

Data Collection Survey for Global DX Mainstreaming Final Report

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**Japan International Cooperation Agency
(JICA)**

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Data Collection Survey
for Global DX Mainstreaming
Final Report
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Chapter 1 Survey Outline

1.1. Background and Purpose

Digital transformation (DX), which reconstructs and transforms conventional social systems with digital technology, is progressing all over the world. In developing countries, mobile phones have become widespread without being bound by development path that developed countries once followed (for example, without waiting for communication networks development, which is the transition from industry 1.0 to 2.0 and 3.0). An increasing number of countries are attempting to introduce the latest digital technology and innovative services by taking advantage of undeveloped regulatory and social infrastructures as a “leapfrog” to gain a foundation for a digital economy, industry development enhancements, and social services expansions all at once. In response to those changes and the needs of developing countries, modern technologies will be utilized, innovative approaches will be used, and private funds will be mobilized to achieve SDGs. The influence of the new coronavirus (declared a pandemic by the World Health Organization in early 2020) has forced non-contact lifestyles and business developments, forcing society to utilize digital technology.

Under these circumstances, JICA established STI/DX department in June 2020 to grasp rapidly-changing trends in DX and allow appropriate deployment to developing countries, and to use JICA projects to bring DX into the mainstream. It will be required to swiftly mainstream DX as a whole organization in response to the new coronavirus and continued business under travel restrictions.

- ① Seek an ideal method to mainstream DX in JICA projects, external disseminations, and enlightenment activities
- ② Pilot activities to form DX-related flagship projects
- ③ Construct a mechanism to accumulate and utilize business-related data at JICA

1.2 Survey items

The survey items implemented for each of ① through ③ in 1.1 are described below.

- ① Seek an ideal method to mainstream DX in JICA projects, external disseminations, and enlightenment activities

While this component aims to build a concrete successful model for the mainstreaming of DX in JICA by launching a DX flagship project in the short to medium term, at the same time, by considering the ideal state of JICA’s DX mainstreaming from a medium-term perspective, communicating externally, and conducting internal awareness-raising activities, it aimed to build external awareness of JICA’s DX

activities among developing country governments and other donors, and to form mechanisms and an organizational culture within JICA to consider the use of digital technology in all projects.

(1) Survey of the state of DX initiatives at JICA

As a part of the activities of the DX Task Force, in December 2019 JICA took inventory of ongoing and scheduled projects at the projects division that contribute to DX. In addition to the results and the final report by the DX Task Force, we analyzed the following past reports on ICT utilization (published in the JICA Library).

- Final Report on Project Research: A Survey on the State of Data Communications Technology Application in Developing Countries (Oct. 2015)

- Final Report: Data Gathering and Verification & Survey Work on Data Communications Technology Utilization Case Studies contributing to the Achievement of the Sustainable Development Goals (Feb. 2018)

Also, after conducting interviews at JICA and gathering related information, we sorted out the status of DX initiatives at the related JICA departments.

(2) Survey on DX trends and data utilization initiatives in development cooperation

We conducted a desk study of the policies, approaches, and specific projects for developing countries that have been adopted for assistance to developing countries in the DX strategies published by multinational organizations such as the United Nations, the World Bank Group, the Organization for Economic Cooperation and Development (OECD), the Asian Development Bank, the African Development Bank, the Inter-American Development Bank, the World Economic Forum, and European organizations, as well as bilateral assistance agencies, NGOs, and foundations in the United States, the United Kingdom, France, Germany, Australia, China, and South Korea (hereinafter referred to as “donors”), and conducted a comparative study of their features and directionality. For the project case studies, in addition to good examples from each agency, our survey also included examples of e-government in developing countries in relation to item (3).

We also conducted a desk study of strategies for utilizing data acquired through support for developing countries and methods for providing open data as adopted by each donor, and the utilization status at and among each organization, as well as good examples that utilized data.

In addition, in respect to the five or more donors implementing advanced initiatives that would be good references for JICA, our survey staff directly held online and on-site interviews and exchanged opinions with the donors on items including the strategies and policies that they employ for project DX and data

utilization, organizational structure, procurement and accounting systems, hiring and personnel development, and external-facing PR activities, and organized and analyzed the results. In our analysis, we evaluated the degree of maturity of each donor’s DX and data utilization, and then identified success factors and execution issues to find hints for JICA’s DX mainstreaming.

(3) Survey of international partners and resources for JICA DX mainstreaming (Estonia and India)

In respect to cutting-edge examples from Estonia and India, which are leaders in e-government, we believe there is potential to apply such examples when deploying and promoting projects in third countries along with Japanese local governments and private companies, so in this survey we considered specific methods for cooperating with these two countries. In our considerations, we established overviews of the two countries’ initiatives, their expectations for JICA and Japan, how to collaborate in a way that is mutually beneficial, the communication approach to take, and the JICA-side actions, schedule, etc.

- Estonia:

We conducted a desk study regarding the utilization of X-Road—which was developed in Estonia—in JICA projects, assuming that the target country for JICA support is a country with a relatively small population. We also discussed methods for private company adoption which are being implemented and promoted in Japan, and deployment methods in third countries.

- India:

Advancements in business-based partnerships between Japan and India are expected based on the Japan-India Digital Partnership signed by the Ministry of Economy, Trade and Industry, and we considered the possibility of cooperating on initiatives that would support such partnerships, as well as creating environments for companies’ international expansion. For this consideration, we first held interviews in Japan with the Ministry of Economy, Trade and Industry, the Information-technology Promotion Agency, and other related bodies, and then held on-site meetings to verify support measures that JICA could take. We conducted the on-site survey efficiently, for example by combining it with preparations for the pilot activities.

(4) Survey on Japan’s DX-related technology & services, and data utilization initiatives

Based on the contents of the joint document “Co-creating Digital Development to Achieve Society 5.0 for SDGs” from the Keidanren, Japan’s aid policies such as the Development Cooperation Charter, and Japanese companies’ predominant position and originality in digital technology in general, we examined the technologies and fields in which Japan is thought to have a competitive advantage in the context of

digital technology utilization in developing countries, and thereby identified candidate partners (including start-ups) for the future mainstreaming of DX at JICA. In addition, from among the cutting-edge examples of data utilization at Japan’s central government ministries and regional governments (e.g., Aizu-Wakamatsu in Fukushima Pref.), we surveyed initiatives that would be useful from the perspective of application to JICA DX mainstreaming, held direct interviews and exchanged opinions as necessary, and considered the possibility of partnerships and cooperation. In our considerations, we established an overview of each initiative, the predominant position in the event that an initiative is applied in a developing country, expected development effects, and the actions and schedule required for the JICA side.

(5) The ideal state of DX mainstreaming in JICA projects, and creation of external brochures

After discussing with JICA, we created a document describing the ideal state for DX mainstreaming. We first created an initial draft based on internal JICA considerations, such as the DX promotion policy (proposal) created by JICA, and the DX Task Force report. Afterward, we expanded the content based on the survey results of (1) through (4) above. With a view to DX mainstreaming in JICA projects, the content of the document was expanded to include: analysis of trends of developing countries and donors and the current state of JICA; environmental changes for digital technology and big data; the potential for partnerships in Japan and internationally; the ideal form of JICA in the medium to long term and how it can differentiate itself from other donors; organizational and institutional challenges for mainstreaming DX; the required organizational structure, human resources profile, and management process; and measures for overcoming challenges including the approach to organizational reform. Based on a prioritization of these items, we created a medium- to long-term roadmap described in chronological order.

At the same time, we created external PR materials for JICA DX mainstreaming based on the same proposal (simple video materials, pamphlets, PowerPoint materials, and websites). In preparing these materials, JICA’s stance, its differentiation from other donors, and its message were made clear to governments of developing countries, and we employed creative efforts to raise JICA’s external presence in the context of DX, such as including a menu of specific support items.

(6) Preparation of internal JICA learning materials for DX mainstreaming, and holding remote lectures

In order to raise the degree of understanding on DX among JICA staff members (including “national staff” at JICA’s international offices) and those involved in JICA projects (JICA experts, consultants, JICA trainees, counterparts, etc.) and to promote the utilization of digital technology in the projects of each department, we held a series of eight seminars in which we covered the elements of the ideal state of DX mainstreaming as well as fundamental DX knowledge.

② Pilot activities to form DX-related flagship projects

In this component, we implemented a total of six on-site pilot activities in collaboration with JICA international offices, regional departments, and the relevant departments which focus on specific issues, with a view to forming a DX flagship project at JICA. In these pilot activities, we cooperated with counterparties and relevant agencies in the partner countries, defined challenges, visualized digital technology utilization (use cases), obtained and analyzed big data, built a simple demo system, repeatedly implemented improvements through feedback from related parties, and held discussions with a view to full-scale implementation (e.g., in later technology cooperation projects).

③ Construct a mechanism to accumulate and utilize business-related data at JICA

With the aim of promoting data-driven project formation and monitoring using JICA-held data and open data, as well as the resolution of social issues in a way that drives the use of the digital technology and know-how of private companies and universities, under this component we worked to develop a cloud-based data catalog for realizing the pilot activities conducted in (2). In order to do this, via the following procedure we created a simple demo for the pilot activities, which was actually used by counterparts and JICA staff members in the pilot activities, which verified and enhanced its usability.

Firstly, while easy-to-use tools are adopted that enable JICA staff members to utilize data catalogs in project formation, ex. implementation, monitoring, and evaluation, in the future we envision a scheme which collects primary data that from surveys conducted in JICA projects in the same format, and which makes the data openly available to the outside and available in multiple languages. An ecosystem including a network of human resources involved in data analysis and processing was formed as a result, and the goal was to make it possible to promote international cooperative research by providing data to researchers, and to promote new businesses, business vitalization, and social impact investment by providing data to private companies in Japan and locally.

(1) Formulation of a project-related data application concept

Firstly, in order to ascertain the current state of things, we took inventory of the data held by JICA and organized it by type, item, volume, where to store, rights, etc. We conducted interviews with project related departments at JICA and other surveys and compiled the results. Based on the results of inventory taking and the results of the survey on big data utilization and open data similar to other donors (e.g., the World Bank) mentioned in ① (2), we formed a concept for data utilization at JICA, and established points on complementarity when combined with outside open data, and differentiation from similar

services. In considering this concept, the scope of disclosure was set in stages according to the type of needed JICA-held data, and the use cases for data utilization in JICA projects (visualizations of how the work pertaining to project formation will change, what can be done once data is accumulated, etc.) were established. When doing so, we examined the scope of system functions to be developed by JICA and data to be collected and stored, should be defined. .

We also anticipated that the accumulated data will be not only used for JICA’s operation and evaluation at the project level, but also in academic fields, the private sector, civil society, and society in general where it can be used in various use cases, and these possibilities were also considered when verifying pilot activities in ②.

1.3 Survey Area

Activities related to (1) Seeking an ideal method to mainstream DX in JICA projects and external dissemination and (3) Construct a mechanism to accumulate and utilize business-related data at JICA are being conducted in Japan.

We will conduct domestic operations and overseas operations (with short field trips) to implement (2) Pilot activities for DX-related flagship projects in 6 countries (Uganda, Cambodia, India, Mauritius, Vietnam, and Thailand).

1.4 Survey Team Structure

The survey will be conducted by 37 members as shown in the table below.

Table 1 Member List

#	Work in charge
(1)	Project Director/ Development Cooperation/Digital Strategy 1
(2)	Assistant Project Director/Development Cooperation/Digital Strategy 2
(3)	Policy formulation/Public relations/teaching material
(4)	Assistant Policy formulation/Public relations/teaching material
(5)	Administrative computerization/e-government
(5-1)	Assistant Administrative computerization/e-government
(6)	Administrative computerization/e-government survey (Japan)
(7)	Administrative computerization/e-government survey (North America)
(8)	Administrative computerization/e-government survey (Europe)
(9)	Innovative financial services (finance)
(10)	Innovative financial services (administration)
(11)	Public-private ecosystem formation
(12)	Demo app design/simple development
(13)	Assistant Demo app design/simple development
(14)	Demo app service design
(15)	Assistant Demo app service design
(16)	Open data utilization strategy/design
(17)	Examination of system requirements and procurement
(18)	Trial data infrastructure development/ operation guideline development
(18-1)	Assistant Trial data infrastructure development/ operation guideline development
(19)	Data analysis/utilization/impact evaluation
(20)	Data analysis/utilization/impact evaluation (Uganda)
(21)	Assistant Data analysis/utilization/impact evaluation (Uganda)
(22)	Data analysis/utilization/impact evaluation (Cambodia)
(23)	Assistant Data analysis/utilization/impact evaluation (Cambodia)
(24)	Data analysis/utilization/impact evaluation (India)
(25)	Assistant Data analysis/utilization/impact evaluation (India)
(26)	Data analysis/utilization/impact evaluation (Mauritius)
(27)	Assistant Data analysis/utilization/impact evaluation (Mauritius)
(28)	Data analysis/utilization/impact evaluation (Vietnam)
(29)	Assistant Data analysis/utilization/impact evaluation (Vietnam)
(30)	Data analysis/utilization/impact evaluation (Thailand)
(31)	Assistant Data analysis/utilization/impact evaluation (Thailand)
(32)	UX design/public relations design
(32-1)	Assistant UX design
(32-2)	Assistant public relations design
(33)	UI design

The figure below shows the survey implementation team structure for this project. The following points were emphasized so that the work could be carried out efficiently and effectively.

- ① Constructing a horizontal/vertical pilot activity implementation system: Pilot activities should form flagship projects that maximize the social impact on the target countries and examine the social impact evaluation on JICA in the mid- to long-term. We allocated personnel to watch the six target countries and those who are in charge of data analysis and utilization in each country and to look

- vertically and build a team to provide mutual feedback. (Corresponds to human resources 19-31)
- ② Demo applications development base in India: Control function that utilizes the finalized demo apps for sophistication of service design by looking at the reaction of end users in the six target countries while remembering that local subcontracting is essential. We assigned this function to the social problem-solving lab in India and built a cross-sectional examination system for the sophistication of application. (Corresponds to human resources 12-15)
 - ③ Involvement inside and outside JICA: In view of the importance of inward enlightenment and external cognitive formation toward mainstreaming DX in JICA, in addition to the business management group, a system that provides a cross-sectional overview of this project was established for "forming an industry-government-academia ecosystem through open data, etc." and "strategic public relations design for internal awareness and external recognition." (Corresponds to human resources 11,32, 32-1, 32-2)
 - ④ Establishing an innovative financial services idea board: For highly-specialized financial services that can also be one of the important components in pilot activities in countries outside Cambodia, an idea board was set up with personnel leading the company's fintech expertise team, etc. to provide a forum for regular exchanges of opinions. (Corresponds to human resources 9 and 10)
 - ⑤ Complete in-house cooperation team: We had a team with expertise in this business (private collaboration, utilizing advanced digital technology, fintech, collaborating with international organizations, utilizing geospatial data, translation, etc.), and if necessary, utilizing information and organizational knowledge. In addition, we had been supporting JICA's information system infrastructure and procurement specification examinations for many years and have already established a cooperative system with the team.

