availability of Read & Write API's, which allow transaction instructions to actually execute transfers and withdrawals from accounts; legal ambiguity about individuals' data access rights; and the limited use of online banking in Japan.

Note: In the 2021 Enterprise Survey, banks reported two main categories of issues in implementing open API: problems related to developing the infrastructure, and challenges related to cost and monetization.

Initiatives in the construction industry: Komatsu, Ltd.

- Komatsu's Smart Construction solution boosts process management efficiency and productivity by providing digital data on the activities of every worker, every materials and every machine, in every stage of construction, in real time. It connects all datasets, and allows them to be visualized in one place.

Initiatives in the carbon-neutral space: Sumitomo Mitsui Financial Group (SMFG)

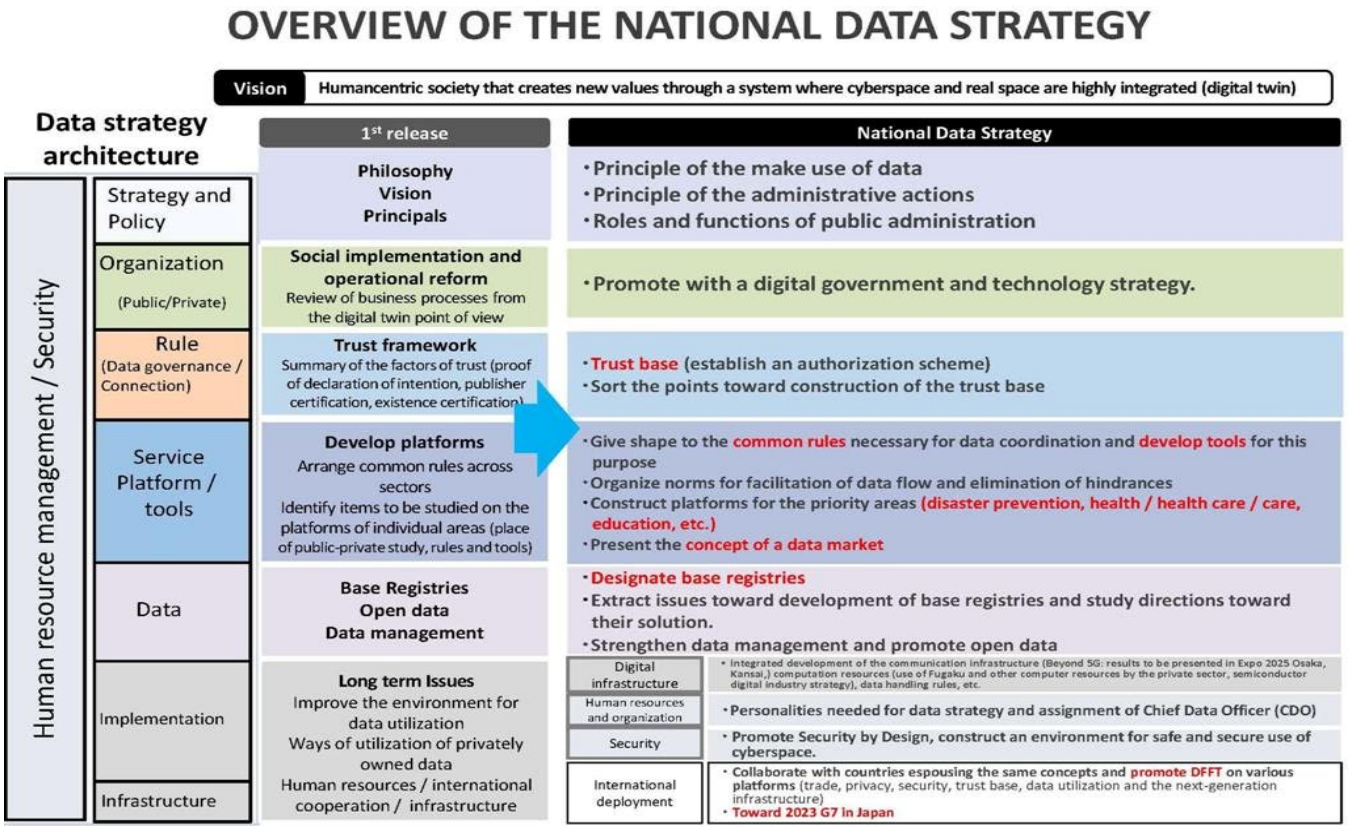
- SMFG believes that decarbonization efforts are highly compatible with digital technologies, and in the context of DX, SMFG proposes the following three solutions to help companies decarbonize. This enables us to provide a series of decarbonization solutions that supports corporate action toward decarbonization and carbon neutrality.

  ・Sustana, a cloud-based tool that calculates greenhouse gas and propose reduction plans
  ・Persefoni, a cloud-based platform that helps global companies calculate greenhouse gas emissions
  ・Climanomics®, a platform supporting climate-related disclosures, including responses to the TCFD

The National Data Strategy: overview

- The government of Japan (Cabinet Decision, June 18, 2021) has established the National Data Strategy, calling for the development of a digital infrastructure worthy of a world-class digital nation.

- Japan should seek its place as a human-centered society that balances economic advancement with the resolution of social problems by a system that highly integrates cyberspace and physical space. This strategic vision can be realized with the architecture that incorporates every aspect of data – not only tools and infrastructure, but also the rules.