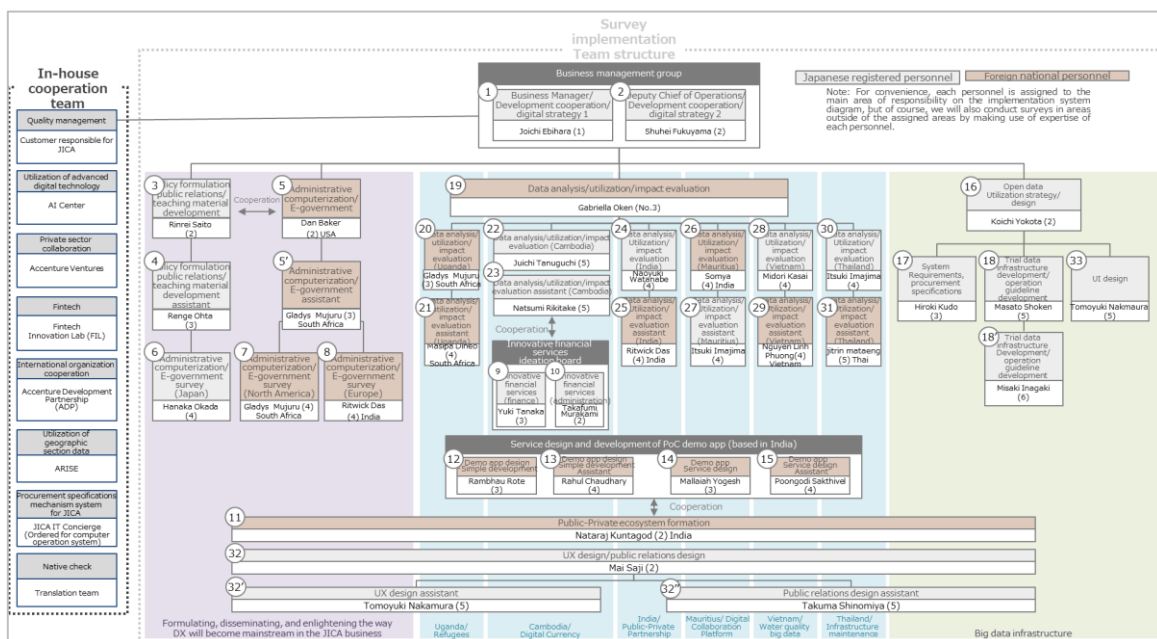


Figure 1 Team Structure

The following is a summary of tasks assigned to each survey team member.

Table 2 Role list

Number	Full name	In charge	Business content
(1)	Joichi Ebihara	Project Director/ Development Cooperation/Digital Strategy 1	<ul style="list-style-type: none"> Formulation of overall policy for promoting DX in JICA projects Internal enlightenment/organizational change/external communication Overall project management
(2)	Shuhei Fukuyama	Assistant Project Director/Development Cooperation/Digital Strategy 2	<ul style="list-style-type: none"> Reflection of DX mainstreaming in development cooperation activities Formation of flagship projects Collect all deliverables and collaborate with overseas offices
(3)	Rinrei Saito	Policy formulation/Public relations/teaching material	<ul style="list-style-type: none"> Formulation of policy for DX mainstreaming Teaching material development/organizational enlightenment/change promotion Creation/transmission for external public relations materials
(4)	Renge Ohta	Assistant Policy formulation/Public relations/teaching material	<ul style="list-style-type: none"> Assistant to Policy formulation for DX mainstreaming Assistant to Teaching material development/organizational enlightenment/change promotion Assistant to Creation/transmission for external public relations materials
(5)	Daniel W. Baker	Administrative computerization/e-government	<ul style="list-style-type: none"> Summary of current status survey part DX tidal current donor analysis Examination of possibility of cooperation with JICA in Estonia/India
(5-1)	Gladys Mujuru	Assistant Administrative computerization/e-government	<ul style="list-style-type: none"> Assistant to Summary of current status survey part Assistant to DX tidal current donor analysis Assistant to Examination of possibility of cooperation with JICA in Estonia/India
(6)	Hanaka Okada	Administrative computerization/e-government survey (Japan)	<ul style="list-style-type: none"> Survey on the status of DX efforts by JICA Survey on Japanese DX-related technologies/services and data utilization-related efforts
(7)	Gladys Mujuru	Administrative computerization/e-government survey (North America)	<ul style="list-style-type: none"> Survey of efforts related to DX trends and data utilization in development cooperation (North American donor)
(8)	Ritwick Das	Administrative computerization/e-government survey (Europe)	<ul style="list-style-type: none"> Survey of efforts related to DX trends and data utilization in development cooperation (European donor)
(9)	Yuki Tanaka	Innovative financial services (finance)	<ul style="list-style-type: none"> Pilot activities/Examination of innovative financial services in subsequent flagship projects (financial perspective)
(10)	Takahumi Murakami	Innovative financial services (administration)	<ul style="list-style-type: none"> Pilot activities/Examination of innovative financial services in subsequent flagship projects (public policy perspective)
(11)	Nataraj Kuntagod	Public-private ecosystem formation	<ul style="list-style-type: none"> Examination of data utilization concept (formation of industry-government-academic ecosystem) Examination/promotion of public-private partnership in pilot activities (India) Examination of data life cycle in pilot activities
(12)	Rambhau Rote	Demo app design/simple development	<ul style="list-style-type: none"> Demo app design/development/update in pilot activities Connection to trial version data catalog system
(13)	Rahul Chaudhary	Assistant Demo app design/simple development	<ul style="list-style-type: none"> Assistant to Demo app design/development/update in pilot activities Assistant to Connection to trial version data catalog system
(14)	Mallaiah Yogesh	Demo app service design	<ul style="list-style-type: none"> Demo app service design in pilot activities Examination of optimal service design in developing countries across pilot activities
(15)	Poongodi Sakthivel	Assistant Demo app service design	<ul style="list-style-type: none"> Demo app service design in pilot activities Assistant to Examination of optimal service design in developing countries across pilot activities
(16)	Koichi Yokota	Open data utilization strategy/design	<ul style="list-style-type: none"> Data utilization concept (including open data utilization) overall concept lead Trial version data catalog system concept formulation
(17)	Hiroki Kudo	Examination of system requirements and procurement	<ul style="list-style-type: none"> Incorporation into the design of the trial version data catalog system concept Examination of data catalog system procurement specifications
(18)	Masato Shoken	Trial data infrastructure development/ operation guideline development	<ul style="list-style-type: none"> Development of trial data catalog system Examination of draft big data operation guidelines
(18-1)	Misaki Inagaki	Assistant Trial data infrastructure development/ operation guideline development	<ul style="list-style-type: none"> Assistant to Development of trial data catalog system Assistant to Examination of draft big data operation guidelines
(19)	Gabriella Oken	Data analysis/utilization/impact evaluation	<ul style="list-style-type: none"> Pilot activity summary Examination of social impact assessment/hypothesis verification in pilot activities
(20)	Gladys Mujuru	Data analysis/utilization/impact evaluation (Uganda)	<ul style="list-style-type: none"> Execution of PDCA cycle in pilot activity (Uganda) (analysis/utilization/impact assessment of data on social impact)

Number	Full name	In charge	Business content
(21)	Masipa Dineo	Assistant Data analysis/utilization/impact evaluation (Uganda)	· Assistant to Execution of PDCA cycle in pilot activity (Uganda) (analysis/utilization/impact assessment of data on social impact)
(22)	Junichi Taniguchi	Data analysis/utilization/impact evaluation (Cambodia)	· Execution of PDCA cycle in pilot activity (Cambodia) (analysis/utilization/impact assessment of data on social impact)
(23)	Natsumi Rikitake	Assistant Data analysis/utilization/impact evaluation (Cambodia)	· Assistant to Execution of PDCA cycle in pilot activity (Cambodia) (analysis/utilization/impact assessment of data on social impact)
(24)	Naoyuki Watanabe	Data analysis/utilization/impact evaluation (India)	· Execution of PDCA cycle in pilot activity (India) (analysis/utilization/impact assessment of data on social impact)
(25)	Ritwick Das	Assistant Data analysis/utilization/impact evaluation (India)	· Assistant to Execution of PDCA cycle in pilot activity (India) (analysis/utilization/impact assessment of data on social impact)
(26)	Somya	Data analysis/utilization/impact evaluation (Mauritius)	· Execution of PDCA cycle in pilot activity (Mauritius) (analysis/utilization/impact assessment of data on social impact)
(27)	Itsuki Imajima	Assistant Data analysis/utilization/impact evaluation (Mauritius)	· Assistant to Execution of PDCA cycle in pilot activity (Mauritius) (analysis/utilization/impact assessment of data on social impact)
(28)	Midori Kasai	Data analysis/utilization/impact evaluation (Vietnam)	· Execution of PDCA cycle in pilot activity (Vietnam) (analysis/utilization/impact assessment of data on social impact)
(29)	Nguyen Linh Phuong	Assistant Data analysis/utilization/impact evaluation (Vietnam)	· Assistant to Execution of PDCA cycle in pilot activity (Vietnam) (analysis/utilization/impact assessment of data on social impact)
(30)	Itsuki Imajima	Data analysis/utilization/impact evaluation (Thailand)	· Execution of PDCA cycle in pilot activity (Thailand) (analysis/utilization/impact assessment of data on social impact)
(31)	jitrin mataeng	Assistant Data analysis/utilization/impact evaluation (Thailand)	· Assistant to Execution of PDCA cycle in pilot activity (Thailand) (analysis/utilization/impact assessment of data on social impact)
(32)	Mai Saji	UX design/public relations design	· Examination of data utilization concept (use case) · Examination of transmission method to promote inward enlightenment/awareness development toward DX mainstreaming · Strategic public relations design that promotes the formation of external recognition of the JICA DX policy
(32-1)	Tomoyuki Nakamura	Assistant UX design	· Assistant to Examination of data utilization concept (use case)
(32-2)	Masari Kurata	Assistant public relations design	· Assistant to Examination of transmission method to promote inward enlightenment/awareness development toward DX mainstreaming · Assistant to Strategic public relations design that promotes the formation of external recognition of the JICA DX policy
(33)	Takuma Shinomiya	UI design	· Incorporating trial version data catalog system concept into UI

1.5 Schedule

Based on the tasks in 1.1, the workflow master schedule outline for this survey is as follows.

- ① The first phase of the contract was from December 2020 to April 2021. It focused on strategy and planning, including surveys to understand the current situation, the concept of DX mainstreaming and data utilization, and basic planning for each pilot activity.
- ② A progress report was submitted by April 30, 2021
- ③ The contract period for the second phase will be from June 2021 to February 2022, and we will construct a trial version of the data catalog system for each pilot activity, implement those pilot activities, and reflect the results in the data catalog system specifications and DX mainstreaming method through trial implementation of "continuous data-based improvement."
- ④ The first draft final report was prepared by early January 2022 and presented at the consultation

with JICA to obtain agreement on the report’s preparation policy. The draft final report was completed by the end of January 2022 after incorporating comments received in the discussion.

- ⑤ A final report was prepared at the end of February 2022 with comments from JICA and submitted deliverables such as pilot activity demonstration applications and a trial version data catalog system.

Table 3 Schedule of Submission

NO	Survey report	Items of note	Submission deadline
1.	Inception Report	Basic operational policies, methods, work processes, personnel plans, etc.	Late January 2021
2.	DX Mainstreaming Proposal and a Draft of the External Public Relations Materials	Draft of JICA's proposal for DX mainstreaming and case studies, etc.	February 26, 2021
3.	Progress report	Status of Survey during the First Contract Period	April 30, 2021
4.	Inception report (updated version)	Basic policies, methods, work processes, personnel plans, etc. for the tasks, reflecting the results of the survey’s first phase	July 8, 2021
5.	Draft Final Report	Overall survey results (draft)	Late January 2022
6.	Final Report	Overall survey results	Late Feb. 2022
7.	Data Catalog System Draft Procurement Specification	Draft procurement specifications for an information system within the Organization to store big data	Late Feb. 2022
8.	Data Utilization Manual	Workflow/procedures after system implementation and system use concept	Late February 2022
9.	Final draft of DX mainstreaming and publicity materials	Draft proposal for DX mainstreaming of JICA and use cases, etc.	Late February 2022
10.	Data catalog system if trial version	Prototypes created while examining the data catalog system and screen designs	Late February 2022
11.	Applications developed for the	Execution program, screen design, execution	Late February

	pilot	environment specifications, etc. for the trial version application	2022
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1.6 Survey Flow Chart

Each survey item is classified by symbols and numbers from A to P, summarized as shown in the table below. The implementation method of each survey item is organized by this classification. The correlation and workflow of each survey item is shown as a flowchart of the entire survey work.

Table 4 Work Contents list

Item number	Work content
A. Inception Report	
A-1	Preparation/discussion/approval of inception reports (basic business policies, methods, work processes, personnel plans, etc.)
B. Understanding current situation	
B-1	Survey on the status of DX efforts by JICA
B-2	Survey on DX trends and data utilization efforts in development cooperation
B-3	Overseas Partnership/Resource Survey for JICA's DC mainstreaming (Estonia/India)
B-4	Survey on DX-related technologies and services in Japan and data utilization-related efforts
C. DX policy review	
C-1	Examination and discussion of the ideal way (hypothesis) of DX mainstreaming
C-2	Brush up hypothesis based on input from business item B, formulate policy, create pamphlet (draft) for external transmission
D. Formulation of data utilization concept	
D-1	Understanding the current status of business processes, data items and infrastructure
D-2	Understanding trends related to data utilization of other donors
D-3	Formulation of data utilization concept/ data utilization use case
D-4	Examination of data holding range/holding method, system construction range/expandability
E. Pilot activity planning (Plan)	
E-1	Uganda / Refugees
E-2	Cambodia / Digital Currency
E-3	India / Public-Private Partnership
E-4	Mauritius / Smart City
E-5	Vietnam / Water Environment/Big Data
E-6	Thailand / AI Waterway Pipeline Diagnosis Technology
F. Progress Report	
F-1	Creation/discussion/approval of progress report
G. Inward transmission/enlightenment	
G-1	Organize targets, formulate transmission approaches, create teaching materials
G-2	Implementation of distance lectures for JICA officials
H. Incorporation into the data utilization concept within pilot activity	
H-1	Realization of data utilization image in pilot activities (organization of social impact KPI/monitoring process)
H-2	Arrangement of necessary data and requirements in pilot activities
I. Demo app development (Do) in pilot activities	
I-1	Creating demo apps and connecting to data infrastructure in pilot activities
J. Measurement of effectiveness in pilot activities (Check)	
J-1	Monitoring social impact in pilot activities
K. Action in pilot activities (Action)	
K-1	Improvements in pilot activities, demo app updates
K-2	Utilization of data accumulated through pilot activities in other fields
K-3	Advanced planning for subsequent projects
L. Trial use of data and examination of mechanism	
L-1	Trial design and construction of JICA project-related big data infrastructure
L-2	Trial version data catalog for user explanation/FB collection
L-3	Regular update of data
M. Materialization of system specifications and operations related to data utilization	
M-1	Arrangement of data rights
M-2	Formulation of draft big data operation guidelines (business flow related to data upload, etc.)
M-3	Each department/consulting briefing session
M-4	Formulation of cloud platform selection criteria and comparison of various services
M-5	Preparation and support of draft procurement specifications
N. External transmission/public relations	
N-1	Finalization of pamphlet for external transmission
N-2	Implementation of seminars
O. Final Report	
O-1	Draft final report preparation/discussion/approval
O-2	Final report preparation/discussion/approval
P. Project management	
P-1	Project management

As stated in the project policy, it is important to experience the continuous improvement process of data-based international cooperation during this project. Therefore, we regard pilot activities as a trial opportunity to strive for continuous data-based improvement in activities, to understand the significance and issues of running PDCA cycle, and to reflect them in JICA DX policy to proceed in the whole project.

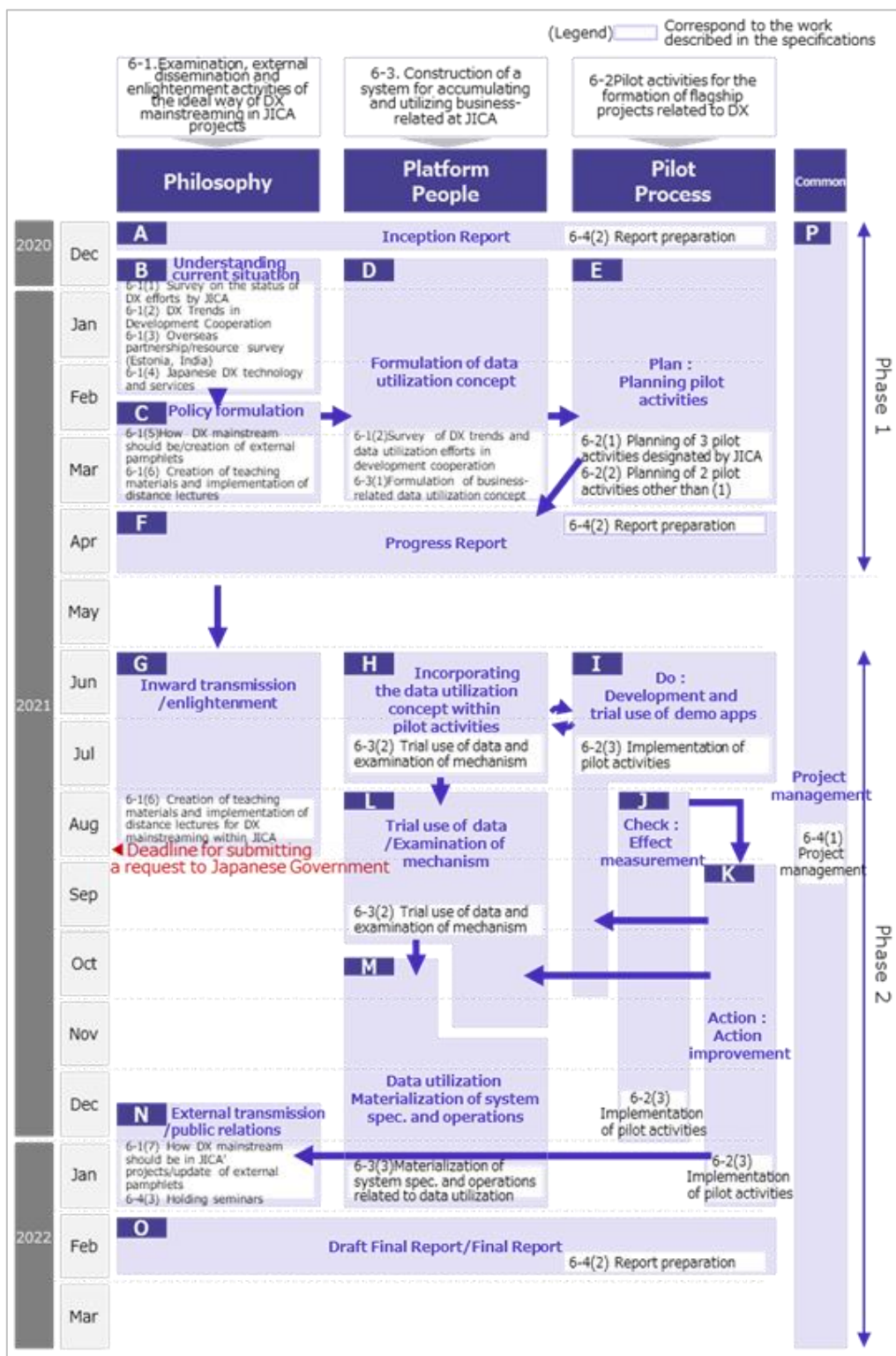


Figure 2 Flowchart

Chapter 2 DX STRATEGY RESULT

2.1 DX mainstreaming scheme

Review Process

The study on the proposed mainstreaming of DX was divided into two sections, in the first section conducted a survey from the three perspectives, and in the second section analyzed and summarized the discussion based on the implementation of the pilot activities.

The results of each of these studies are summarized in the following sections 2.2 as well as details written in the Appendix, and this chapter provides a summary of the discussions and results of the discussions of the directions that were the main points of contention in the study process.

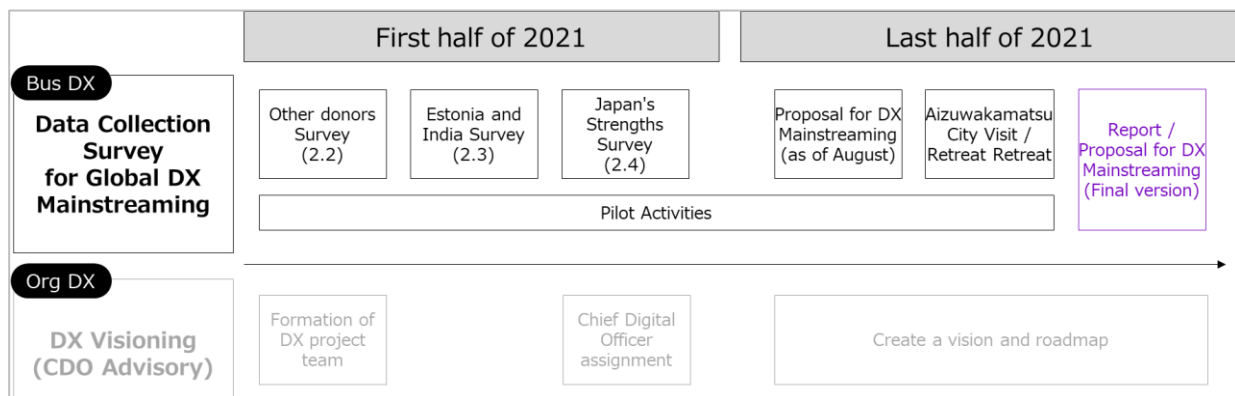


Figure 3 Surveys and related initiatives

A proposal for mainstreaming DX

- 1) Social Transformation by Digital
 - a. Global Trends

The amount of data in the world has increased in recent years due to the progress of digitization and the wide use of the Internet. With the dramatic decrease in the cost of data distribution due to the spread of the Internet and the recent development of artificial intelligence (AI) technology, data is expected to become a source of value in the digital society.

In this new era, companies such as GAFAM in the U.S. and BATX in China, which have transcended the constraints of time, place, and scale to create value based on data, are becoming increasingly influential in the economy and society. In addition, the evolution of a digitally driven economy (digital economy) is accelerating, driven by the shift to new lifestyles by COVID-19.

- b. Current situation in developing countries

The digitalization of emerging and developing countries is also advancing, and in some cases,

emerging and developing countries that have achieved digitalization may overtake developed countries (the leapfrog phenomenon) and quickly realize an integrated digital society in both government and industry.

In addition, even in countries where administrative systems and national IDs are not yet in place, the use of digital IDs and data linkage infrastructure has made it easier than ever to develop them. The COVID-19 disaster has increased the need for digitalization in developing countries, and more and more governments want to use these models as a reference in their national development policies to promote the diffusion of administrative services and infrastructure and to promote financial inclusion.

c. Trend of donors and others

International development is also entering a new phase in which the use of data and digital technologies will not only improve the efficiency of aid implementation, but will also change aid itself, and digital aid itself will become an aid strategy.

Major donors around the world have recognized the use of data as an important factor in improving the efficiency and sophistication of development assistance and are promoting a variety of initiatives, which can be broadly divided into two categories: digital transformation (DX) of operations within organizations and DX of the assistance that organizations provide externally. For example, USAID and GIZ have developed strategies to utilize digital technology and data, while WFP has developed a social infrastructure by using blockchain to provide personal IDs to the refugees they support. The WFP has developed a social infrastructure by assigning personal IDs to the refugees to be assisted using blockchain, and by linking payment tools to the service, it has realized safe and secure money exchange between local stakeholders.

d. Japanese Government Policy and Japan's Strengths

As a new way of society in the digital age, Japan has proposed Society 5.0¹, which aims to realize a sustainable and inclusive society on a global scale. The Cabinet Office has identified an "AI-Ready Society" as a social transformation necessary to realize this vision, and an environment where people can use AI to engage in creative and productive work is desired.

In addition, the government proposed "DFFT = Data Free Flow with Trust" at the Davos meeting in January 2019. In principle, the concept of free flow of data is necessary, and the government is showing leadership in the use of data.

The government's "Keikyo Infrastructure Strategy Council" has made it a key national agenda

¹ Future Investment Strategy 2017 (approved by the Cabinet on June 9th, 2017)

to utilize Japan's high-quality infrastructure to help developing countries solve their social problems and achieve the SDGs.

In response to these developments, the Digital Agency was established on September 1st, 2021. In addition, the "Priority Plan for the Realization of a Digital Society" was approved by the Cabinet on December 24th, 2021, and Japan is accelerating its efforts to realize a digital society.

On the other hand, as the confrontation between the U.S. and China over the use of digital technology becomes more apparent, it is important for Japan to take a third-party position in promoting digital reforms while obtaining the consent of developing countries. In addition, it is essential for Japan to maintain its position as a reliable partner in data distribution, building on the relationship of trust that it has cultivated through its ODA achievements to date.

In addition to the strengths of (1) the accumulation of real data, (2) product and industrial technology, and data and technology, Japan will also be able to take advantage of the fact that Japan also faced and tackled (3) a great need for advanced and serious social issues. In order to use these advantages and demonstrate competitiveness in the upcoming second phase of the digital age, it will be important to see how it can acquire the data that will be the source of its competitiveness, and be able to provide value for customers by linking the data.

2) The changing role of development agencies

a. Increase in FDI flow of private capital to developing countries

As mentioned in above, spread of the Internet and other factors encouraged the separation of supply chains and the globalization of labor, and as global supply chains were spread out across countries, thus the amount of investment in developing countries increased. As a result, the need for attracting private investment increased on the developing country in anticipation of economic development, and the amount of private capital invested in developing countries increased significantly over the years².

b. Growth in ESG investment

In the 2010's, with the advocacy of the SDGs, the global economy was booming, and the amount of money in circulation increased, hence companies and funds were directed also to

² Prepared by Accenture from UNCTAD, Beyond 20/20 WDS - Table view - Foreign direct investment: Inward and outward flows and stocks, annual

developing countries. In response to diverse and complex development issues, various players, including private companies, participated in the field of development cooperation.

In addition, the United Nations Principles for Responsible Investment (PRI) proposed ESG investment in 2006, and many institutions, including Japan's GPIF, which signed the PRI in 2015, have signed on, leading to a growth in investment³.

On the other hand, the private sector alone faces challenges in evaluating ESG investments due to its limited knowledge of impact evaluation in developing countries, and the need for support from JICA and other donors for their expertise in the field of development and social impact evaluation in developing countries is expected to increase.

c. The need for resource mobilization

In the new competitive environment, where the use of digital data has become a weapon and COVID-19 pandemic imposed as a restriction, it is becoming difficult to continue development projects that are solely funded by public funds. In addition, the role of development organizations needs to be redefined in a market environment where various players, including private companies, are participating in the digitalization process.

JICA is also trying to establish and promote a scheme to promote the use of new digital technologies and data in order to solve development issues and realize the world that JICA aims for by mobilizing private companies with cutting-edge digital technologies, such as setting a global agenda and introducing cluster management. In addition to the above, we are also trying to establish and promote a scheme to promote the use of new digital technologies and data to solve development issues and realize JICA's vision of the world.

3) The Direction to aim in the Digital Age

a. Current Status and Issues of JICA

In order to provide the support that is chosen in the digital age, it is necessary to implement DX in order to leverage the strengths of Japan and JICA.

However, at present state, data accumulation and coordination within JICA is not enough, and it is difficult to say that internal knowledge is being effectively utilized in inter-departmental coordination and the use of experts within human resources. In addition, in terms of JICA's support, it also needs to expand as currently it is mostly limited to the implementation of communication infrastructure but not the use of data and digital technology. This shift of expansion of support of providing the value through data would be necessary in terms of

³ Prepared by Accenture from GSIA, GLOBAL SUSTAINABLE INVESTMENT REVIEW (2016, 2020)

leveraging the strength of JICA and to become an organization that is chosen by the developing countries in this digital age.

b. Importance of "quality development"

Quality development, which is becoming increasingly important in the international community and is being accelerated by digitalization, is in line with JICA's philosophy and is a development in which JICA can utilize its strengths in field implementation.

As an understanding, we believe that field of development can be classified into 4 categories, based on to the granularity of the social impact identified and the way in which the social impact is manifested.

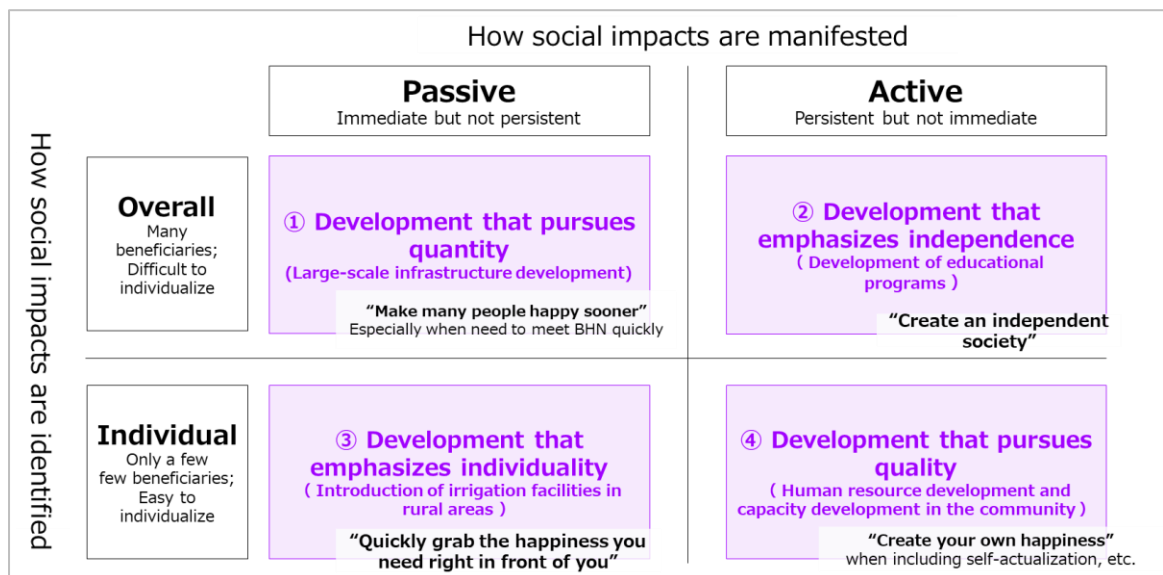


Figure 4 Types of development

Depending on the social impact that each of them emphasizes, there are different priority types of development that are required, such as development that prioritize more on the number of beneficiaries by focusing on making more beneficiaries happy more quickly, or development that focuses more on the individual quality. There isn't any superiority between the types but simply difference on prioritization.