Source: Conference toward AI Network Society, Committee on AI Economy, Expert Group on Data, (16th) Joint Session, December 3, 2021 Attachment 1 Driving the Comprehensive Digital Strategy (Digital Agency presentation slides)

This section considers how tomorrow's world will be spurred by data and AI, and the vision for that world. It focuses on discussions at the Global Forum on AI Network Society 2022, (an international symposium held March 1 by the MIC), including issues to be resolved in order to realize the vision. The expert panelists and speakers' views are summarized in this assessment of the future prospects and challenges for data and AI.

Future prospects

- The technologies that leverage data and AI are nascent; their effects remain to be seen. However, if the industrial revolution is a guide, we can expect AI to become commonplace technology. Enterprises will be able to **use AI and data to increase productivity and achieve high economic growth**, while individuals stand to **benefit from newly added value**, such as convenient services personalized to their needs.
- Thus, **leveraging AI and data** is expected **to solve a number of social issues and help build a prosperous future**.
- However, dealing with AI and data calls for caution. **Complex, intrinsically human tasks involving ethics and creativity are problematic for AI** and should remain in the purview of humans. Data should be shared as it generates new knowledge, but with **a global effort to distribute it safely and securely.**

Issues and challenges

- **Labor policy responses to data- and labor-intensity changes that impact corporate productivity:**

  In the AI era, there is a crucial **need to identify and hire AI-proficient talent**, while also adopting supportive labor market policies such as **human resources development and retraining to help workers readjust**.

- **Enabling the free flow of data as envisioned in the Data Free Flow with Trust (DFFT) concept:**

  The three keys to creating an environment that enables safe, secure data sharing and utilization are: **data ownership; user experience of consent; and data sharing across disciplines with security**.

Current Status of AI and data utilization and the resulting effects

- The Committee's analysis indicates a **positive relationship between AI/data utilization and added value**, and suggests that the keys to firms further increasing added value with AI include the right staff leading data operations, and creating a system that enables joint analysis with external partners.
- About **20-30% of respondents** in the 2021 Enterprise Survey **reported that they are neither utilizing data nor considering it**, and only about 10% are actually using AI. The most common issues in data utilization are **lack of qualified staff and concerns over the handling of personal data**.
- An international comparison of AI utilization reveals that 44.1% of U.S. enterprises have already adopted the technology, while **Japanese enterprises lag behind at 20.5%.**

The ITC environment, economic conditions and related factors

- **Japan's broadband infrastructure**, both fixed and mobile, **is among the best in the world**.
- Internet traffic in Japan spiked in response to the Covid-19 pandemic. Meanwhile, **the socioeconomic climate has been impacted by global events**, such as Russia's invasion of Ukraine, which in turn is expected to increase inflation worldwide, as GDP declines.

Trends in EU data- and AI-related regulations

- The EU has seen a regulatory trend with the introduction of several bills on AI and data. The Digital Markets Act (entered into force November 2022) **mandates that online economy gatekeepers maintain interoperability and data portability**. The Data Act (published February 2022) includes rules to facilitate switching between providers of cloud services and other data processing services, while the Artificial Intelligence Act, proposed in April 2021, classifies AI applications by risk and regulates them accordingly.

Japan’s data strategy

- The government of Japan is addressing data issues pursuant to the National Data Strategy (Cabinet Decision, June 18, 2021).

Discussion on AI, data, and productivity

- Because experts have diverse views on how much impact AI and data will have on productivity, **there is room for further discussion and debate**.

Chapter 5（Summary） 5.2 Recommendations

- Japan faces a variety of socioeconomic challenges, including:
  - ・Issues arising from the declining birthrate and aging population (e.g. labor shortages, shrinking economy due to reduced domestic demand)
  - ・Issues demanding a global response (reflected in Sustainable Development Goals (SDGs), such as achieving a decarbonized society)
  - ・Issues of economic uncertainty due to recent world events, (e.g. Ukraine invasion, Covid-19 pandemic) that raise supply chain risk, and drive moves to enhance productivity and socioeconomic sustainability
- Japan is an advanced nation with 21st century challenges. Thus, it should proactively adopt AI and data into its socioeconomic dynamics, to develop economically while also solving social issues. As mentioned, it has **well-developed ICT infrastructure, but may not be as advanced in utilizing data and AI effectively**.
- **Based on its analysis, indicating that the use of data and AI positively impacts enterprises' productivity,** and further premised on a high-level vision of the ideal environment for these technologies, the Committee believes the following actions are key to solving Japan's social issues.

Recommendations: Some of the specific actions Japan should take

1. **Development of a market environment for data distribution**: ● **Standardization** for data sharing (promote data portability and interoperability, with an eye on data ownership issues) ● **Personal Data Trust Bank** (further the discussion on the use of personal data in the quasi-public sector and the mutual collaboration areas, where there is a high need for utilization of personal data.)
2. **Promotion of AI implementation in various sectors**: ● Promotion of **AI utilization in enterprises** (create the environment for the AI lifecycle; raise awareness on the effectiveness AI) ● **Human resource development** (e.g. training for corporate employment and reskilling) ● Promotion of **DX in quasi-public fields (medical)** (including campaigns to raise awareness of DX effectiveness)
3. **Securing the ICT infrastructure** to support the AI era: ● Create a future-friendly, **sustainable ICT environment**
4. **Contribution to international rule-making:** ● **Actively engage and lead in the global dialogue** with emerging frameworks for the digital economy, such as DEPA and IPEF in mind