JICA has a particular strength in ② development that emphasizes independence in the above figure, and has a history of focusing on this area. At the same time, while there are a limited number of donors with the field capacity to engage in micro-level development issues, JICA, with its sufficient assets and capabilities, is one of the few donors that can create a quality social impact

that focuses on each individual, which is increasingly important in today's society.

(Features of JICA's support)

- A broad menu of support, including technical cooperation and capacity building, to enable communities to become self-reliant
- Support system with local offices around the world to understand the issues and culture of the communities.

In a world where BHNs are being met, there is also an increasing emphasis on human development and other forms of development that allow people to create their own potential. As world is also shifting from Millennium Development Goals (MDGs) to SDGs, where inclusiveness and fairness are emphasized, as well as well-being and happiness of individual. The growing importance of each individual's internal well-being, it can be said that type of ④ has a greater needs by society.

Furthermore, while the immediate and macro-level effects of development have always been statistically measurable, as technology advances to capture the lives of individuals, it is now possible to measure ongoing changes and changes in individual people, and to capture behavioral changes at the individual level. As a result, the feasibility of "quality development" is increasing.

By pursuing "quality development" that focuses on the "health, safety, and well-being" of each and every human being in developing countries through the use of digital technology, JICA can strengthen its efforts to protect people's "lives, livelihoods, and dignity" and to support the empowerment of people, organizations, and societies so that people can pursue their own potential, which is part of JICA's new era of "human security. In addition, we should strengthen efforts to support the empowerment of people, organizations, and society so that people can pursue their own potential. Furthermore, it is envisioned to embody "Society 5.0" in international development by aiming to realize the diverse happiness of each individual. It is desirable to establish a model to enhance this "quality" and provide assistance that is truly valuable to developing countries and their people, thereby enhancing trust with developing countries and contributing to⁴ securing national interests such as maintaining and defending the international order.

In addition, it is important that the resources of the international community be mobilized in order to create a level of social impact that cannot be achieved by JICA alone, by setting a new

⁴ Outline for Development Cooperation

"quality" development model centered on "Society 5.0" as the standard not only for JICA but also for international development. It is important to mobilize the resources of the international community to create a level of social impact that JICA alone cannot achieve.

In the resource mobilization approach, the movements of each donor are also summarized in this report's survey of DX trends in 2.2development cooperation and efforts related to data utilization.

c. Direction of DX in JICA projects

The Global Agenda "Promoting Digitalization" formulated by JICA states that developing countries should respond appropriately to the digitalization of the economy and society in order to enjoy its benefits and reduce its risks. The goal is to build a sustainable and resilient society where digital data is used to solve problems and ensure people's safety, as well as a society where each individual can realize various possibilities and happiness. In addition, through cooperation in this field, developing countries and Japan will work together to digitize their economies and societies, aiming for mutual development. In order to achieve this goal, we will focus on mobilizing and co-creating diverse actors.

Furthermore, it is desirable to emphasize the quality of development that focuses on the well-being of each individual by understanding their needs and behaviors as data, with the aim of realizing their diverse potential and happiness (well-being). In order to realize these goals, it is necessary to develop digital infrastructure and organizational structures that promote co-creation and innovation, without necessarily relying on the traditional development cooperation business model.

4) Policy for achievement

In order to achieve the above vision, it is necessary to promote reforms at three levels: promotion of social reform in developing countries, promotion of reform in program and project promotion, and promotion of organizational reform in JICA. Each of these three levels can be further divided into two categories: total and individual. Specifically, Industry Transformation (IX) aims for social and industrial reform in developing countries, Human Transformation (HX) aims for the well-being of each individual in developing countries, Business Transformation (BX) aims for transformation to a co-creation-driven business model based on data utilization, Corporate Transformation (CX), which promotes co-creation and innovation within the JICA organization; and JICA HR Transformation (JHX), which aims to make it easier for JICA employees to work, improve their capabilities, and feel motivated to live. (JHX). These five transformations have a relationship that is strengthened through mutual feedback.

In the promotion of the projects covered by this research report, we will focus in particular on the contents of assistance to developing countries and changes in the promotion of projects, and describe HX, IX, and BX in detail.

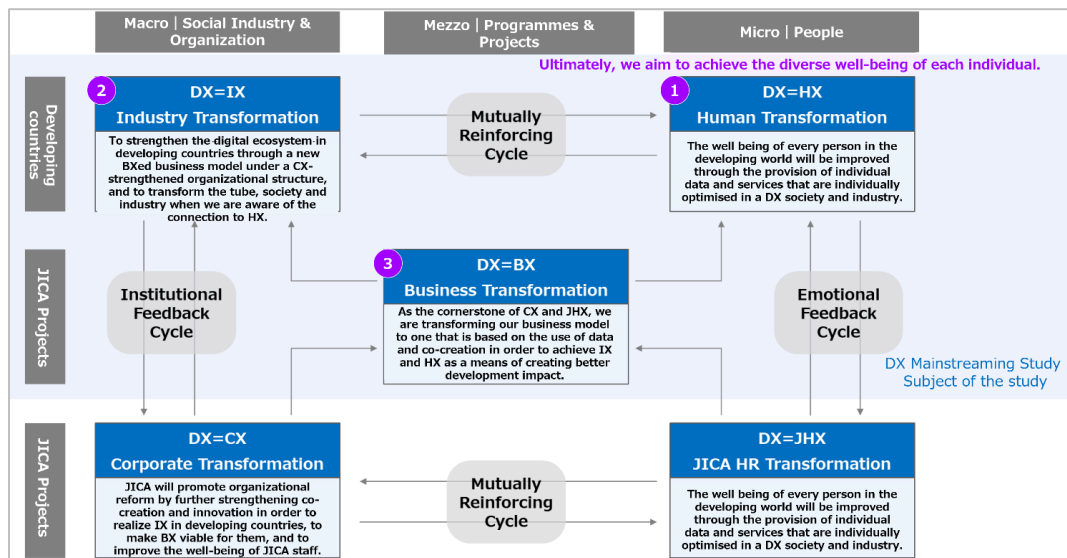


Figure 5 Policies for DX Promotion

① Human Transformation (HX)

The goal is to create development impact that focuses on each beneficiary as much as possible in order to realize the diverse possibilities and well-being of each individual. In the future, digitalization will be promoted in both the content of support and the structure of the state, and optimized services will be provided based on the data of each citizen. If services can be connected to individuals and data can be obtained, it will be possible to evaluate the impact of aid by focusing on the individual. In the future, we aim to improve the well-being of each individual by incorporating not only quantitative data but also qualitative data and diverse values.

In the case of partner governments and private companies, through the provision of digital services, we can capture behavioral changes toward the realization of the world that JICA is aiming for. In addition, by capturing data on the individual needs of each citizen, who is the ultimate beneficiary, and by comprehensively grasping their living and health conditions, the degree of individual satisfaction with the assistance and the degree of achievement of well-being can be examined as impact indicators.

② Industry Transformation (IX)

When we focus on the customer perspective of each and every beneficiary as stated in the HX, we will need to provide services and value that transcend industry boundaries, and the vertically

divided industrial structure will need to be transformed. In addition, in order to realize a highly competitive nation in the digital age, it is necessary to formulate a national strategy and digital architecture based on the premise of digital technology, and to quickly establish the foundations for digital promotion, such as the construction of systems and infrastructure and the development of human resources to realize the strategy. At the same time, it is important to build a competitive environment in which new services and technologies can be created based on these strategies. Therefore, in the digital architecture, industrial policies are required to realize the country's economic growth by clearly defining the areas of cooperation that should be supported mainly by the government across industrial boundaries and the areas of competition that should be led by private companies in each industrial field. From its position as a donor, it is important to promote digitalization in developing countries and support social and industrial transformation by integrating the overall architecture in cooperation with private companies, academic institutions, and other donors.

③ Business Transformation (BX)

In order to realize IX and HX for creating better development impact for each individual, maximize the use of data in business promotion, and realize a business model that is mainly based on co-creation with diverse actors in the cycle of implementing data utilization.

The first step is to collect and analyze a variety of individual data, including the needs of citizens in developing countries, in order to improve the efficiency and speed of business promotion and service provision, as well as to provide higher value-added support. Next, the data acquired in the project will be used internally for project evaluation and PDCA, which will be utilized for reviewing the project portfolio and setting targets. In addition, it is possible to leverage the data it has acquired based on its relationships of trust with developing countries to create opportunities for collaboration with a variety of actors, including digital servicers and local companies, to promote industry-government-academia collaboration and realize resource mobilization.

In this activity, it is important to collect and analyze data in the course of HX/IX initiatives, utilize the data within the Organization and return it as value. Currently, we are able to collect and visualize data on important KPIs of the clusters, but the issue is that the frequency of data collection is low, and the frequency of evaluation, consideration of measures, and review of plans is also low. In the future, data will be collected and visualized more frequently, and evaluations and reviews of measures and plans will be conducted more frequently than in the past, such as on a monthly basis, in order to achieve a state in which business operations are appropriately improved. In the future, we will analyze not only the business effects, but also link them to budget

information to evaluate SROI, while aiming to operate the business with a portfolio that has a higher return on investment than before.

2.2 Research on the DX trend and data utilization in development cooperation

In order to examine JICA's approaches and areas of differentiation, we conducted a survey of international organizations (donors, etc.) on their objectives and approaches to development using digital technology in development cooperation, as well as specific measures that support these approaches. The survey was conducted in two steps: a desktop survey of DX initiatives outlines for about 10 donors whose initiatives JICA has been closely monitoring, and in-depth interviews with five major donors with advanced DX initiatives. (See Appendix 2.2 for detailed survey results)

The objectives of digitally enabled development initiatives vary in nature from enabling digital access for more people to identifying development issues that focus on individual needs and livelihoods, and can be categorized into the following four main objectives.

- Digital Inclusion and Infrastructure Development [Digitization (Hard Infrastructure)]
 - Focus on providing digital infrastructure such as social infrastructure with the aim of enabling more people to access digital services and be included in the economy.
 - Representative donors: WB (digital team specifically focused on infrastructure and digital social infrastructure), AfD, China
- Building Capabilities [Digitization (Soft Infrastructure)]
 - Emphasis on helping national/regional communities to grow independently and solve problems within their own countries, even as society is transformed by digital adoption
 - Representative donors: KOICA (from its past focus on contributing to BHN, it will now present a policy of emphasizing local ownership based on partnerships with developing countries), USAID
- Streamlining resolution of existing issues [Digitalize]
 - The focus is to use power of digital to make provisions for basic human needs, particularly aligned to the SDGs, and more efficient and faster adoption.
 - Representative donors: ADB (focusing on applying the latest technology in each practice to promote problem solving), WFP, UNDP
- Identifying new issues and values [Digital Transformation]
 - As data reveals more about people's behaviors and lifestyles, existing issues will be resolved, and development will be oriented addressing themes that are more attuned to individual needs and real-time situations.
 - Representative donors: GIZ (for human-centered development, with an emphasis on identifying

and solving problems using real-time data), OECD

	Digitization	Digitalization	Digital Transformation	
Objectives Classification for Development with DX	Supporting digital inclusion and developing infrastructure to ensure digital accessibility for everyone	Improving efficiency in solving existing problems through digital use of existing support	Identifying new issues and values by increasing the picture resolution of issues with data	Building a digital ecosystem to promote independent growth in a digital society
Characteristics of Support	<ul style="list-style-type: none"> Development of communication infrastructure, electric power infrastructure, etc. Development of communication standards and legal systems, etc. 	<ul style="list-style-type: none"> Improving efficiency of logistics for appropriate and early delivery of resources and services Implementation of AI, IoT and other digital solutions in support service delivery 	<ul style="list-style-type: none"> Data-based definition of development issues and consideration of focus areas Data-based, real-time improvement of support content, etc. 	<ul style="list-style-type: none"> Supporting local start-ups and demonstration of new solutions Capacity development for digital related skills, etc. in mind

Figure 6 Purpose of development with digital

In addition, each donor has developed its own approach to creating impact while mobilizing more resources, considering development objectives. Resource mobilization approach is based on the following four axes, namely

- the types of resources to be mobilized (1. monetary resources, 2. non-monetary resources)
- timing of resource mobilization in the project process (A. upstream timing (conceptualization and programming of development issues), B. downstream timing (generalization and replication of projects, accumulation of knowledge and data through projects)).

The following four categories are created by multiplying the two axes.

- Thought Leader (1&A): Establish a concept with new development issues by mobilizing knowledge and information resources.
- Platformer (1&B): Mobilize stakeholders (resources) to solve existing problems
- Market Maker (2&A): Facilitate financial mobilization through rulemaking that encourages investment
- Mobilizer (2&B): Mobilize monetary resources through financial investment in business, etc.

Institutions that aim to identify new challenges and values tend to take the position of Thought Leader, such as GIZ, which aims to become a Thought Leader in data utilization for development with a human-centered approach. For example, WFP is building a common platform to improve logistics efficiency in the food supply chain and mobilizing stakeholders.. Institutions that aim for digital inclusion and infrastructure development tend to take the position of market makers. For example, China is focusing on international standardization of technology and actively participating in global discussions. Institutions that focus on supporting national and regional communities to grow independently and solve their own problems take the positions of the Platformer. Institutions that focus on investment in business tend to take the position of Mobilizer (2&B). For example, KOICA is actively investing in startups from the perspective of human resource development.

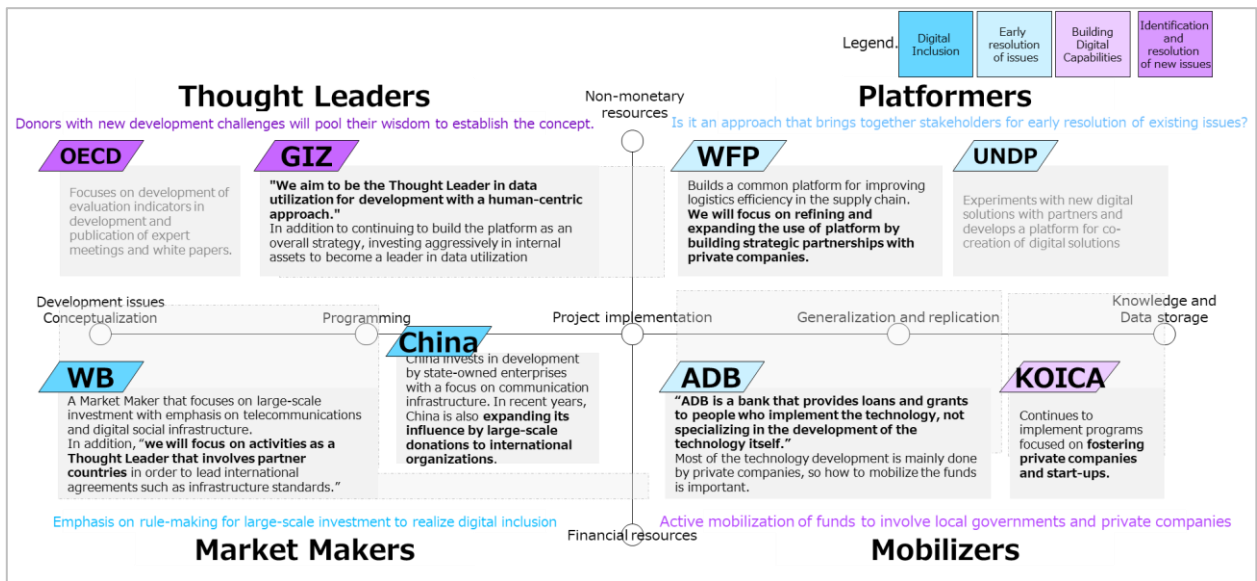


Figure 7 Resource mobilization approach

In addition, this survey also summarized the trends of other organizations in terms of the specific measures needed within an organization to realize DX.

▪ Organizational Structure for Realization

The organizational design for promoting cross-divisional digital-related support can be divided into two types: top-down promotion type and advisory type. For example, at WFP, digital strategy is formulated top-down from the board level, and technology team takes the lead in technology implementation, thus promoting top-down initiatives. On the other hand, ADB is structured in an advisory manner and has formed a digital unit to provide advisory support to each operational team.

In terms of organizational design for the creation of innovative initiatives, there are two types: accelerator and sandbox. WB has adopted the accelerator type and has formed a startup support team (innovation accelerator) to develop prototype versions of ideas. Whereas, ADB has adopted the sandbox model and has launched the ADB Innovation Digital Sandbox, which provides a sandbox environment for considering the use of new technologies.

▪ KPI setting and evaluation

Within this survey, there were no organizations that were successfully practicing this. and this is based on the inference that it is difficult to set and evaluate KPIs to measure the success of DX specific initiatives. However, several organizations have established certain indicators to evaluate the degree to which digital means is being adopted in their projects. ADB, for example, has a general measure to track the use of digital technology in the form of "The number of development projects with digital components".

- Collection and utilization of data

In addition to increasing real-time, automation, and individualization of acquisition methods in data collection, it is becoming increasingly important to establish rules for data protection. WFP has established guidelines and a Data Protection Officer (DPO) for internal data protection. GIZ is working with various partners, including the AU, to advise on data regulation and promote the use of data towards a human-centered approach (as opposed to the Chinese and US approaches).

In the use of data, there is an emphasis on implications for decision-making and evaluation, as well as on updating the use of big data to assist. ADB, for example, is focusing not on building technology on big data, but on supporting the use of big data by governments and other partners. In addition, there are organizations that have established data utilization itself as a competitive advantage, such as GIZ aims to bring data utilization capability in-house in all areas in order to establish a new position in international development to leverage the strength of data utilization.

- External Cooperation

The purpose of external collaboration can be divided into three main categories. The first one is to consolidate knowledge and wisdom, and as a Thought Leader, consolidate knowledge through external collaboration in order to establish standards in each area. For example, WB procures grants from government agencies and development donors to form a partnership ecosystem and implements projects and forms standards within the framework of grants. The second is to promote the use of the latest technology and data, and to establish policies and methods for the use of technology and data to promote projects effectively and efficiently. The third is to build capabilities, and in addition to promoting DX within the organization, they are collaborating externally to establish digital competitive advantage. For example, GIZ has adopted a partnership approach rather than a supplier contract and is working with Mozilla and Fair Forward on AI.

- Contracts/Procurement

Since government organizations use taxpayer funds to promote their projects, it is difficult to realize agile forms of contracting and procurement that complicate accountability, and hence traditional contracting and procurement processes are likely to be the basis. However, some organizations are working on agile contracting and procurement (e.g., GIZ: incorporating bidding into accelerator schemes and trying partnership contracts in frameworks), so there is some potential for flexible contracting and procurement in the future.

- Internal development and collaboration

In terms of internal development and collaboration, many organizations mainly create opportunities for collaboration, hold events, and provide training. For identifying collaboration opportunities, there are many measures to promote employees' opinions and ideas, such as encouraging employees to participate

in external competitions and soliciting ideas. As for initiatives to improve digital knowledge, events inviting external partners such as major technology companies are held to improve the knowledge of employees. In terms of providing training to acquire digital skills, there were also efforts to foster digital momentum in the organization by appointing digital fellows from each team within the organization and providing them with intensive training.

- Talent Acquisition

Organizations that focus on project propulsion tend to emphasize hiring generalists who have a balance of project implementation and digital expertise. WFP, for example, is shifting from hiring people with technology-specific skills to hiring people with cross-functional skills.

Organizations that emphasize the use of data and digital technologies within the organization tend to focus on hiring of data scientists, who are the driving force behind the use of data. For example, GIZ has set up a data lab to drive data utilization and has hired full-time data scientist to run the organization.

In terms of talent acquisition, there are various methods, including hiring people from consulting, technology companies, and startups, bringing in seconded staff, and developing talent internally. Some organizations mentioned that they try to balance internal staff with external contract staff such as consultants, but this approach tends to be dictated by the requirements of the project or initiative.

2.3 Study on JICA's overseas partners and resources for DX mainstreaming (Estonia, India)

In order to reinforce competitiveness in e-government field, we discussed the policy of collaboration with e-government solutions from Estonia and India. (See Appendix 2.3 for detailed survey results)

The 2000 IT Strategy Council defined e-government as "a new form of government in which information is instantly shared and utilized across ministries and agencies, and across national and local levels. The "common IT infrastructure" required for e-government comes in a variety of forms, with a myriad of specific solutions. Among these, open source solutions such as X-road and MOSIP are attracting attention due to its multiple examples of implementation worldwide and value realization.

One of JICA's objectives in e-government is to achieve a user-oriented "digital government" based on the concept of Society 5.0, which is a development of e-government, and to realize a next-generation social infrastructure that will lead to sustainable growth in the target countries. The survey was conducted based on the concept of "digital government" from user's perspective based on concept of 5.0. This is because the Japanese government has been promoting "digital government" since 2017, and JICA believes that it is required to conform to the Japanese government's definition in international development. It is important, especially in the world of international development, for each citizen to be able to enjoy government services with optimized end-to-end experiences from user's perspective, suitable for the Society 5.0 era, rather than simply building information systems and moving procedures

online.

Incidentally, World Bank, a leading donor in the field of e-government, has been working on initiatives, especially on the theme of digital identity, and JICA is expected to be a collaboration partner.

In addition to Estonian and Indian solutions mentioned in Inception Report, this study added two more solutions that are representative of Japan and compared the characteristics of each.

- X-Road (Estonia)
 - A system that Estonian government has been implementing since 2001 to realize an "electronic nation", including digitization of government administration and branding.
 - It has been open sourced for deployment in other countries and for private sector use.

- MOSIP (India)
 - Aadhaar, a biometric national ID system implemented by the Indian government since 2010, and a set of APIs for related functions (India Stack) have been made open source for deployment in other countries.

- FIWARE (EU)
 - An open source solution developed in 2011 under a public-private partnership program in the EU, and is being implemented in Japan's smart cities mainly by NEC, which participated in its development.

- DCP (Japan)
 - Developed and implemented by Accenture as the base infrastructure for Smart City Aizu Wakamatsu, and is now being introduced to other municipalities and the private sector.

Table 5 Characteristics of each solution and targeted needs

	Characteristics of each solution and targeted needs
X-Road	<u>Mainly from the perspective of government and servicers:</u> <ul style="list-style-type: none"> • Cloud-based secure data exchange solution for sensitive and public data • One-time data management • Decentralized data management (ownership of data is tied to the person/organization who provided the data)
MOSIP	<u>Mainly from the perspective of end users:</u> <ul style="list-style-type: none"> • Establish a basic personal ID system (covering the entire population of the country) • Connect multiple means of authentication (biometrics, demographics,

	OTP, static pins) for greater convenience and security
FIWARE	<p><u>Mainly from the perspective of government and servicers:</u></p> <ul style="list-style-type: none"> • Linkage of open data and IoT data • Advanced data analysis and utilization for service development • Management of IoT devices
DCP	<p><u>Mainly from the end-user's perspective:</u></p> <ul style="list-style-type: none"> • Providing digital services to maximize end-user convenience • Platform to promote innovation

In addition, each solution has different characteristics in terms of the functions it provides to meet the targeted needs, and a comparison of the four solutions in terms of functions according to the architecture defined by Cabinet Office (see figure below) shows that they focus on different functions, as shown below.

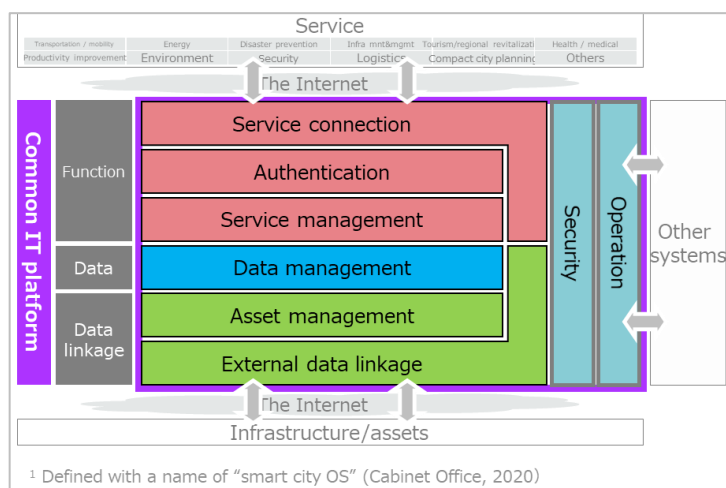


Figure 8 Architecture as defined by Cabinet Office

A summary of individual solution's position by features			
Outstanding features (when compared to others)			
X-Road	Service connection	Data management	Security
	Authentication	Asset management	Operation
	Service management	External data linkage	
MOSIP	Service connection	Data management	Security
	Authentication	Asset management	Operation
	Service management	External data linkage	
DCP	Service connection	Data management	Security
	Authentication	Asset management	Operation
	Service management	External data linkage	
FIWARE	Service connection	Data management	Security
	Authentication	Asset management	Operation
	Service management	External data linkage	

Figure 9 Summary of the positioning of each solution from a functional perspective

Based on characteristics of these solutions, this study also interviewed the stakeholders and agencies associated with X-Road and MOSIP to identify challenges and success factors in their introduction, and to discuss how JICA can be involved and support them in their introduction to developing countries.

The organization in the introduction is summarized in the following four steps.

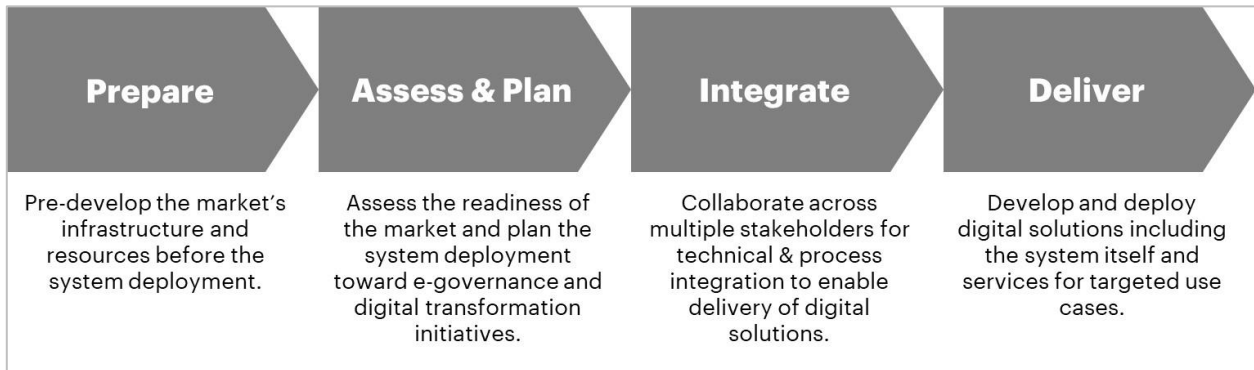


Figure 10 Steps in implementation

Following the above steps, the issues can be summarized as follows.

- Prepare
 - Local government is difficult to engage (lack of value awareness), resulting in no top-down initiation
 - Trust of data and players needs to be ensured e.g. by legislation
 - Data standardization is essential but often a challenge e.g. unorganized ownership & format, duplication

- Assess & Plan
 - Plans need to build on the country's visions and ongoing strategy
 - ✧ Avoid isolation of initiatives

- Integrate
 - Difficult to steadily progress without local driving leadership and top-down push
 - Ineffective collaboration within extensive ecosystem
 - ✧ Despite the significance of mature ecosystem
 - Initiatives fail when citizens lack literacy, understanding and trust

- Deliver
 - Failure when system scaled without plans and steps
 - Setbacks due to short-term availability of resources
 - ✧ Skills & knowledge provided temporarily from outside
 - Lack of financing

When considering the above issues, it emerges that non-technical implementation elements require a lot of attention, patience, and sustained effort, and approaches to make the project sustainable is considered as an important factor.

In this regard, JICA, with its on-ground communication and trust-building skills with local community, background knowledge, cultural understanding, and network of stakeholders in target country built through past experiences, can contribute in the following four areas.

- A) Top-down Engagement
 - Cooperate with government ministries to raise awareness of the needs and explore priorities
 - Enable necessary legislation
- B) Implementation Planning
 - Roadmap toward the long-term strategic goals
 - Collaboration model for sustainable operation
 - Sustainable financing plans for entire ecosystem
- C) Stakeholder Collaboration
 - Communicate with key stakeholders including public sector, private sector and local citizens to first engage them
 - ✧ Grow understanding of the values with digital literacy and motivate
 - ✧ Act as the communication hub and initiate collaboration
 - Expand the collaboration scope to broader range of stakeholders in stages toward self-sustained ecosystem
- D) Conducting PoC
 - Not only assess feasibility of the plan but also implement the initial stage of deployment alongside the locals while providing supports for them to carry on further themselves
 - ✧ Include training, interactive discussion and knowledge transfer
 - ✧ Change management at government agencies and users for adoption of digital solutions

In developing e-government solutions in the future, it will be important to provide the above support as well as to accurately screen target countries for implementation. There are three key requirements for screening.

- ① **DIGITAL LEADERSHIP:** Existence of National agendas towards building a Digital Economy
- ② **DIGITAL INFRASTRUCTURE:** Existence of shared digital infrastructure with strong government sponsorship across the public and private operations
- ③ **DIGITAL LEGISLATURE:** Existence of legal and regulatory environment that provisions new laws for data privacy, citizen protection, digital signatures, digital identification and cybersecurity.

Specific steps to extract countries that meet the above requirements could be as follows

- ① Country identification based on three global benchmarking reports across leadership, infrastructure,

and legal dimensions.

- The focus should be on assessing the country's maturity against the "mandatory" minimum requirements, which should be narrowed down based on the report and a more detailed status survey should be conducted
- ② When the existing efforts of JICA are mapped in countries narrowed down in (1), target countries are further narrowed down based on the relevance of existing support and bilateral relations.
- ③ Determined based on readiness for digitization
 - Moderate digital readiness: Countries with existing digital agencies/Infrastructure readiness and technology penetration/Existing national identity/data privacy agencies, use of open data, etc.
 - Low digital readiness: Countries with no digital-related government agencies/high percentage of unregistered population/no national ID (or no digitization)/no standardized government online service delivery/no data privacy agency (or policy)

Once the screening is done, appropriateness of X-Road and MOSIP as a solution to be implemented can be determined by considering the following conditions, respectively.

X-ROAD

- There are a set of services or potential use cases that require the same data (therefore data exchange and once-only management is beneficial)
- There is no one platform that connects data sources of different services and business sectors for the usage among the target geographical area

MOSIP

There is no fundamental digital identity system installed that covers the entire target geographical area (country/municipality/etc.)

2.4 Survey on DX-related technologies and services and data utilization-related initiatives in Japan

We conducted a survey to identify Japan's strengths that could be a differentiating factor from other organizations when JICA formulates specific DX projects in the future. The survey was conducted in five main areas: ① healthcare, ② urban and regional development, transportation, and disaster prevention, ③ agriculture, ④ manufacturing and private sector support, and ⑤ environment, resources, and energy. The survey was conducted from three perspectives: (1) Japan's strengths in each area, (2) the needs of developing countries, and (3) possible DX projects (examples) when (1) and (2) are combined, and the survey results were organized by area. Japan's strengths are identified from various documents issued by the Japanese government, such as the "S&T (Science & Technology) Foresight 2019

Comprehensive Report" by the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and also based on the focus on areas of science and technology that are of high importance to Japan in order to realize a desirable society in 2050. For the needs of developing countries, we refer to the cluster strategy. We also use our database to collect the latest examples in each area and present them as use cases.

In order to ensure the accuracy of the above desk research, we also conducted interviews with relevant ministries and agencies, experts in JICA, and experts from the private sector to validate the results of the research and to compile a list of promising solution providers in Japan. Based on the intentions of JICA's water resources management division, an experimental pilot project in Thailand was organized, the expected development impacts as required by JICA, and the project schedule were concretized, that led to the formulation of the pilot project plan. Regarding the desk study mentioned above, interviews were conducted with experts from the central ministries in charge of each area (Ministry of Economy, Trade and Industry and Cabinet Secretariat) to reflect not only the desk study but also the latest trends and possibilities of overseas development by Japanese companies.

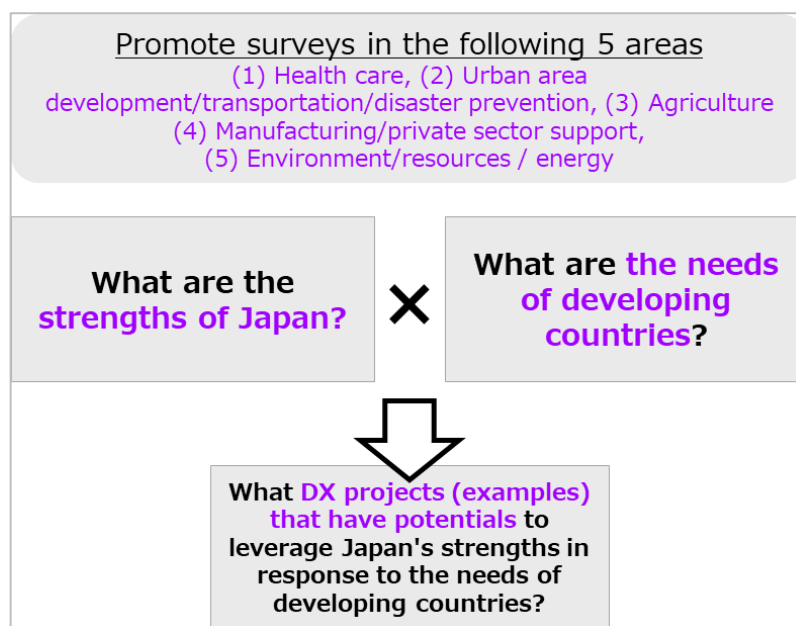


Figure 11 Research Framework

The premise of this study takes into account the fact that; until now, competition has been observed in cyberspace with the oligopoly of major platformers such as GAFA (Act 1), but is now shifting to areas that need to be applied to business sites in physical (real) space (Act 2). Based on the premise that Japan's strengths will be mainly demonstrated in this second act, we have broken down the elements of strength in the second act.

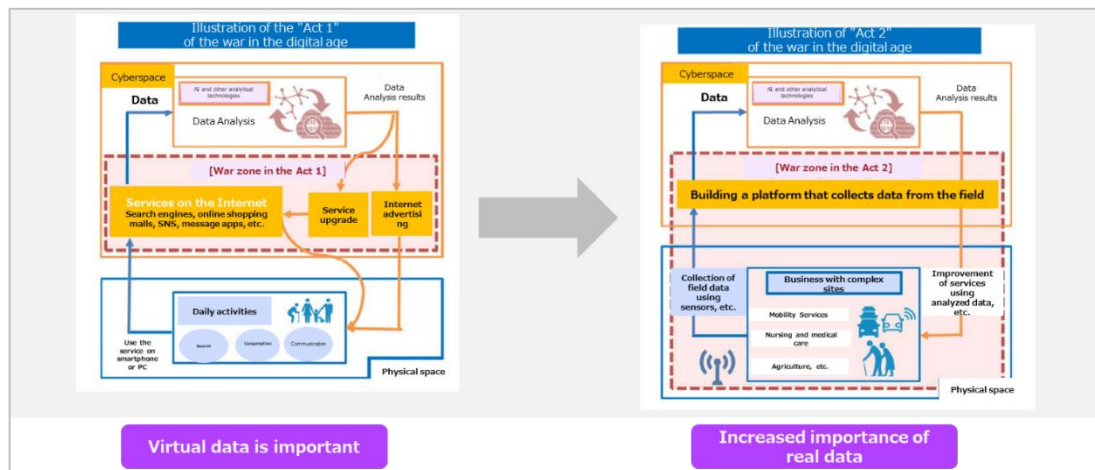


Figure 12 Changing the playing field in the digital age ⁵

(1) Regarding Japan's strengths, a survey was conducted from four perspectives: diffusion rate of goods, accumulation of real data, advanced common infrastructure technology, and advanced domain-specific science and technology, as factors that may demonstrate Japan's strengths in organizing "real data utilization cycle". "Real data utilization cycle" refers to the cycle of collecting complex on-site data in physical space using sensors, etc., analyzing it in cyberspace using AI, etc., and applying results of data analysis to physical space to develop new products and improve services. In the digital age, creation of this cycle is considered as one of the key points. Based on the premise that it is equally important to create a "real data utilization cycle" in developing countries, it is perceived that it is possible to develop technologies used in Japan, leveraging services actually created, and the know-how obtained through the promotion of real data utilization cycle as value.

⁵ Source: Strategic Headquarters for the Promotion of an Advanced Information and Telecommunications Network Society, Public-Private Data Utilization Promotion Strategy Council, "New IT Policy Outline for the Digital Age" (2020); Ministry of Economy, Trade and Industry, Industrial Structure Council, New Industrial Structure Subcommittee, Secretariat, "New Industrial Structure Vision. (2017)

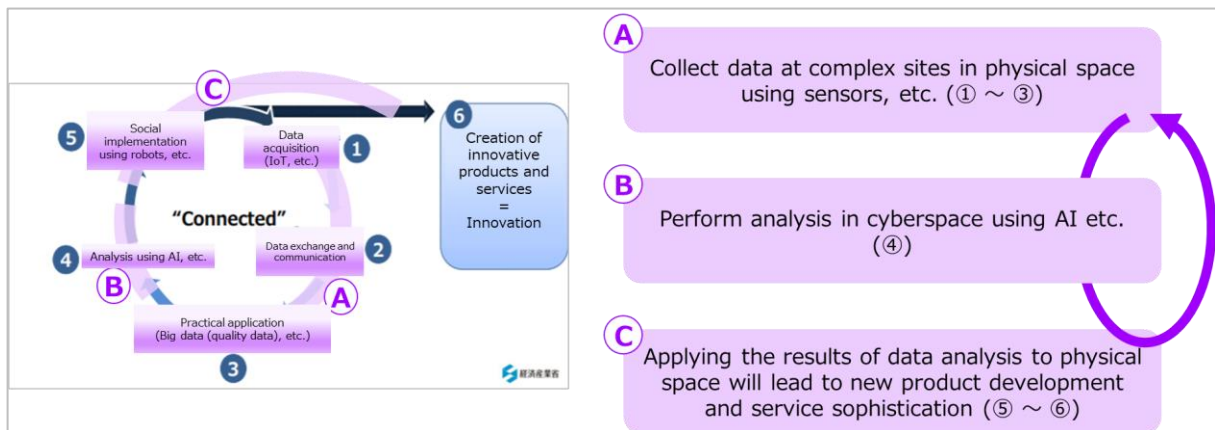


Figure 13 Real Data Application Cycle⁶

The following is a summary of main strengths of Japan and specific examples of DX projects for which there is a high need in developing countries, based on interviews with experts in each area. (See Appendix 2.4 for detailed survey results including the results of the desktop survey)

【①Health Care】

- Strengths of Japan
 - Establishment of "Guidelines for Disease Risk Analysis"
 - (Future potential) Service provision mechanism using digital ID (My Number Card)
- DX projects that are considered to have high needs in developing countries (examples)
 - Regional medical cooperation through medical ICT systems
 - Remote comprehensive support for pregnant women
 - Remote diagnosis of ophthalmic diseases using smartphones etc.

【②Urban and regional development, transportation, and disaster prevention】

- Strengths of Japan
 - "Urban development using "urban OS" built on the concept of "citizen-participatory urban development" (not only system infrastructure, but also concept of urban development, services, experience, and know-how can be presented as a package)
- DX projects that are considered to have high needs in developing countries (examples)
 - Building a Smart City Using "Urban OS"
 - Location-based evacuation guidance for disasters

⁶ From "New Industrial Structure Vision" (2017), Secretariat, New Industrial Structure Subcommittee, Industrial Structure Council, Ministry of Economy, Trade and Industry

【③Agriculture】

- Strengths of Japan
 - Agricultural Machinery Penetration Rate
 - Plant Factory Related Medical Technology
 - Technology related to rice cultivation
- DX projects that are considered to have high needs in developing countries
 - Promotion of data-driven seedling growth (smart seedling growth)
 - Remote guidance on pest control using photos taken with a smartphone
 - Using satellite data to improve productivity
 - Financial inclusion of farmers, introduction of e-commerce
 - Visualization of the distribution process through data

【④Manufacturing and private sector support】

- Strengths of Japan
 - Penetration rate of industrial robots
 - Widely developed logistics system
 - Blockchain-based trade information collaboration platform
 - AI-based behavior analysis solution for skilled worker
- DX projects that are considered to have high needs in developing countries
 - Promotion of logistics efficiency through fleet management with sensors attached to transport vehicles
 - Development of a cold chain to achieve quality control of food products using digital technology (logistics x food)
 - Optimization of inventory at each site based on demand forecasting
 - Establishing a data collection system across industries and companies to strengthen supply chain
 - Guidance on how to improve work styles by utilizing human flow data in factories

【⑤Environment, resources and energy】

- Strengths of Japan
 - Initiatives for data utilization by water utilities, etc. (Efforts are underway in Japan to use results of data analysis of wide-area facilities to improve operational efficiency, etc.)
 - Highly accurate incinerators (be careful, as the specifications may be too high to be introduced in developing countries)

- DX projects that are considered to have high needs in developing countries (examples)
 - Improving operational efficiency by centralizing management of maintenance data for multiple water and sewage facilities
 - Construction of a risk prediction and management system for water and sewage facilities that leads to BCP response (e.g., prediction of damage to facilities and the number of personnel required in the event of a disaster)
 - Remote guidance using AR/VR
 - Improving efficiency of urine treatment by cross-checking customer data (type of toilet installed, etc.) with water and sewage map information data
 - Optimization of garbage collection routes and upgrading of complaint handling by installing sensors in garbage collection vehicles
 - Using drones to visualize the remaining capacity of waste treatment plants to predict number of years the plants will have excess capacity and provide advice on how to fill it.
 - Establishing a digital waste fee collection system that is attached to water and cell phone bills

In addition, during expert interviews, recommendations on points that should be taken into consideration when structuring specific DX projects at JICA in the future are described below.

- How to understand Japan's strengths
 - Japan's leading-edge strengths do not necessarily function as optimal solutions when adapted to developing countries (e.g., too high specifications cause numerous operational issues). It is most important to consider how to respond to the needs of developing countries from the perspective of how to respond to the needs of developing countries.
 - Comparison with Europe and the U.S. may provide a clearer picture of Japan's comparative advantage.
 - In terms of digital technology, there are more and more cases where local startups have the power, so Japan may need to sell "content" rather than "technology"
- How to capture real data
 - Regarding Japan's strength on "(2) Accumulation of data", although data is available, it is often not yet ready for utilization, so we should be aware of the factors that may become challenges.
 - To create initiatives that encourage people to change their behavior, it is important to utilize real-time data (vital data, traffic data, etc.) rather than past results data.
- How to understand the needs of developing countries
 - While it is important to consider how Japan can utilize its strengths, it will also be important to consider how to identify potential social issues in developing countries and how to respond to them.

2.5 Improving Internal Awareness

The goal of the project is to "create a framework and organizational culture within JICA where digital technology is considered for all projects," and the main policies were discussed regarding JICA's internal awareness of DX mainstreaming. We previously identified three stakeholder issues in DX projects and outlined countermeasures for each.

- ① There are few opportunities to share and discuss DX mainstreaming ideas with management executives
 - Measures: Create opportunities for executive-level meetings (retreats)
- ② Few core human resources at the general manager, deputy general manager, and section chief levels to implement and promote DX projects.
 - Measure: Develop core human resources in managerial and non-managerial positions
- ③ Room for improvement in the mindset of staff and others involved in the DX program
 - Measure: Increase the mindsets, knowledge, and skills of JICA staff members and external stakeholders

We decided to focus on ③ as the FY2021 implementation scope and to hold a series of "DX Seminars for Staff Members" for bottom-up improvement of mindsets and basic knowledge.

The "Project DX Seminars for Staff Members" consists of 7 sessions including final report for internal and external and 2 special lectures. The 1st-4th, 7 and 8th sessions for internal and the special lectures are held for JICA staff members. The 8th "final report for external" session is open to external parties (consultants and counterparts) and other JICA staff to share JICA's goals, the data catalog system concept, and the pilot activity report.

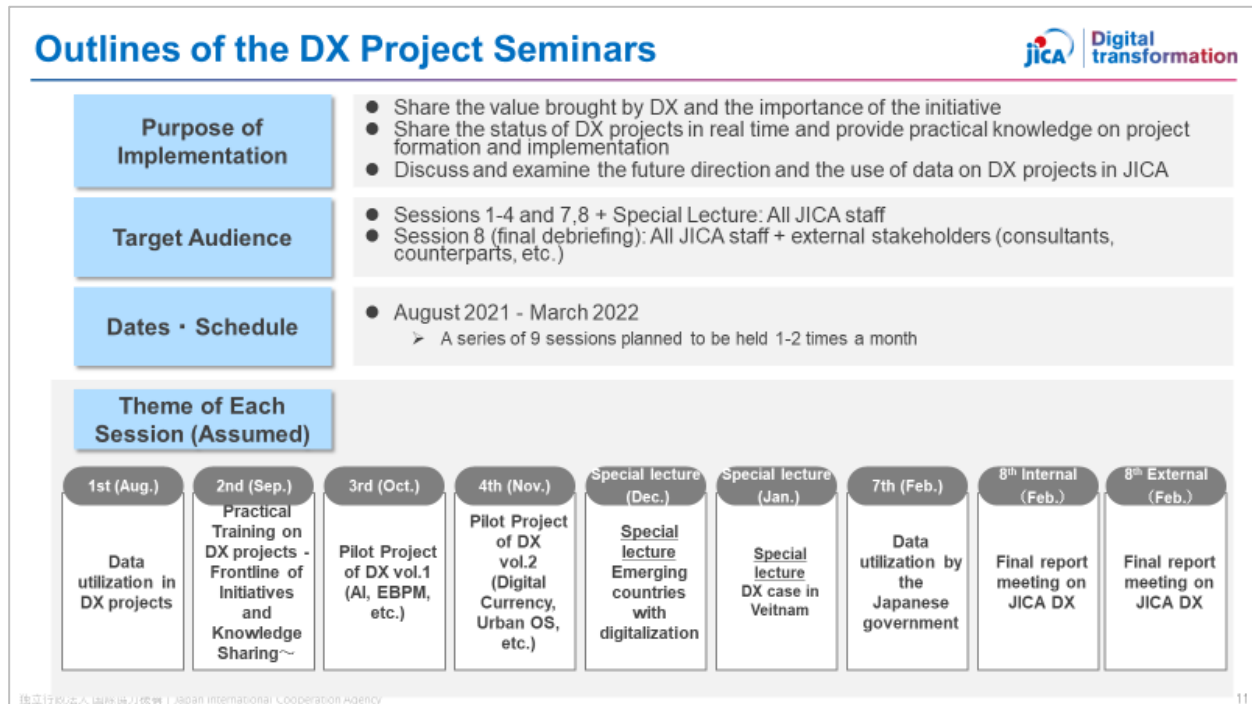


Figure 14 Outlines of the Seminars

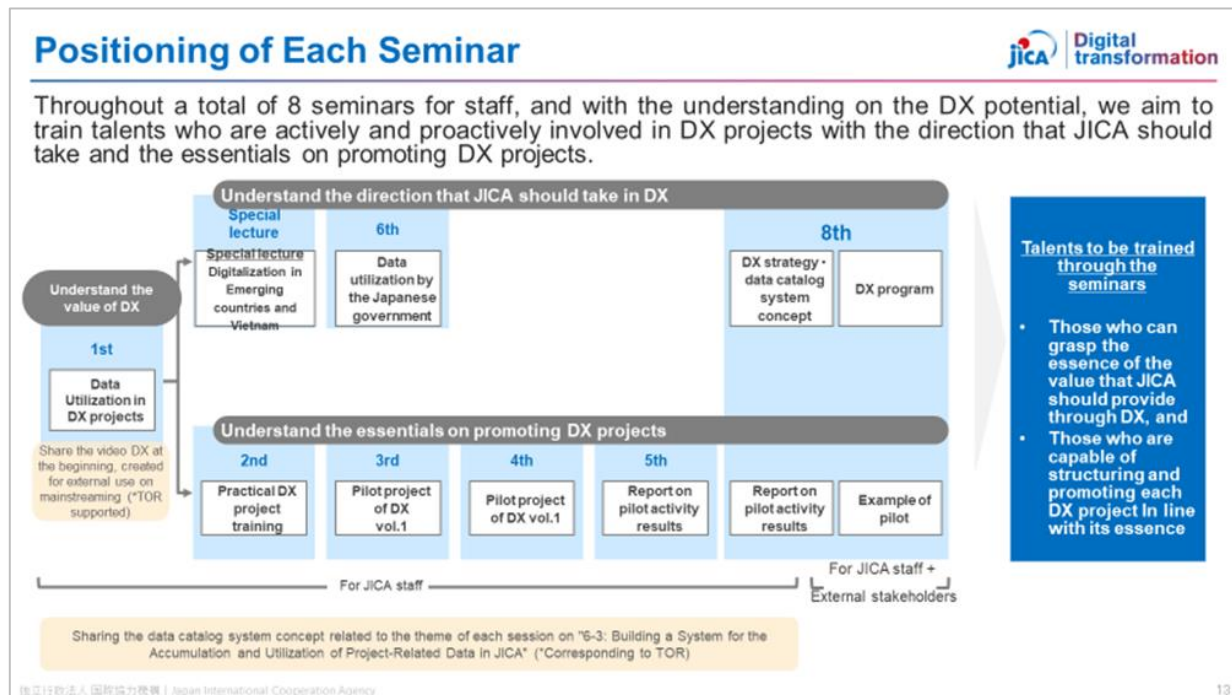


Figure 15 Positioning of Each Seminar

The first seven sessions were held, and excluding special lectures, 175 people registered for the first

session, 108 for the second, 80 for the third, 43 for the fourth, 112 for the seventh, 44 for the eighth (internal) and 141 for the eighth (external), which had not yet been completed as of February 24, 2022, providing a cumulative total of 703 people with opportunities to raise their mindset, knowledge and skills. (See Appendix 2.2 ② and ③ for details on the application, seminar outline, and questionnaire results for each session, as well as materials projected on the day.)

Content and operational aspects were the primary recommendations for future internal training, based on the first seven seminars. The 8th seminar is scheduled for end of February.

- Contents
 - There is great interest in the "What is DX? What is its value?" content
 - When introducing case studies, share detailed information so participants understand the initiatives and can consider and implement initiatives on their own
 - Participants are willing to reflect on what they have learned and put it into practice in their area of responsibility. It is important for them to generalize what is learned in the seminar, refine it, and share the suggestions.
 - Participants desire to learn through seminar discussions
- Operations
 - Efforts are required to reach the targeted audience
 - ✧ Improve the notice message and repeatedly request that each department participate
 - JICA staff tend to "just attend the seminar." Develop strategies to encourage them to continue learning.
 - ✧ Hold a 30-minute informal discussion session immediately after the seminar or later. Allow time besides seminars for participants to fill out a questionnaire to reflect on what they learned. Set up a mandatory individual discussion session with the STI/DX Office targeting departments that were encouraged to participate

We have compiled the following four measures linked to the three issues presented at the beginning of this report and the results of the Project DX seminar for staff members. Use these measures as proposals for internal awareness-raising in FY2022 and beyond.

- ① There are few opportunities to share DX mainstreaming ideas from management executives
 - Suggestion: Set up a retreat for executives to consider the direction of DX for the entire organization, as well as strategies and initiatives, with the CDO as the main participant.
- ② Lack of core human resources at the general manager, deputy general manager, and section chief levels to implement and promote DX projects.
 - Suggestion: Select and train core personnel in managerial and non-managerial positions
 - ✧ Core management: Develops human resources who can propose overall JICA policy to the executive level and disseminate the finalized policy to each department and

- related parties.
- ✧ Core non-managerial positions: Develop personnel who can lead the organization and promotion of projects and communicate the key points of promotion to the field.
- ③ There is room for improvement in the mindset of staff members and others involved in the DX program
 - Suggestion: Hold seminars using teaching materials for the "Project DX Seminars for Staff Members"
 - ✧ The seminar will be held on a regular basis, utilizing the seminar materials, for the purpose of training staff and external stakeholders who understand the direction JICA is aiming to take, and who will play a role in examining, organizing, and promoting each DX project on the ground in Japan and overseas.
- ④ (Measures related to all issues)
 - Suggestion: Set up a structure to connect people and ideas from all positions/roles.
 - ✧ The core personnel in ② and the staff who were interested in the seminar in ③ and made inquiries, etc., will be invited to brainstorm ideas. The best ideas will be presented at the review meeting in ①, so that ideas from people at all levels can be scooped up and put into practice.

For details of the above, we described in Appendix 2.2 ①.

2.6 External Dissemination

People's interest in and expectations of DX are growing worldwide. Many players have entered DX-related businesses and are communicating their visions and activities to the world. JICA is committed to mainstreaming DX, but is also facing the critical issue of increasing its public presence. Business DX requires collaboration with many partners and partnership appeals to companies with digital technology and the people around them. This is directly linked to the revitalization of the JICA DX project, and requires correct and attractive information dissemination.

Currently, JICA's information dissemination concerning the DX program is limited to sporadic events and seminars held in various departments. Even on JICA's official website, which provides the widest range of daily contact, information is only summarized on the "Information and Communication Technology" page, which is one of their many "Projects" pages. New and ambitious DX projects are being created every day at JICA, but their actual status is not properly communicated to the general public.

The following three public relations materials were created and maintained to disseminate information on DX mainstreaming.

- ① Website focus on business DX dissemination
- ② Movie (conceptual and practical versions)
- ③ Pamphlet (overview and translation in details)

The following details the three points above.

< ① Website focus on business DX dissemination >

All stakeholders outside of JICA should be informed of JICA's DX mainstreaming, but we decided to approach high-priority targets to maximize the effect. The primary targets of the website are Japanese companies that can partner with JICA for future DX projects. Two specific targets are (1) Startup CEOs and (2) people in charge of new businesses at major companies. We developed a journey (process of behavior change) for them once they decide to cooperate with JICA.

The goal of the website is to provide an opportunity for these people to consider collaborating with JICA. The website was developed as follows.



Figure 16 Website top page design (examples)

In addition to introducing the STI/DX Office and how to collaborate with JICA, the main content of the site includes "Case Studies" and "Interviews." The articles detail JICA's promising DX projects and were created to be attractive to the target audience by considering a balance of themes and regions.

Case Studies * Regions in parentheses

- (1) Sagri (India)
- (2) Melody International (Thailand, Bhutan, Kenya)
- (3) Fracta (Thailand)

Interviews

- (4) T-ICU (Asia Pacific, Latin America, etc.) and Beyond Next Ventures (investor in T-ICU)

An inquiry form was introduced on the website to facilitate smooth communication with people interested in JICA's DX.

We translated the above case studies (1) through (3) and prepared a manuscript for the English version of JICA's official website.

<② Movie (conceptual and practical versions)>

The roles and uses of video were divided between the 1st and 2nd phases of production. Two types of videos were produced for the entire project period.

During the first phase of video production, the focus was on the concept and characteristics of future assistance using DX-based digital technology policy as of January 2021. It focuses on visualizing the concept and characteristics of future assistance with digital technology and the donor countries for this assistance. The primary targets were the governments of the donor countries, but the content was intended to convey the concept of JICA DX for a wide range of uses. After creating the Japanese version, we translated it to English with narration and subtitles. The DX Office staff used it on site after the 1st phase delivery and inspection, and was updated for the 2nd phase.

The main target audience for the 2nd phase was the same as for the website: (1) Startup CEOs and (2) people in charge of new projects at major companies, aiming for practicality. The content focuses on the efforts of Melody International and JICA featured in the "Case Studies" on the website and provides an in-depth look at examples of perinatal medical DX assistance in Thailand, Bhutan, and other countries. We interviewed and filmed each relevant party and prepared three different video patterns: a short (3 minutes) main video, a long (5.5 minutes) interview video, and a very short (25 seconds) video for the website's top page. The English versions of the main video and the interview were also created with English subtitles.



Figure 17 Movie screen capture produced in the 1st phase



Figure 18 Movie screen capture produced in the 2nd phase

<③ Pamphlet (overview and detailed translation versions)>

We prepared a pamphlet for the 1st phase of the project with general information about JICA's DX. We received a similar JICA pamphlet in the 2nd phase, translated it and laid it out.

In the 1st phase, the pamphlet was designed to clearly explain the background and objectives of DX promotion and JICA's policy, based on the "Promoting Digitalization" cluster strategy paper (Internal Use).

It is four pages folded in half, including the front and back covers. The data was delivered and inspected⁷.

In the 2nd phase, we received JICA's Global Agenda Leaflet text and data, translated it into English, and used it as a base to prepare versions in other languages. The data was also delivered and inspected.

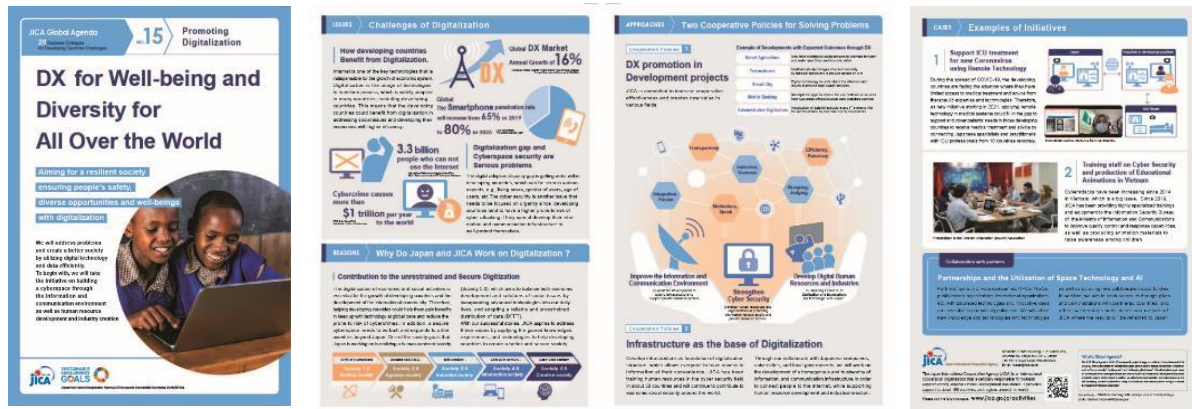


Figure 19 Pamphlet produced in the 2nd phase (English version)

< External Communication and Future Prospect Results >

We acquired external PR materials (website, videos, pamphlets) through these first and second phase external communication activities. However, external PR materials alone is insufficient, and future operations are important. It is necessary to use external PR materials strategically in a medium- to long-term fashion, including setting KPIs and developing comprehensive PR activities.

During this activity's discussion, we confirmed that the key to successful DX projects is high-quality matching and good relationship building between JICA and its collaborative partners. To achieve this, both parties must communicate closely over an extended period of time, rather than one-off or sporadic contact. We should seek ways to continuously facilitate effective communication with potential collaborative partners, including how to operate the above tools and build a system.

Also during this activity's discussion, we examined the journeys (attitudinal change process) for when a target decides to collaborate with JICA. We prioritized creating tools for the phases in the journeys that we judged to be particularly important. It will be desirable to increase the number of tools, extend target phases, and expand communication methods and points of contact.

⁷ Since it was decided that the pamphlet would be created in a unified format, the pamphlet was reorganized in a unified format based on the content and design of the pamphlet delivered in the first phase.

Chapter 3 PILOT ACTIVITIES PERFORMANCE RESULTS

3.0 Executive Summary

Survey Pilot activities will be conducted based on the ideal method for DX mainstreaming as described in Section 2.1, "What-If Verification." It is important for DX mainstreaming to provide data and run the following three cycles as part of the cycle of value creation.

- ① Promoting cycles of individual case promotion
- ② Establishing as a platform
- ③ Promoting resource mobilization cycles

Promote resource mobilization cycles with data from the data utilization cycle for individual projects. Cycle acceleration is expected when deploying valuable data to partners.

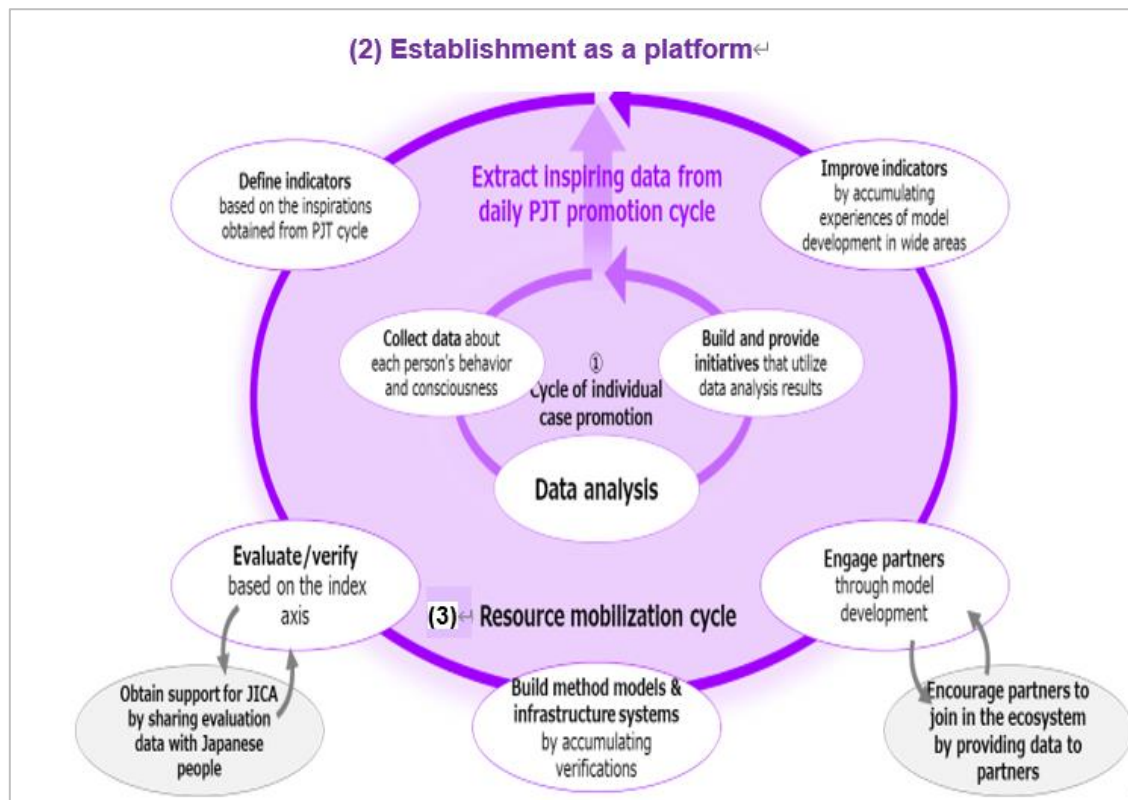


Figure 20 Three Cycles of Value Creation through Data Provision

Plan pilot activities to verify effective methods for each cycle. In addition to the pilot activities described in the specification, we will propose pilot activities utilizing private AI technology in Thailand to verify

from the viewpoint of (3) use of private digital technology with open social and environmental data, etc. in the resource mobilization cycle. The linkage between each pilot activity in six countries and the strategic verification points at the planning phase are as follows.

Positioning of each pilot activity		Verification point		
1. Individual project promotion cycle	Data collection and analysis/visualization	Uganda	Enhanced efforts by collecting, integrating, analyzing, and visualizing user data	<ul style="list-style-type: none"> ✓ Data acquisition and integrated analysis (utilization of existing data) ✓ Visualization method, behavior change of government officials (resource allocation based on results) ✓ Focus on the quality of the inhabitants (refugees) ✓ JICA support in transformation
	Digitally High speed and efficiency	Vietnam	Transformation of development methods from conventional problem solving type to prediction and prevention type by utilizing big data	<ul style="list-style-type: none"> ✓ Method for obtaining data from residents ✓ Prediction accuracy with big data ✓ Behavior change of residents based on predicted results (quality) ✓ From a problem solving type to a prediction and prevention type ✓ JICA support in Transformation of water resource
	Policy sophistication through information accumulation	Cambodia	Improving the customer experience of developing countries and business operators and enhancing policy support functions through data storage and analysis	<ul style="list-style-type: none"> ✓ Improving outreach for digital services ✓ Data collaboration with private business operators ✓ Changes in The Behavior of Government Officials (Upgrading Monetary Policy Support)
2. PF establishment	Data and function collaboration	Mauritius	Data utilization across domains by building a data analysis platform	<ul style="list-style-type: none"> ✓ The Utility of The Resident's Point of View of the Digital Collaboration Platform ✓ Changes in the behavior of government officials (allocation of resources based on predictions) ✓ From disaster support type to prediction and prevention type ✓ Possibility of cooperation in other areas (urban development, etc.) in the platform ✓ JICA support in transformation of disaster prevention
3. Resource mobilization cycle	Stakeholder Engulfing	India	Realization of development effects by mobilizing local companies	<ul style="list-style-type: none"> ✓ A history of use of digital ODA to leverage deals ✓ Ecosystem platforms needed to mobilize local companies
	Working with digital servicers	Thailand	Construction of support models in collaboration with companies with digital technology	<ul style="list-style-type: none"> ✓ Realization and effectiveness of new support models by mobilizing private technology ✓ JICA Open data to be acquired and accumulated

Figure 21 Linkage of each pilot activity to strategic verification points

Please refer to the attached reports for the results of the above verification points.

3.1 Uganda

In the Ugandan health sector, the Health Management Information System (HMIS) is used as a system for storing data on trends in health facility users. However, in the West Nile region in particular, paper-based user data records and manual data entry into the system were found to be the basis of data collection operations. This situation has led to concerns about the accuracy of the data, the workload of the facilities and the local administration (DHOs and Bio Statisticians in each district) for data collection, and the time loss for data collection and sharing of results. Particularly in the Level II and III health facilities that we visited this time, the limited number of facility staff took up a lot of time for manual data recording operations. It was found that level III takes about 900 man-hours per month, while Level II takes about 400 man-hours per month. It resulted in prolonged waiting time for patients, and the negative impact was also felt by patients.

At the same time, 91 health data acquisition systems have already been deployed at different regional and facility levels, mainly by donors, and unified digital data collection and integration continues to be a challenge. In order to overcome this situation, the MoH intends to roll out the systems (iHFMS: integrated

Health Facility Management Information System for data collection, DHIS2/HMIS for data storage, etc.) developed under the Ministry's initiative. However, due to the budgetary limitations of the MoH, it has not been possible to digitize operations to collect patient data for level II and III facilities..

Due to the current situation, local administrators and the Ministry of Health (MoH) felt that the following issues were expected at the beginning of the pilot: (1) lack of timely visualization of facility status, (2) low resolution of user attributes in each facility, and (3) difficulty in making appropriate resource allocation decisions due to concerns about the accuracy of the data. Therefore, in this pilot activity, we will continue our efforts to improve the accuracy of the data. Therefore, in this pilot activity, it was decided to verify the effectiveness of the solution that contributes to the improvement of efficiency and effectiveness of data collection and visualization.

In addition, considering the fact that JICA has accumulated data on multi-sectors, not limited to health, in Northern Uganda, it was decided to organize the available data by conducting a survey and implementing a test solution from the perspective of data acquisition and visualization. In addition, we attempted to examine the points that can provide value in the future while utilizing the data that JICA has collected in past projects.

In the data collection (IVR and tablet) of this pilot, although there were some implementation issues (constraints of infrastructure such as power and communication environment), we tried to include methods to deal with the issues in cooperation with private companies. As a result, we were able to confirm that partial substitution or supplementation of the existing data collection process by digital technology could significantly reduce the operational burden of data collection and provide sufficient cost-effectiveness for accurate and timely information collection. In particular, tablets are useful as a digital substitute for existing processes, and IVR is useful for understanding the characteristics of facility users without touching existing processes.

Data acquisition and integration analysis:

In the sector such as the Ugandan health sector, where data collection operations are defined but having differences in the accuracy of data and the efficiency of the collection process among regions and target groups, it was concluded that two types of actions would be effective: (1) to take advantage of local government-led data collection and storage frameworks and systems, rather than setting up new donor-led systems, and (2) to introduce ad hoc data collection methods that do not overburden field operations with data collection that cannot be covered within these frameworks. In countries where there are differences in the accuracy of data and the efficiency of the collection process among regions and target groups, however, we concluded that two types of actions would be effective: (1) making use of local government-led data collection and accumulation frameworks and systems, rather than setting up new donor-led systems, and (2) introducing ad hoc data collection methods that do not burden field operations for data collection that cannot be covered by those frameworks and systems.

Visualization methods, behavioral change of government officials (performance-based resource allocation):

While developing the dashboard and collecting feedback, it was suggested that if data could be provided and visualized in line with specific decision criteria, indicators, and KPIs, it could be linked to specific decisions and actions in policy making. In order to achieve this, it is necessary to create an environment and process where not only administrative staff but also end users (in this case, health facility staff) can experience: the environment (1) to Discuss and collaborate to incorporate the requirements into the functions of local government-led systems or systems that have already been created and deployed by other donors, and (2) where timely and accurate data collection will lead to load reduction and data quality improvement. We consider that it is necessary to foster value recognition and trust in data among various stakeholders to cultivate an organizational culture and capability that emphasizes EBPM.

Transformation of JICA's activities, focusing on the well-being/quality of life for the residents (both refugees and Ugandan citizens):

By applying a system that enables evaluation and monitoring of administrative services from the perspective of the local residents, such as IVR, which was verified in this study, it is possible to examine how to provide the necessary resources and support to bring benefits to the local residents, who are the final beneficiaries, as well as the facility operator. In addition, if the local government and JICA can share the inner life and values of the local people, such as the degree of satisfaction of their lives, the depth of their problems, and the gap between their personal state of mind and the current state of well-being that they are aiming for, there is a possibility of creating an opportunity to discuss the project goals and approaches that are truly desired by the partner country or region, rather than just the goals based on material KPIs. While discussing on this pilot, we examined the possibility and potential utilization of data of the health facility acquired this time and data collected by JICA in the past, since JICA hold accumulated data in multi-sectors in Northern Uganda. As a result, it was concluded that in order to utilize data of multi-sectors held by JICA, it is necessary to overcome the following issues: (1) Specifying the issues and factor hypotheses to be visualized, (2) Improving data granularity and accuracy and expanding the scope, and (3) Improving the system of data users. For (1), in order to lead to effective discussions that contribute to solve issues in partner countries, it is not possible to conduct suggestive analyses unless appropriate data are collected after clarifying the issues to be monitored and the causal hypotheses, which the same scenario as when utilizing data in single sector. To overcome the issue (2), it is necessary for the Ugandan government to establish a method to collect data with sufficient granularity and accuracy on a continuous basis, instead of the traditional method which is one-time and fragmented data collection. As for (3), the cross-sector data users need to be the actor who has certain governance on multi-sector stakeholders with understanding the sense of issues across sectors, otherwise it will be difficult to reflect the insights from cross-sector analysis in the policy making processes. For this reason, if JICA develops discussions based on data analysis of the current situation and issues involving multiple sectors, it would be effective to hold discussions with organizations

involved in multi-sectoral issues from the perspective of refugees, such as OPM (Office of the Prime Minister) in Uganda. However, among the issues related to the utilization of multi-sectoral data, especially (2) improvement of data granularity and accuracy and expansion of the scope, the introduction of the data utilization concept and project-related Data Catalog System, described in Chapter 4 of the main part of the report, will help to define common data items across projects, accumulate raw data (primary data), and share them within the Organization.

The issues of low data quality, collection cost, and collection speed due to manual data entry are common not only in Uganda but also in other developing countries and regions. In the process of capacity building by JICA for evidence-based policy making (EBPM), it is essential to establish a method to solve the same issue in the data value chain. All of the digital methods tested in this pilot are expected to be cost-effective not only in Uganda and the health sector but also in other countries, sectors, and regions with difficult power and communication environments. The project is expected to contribute to the resolution of issues in the data value chain toward the realization of EBPM.

3.2 Cambodia

Bakong (launched October 2020) has the potential to be used to promote greater financial inclusion, improve tax revenue, spread social services, and fight corruption and money laundering. Pilot activities will support service expansion.

The app has been downloaded 200,000 times, and currently 5000 stores use the Bakong system (primarily in the capital of Phnom Penh). Bakong’s transaction volume is currently less than 1% of Cambodia's GDP. The app is not widely known, its benefits have not been conveyed, and future benefits and its ideal form have not been formulated.

The following three measures were implemented to counter these issues: ① Consumer promotions to increase awareness and attract users: Trial campaign on Facebook, introduction of Bakong by local influencers, and advertising on TukTuks (major local transportation), ② Additional function development to expand Bakong for businesses: collect requests for additional Bakong functions from retail, healthcare, and transportation businesses, and ③ Study how to form a Bakong data ecosystem to enhance data-based economic policy: consultations with relevant stakeholders.

Suggestions for future activities from each measure are as follows.

- ① NBC launched a Bakong Facebook page and has been raising awareness among general consumers with videos and posts, but has not been able to get Cambodians to start using Bakong. We considered and implemented complex measures to link the awareness→understanding→action (primarily on Facebook). The post reached 14 million people and received 870,000 likes and other reactions, leading to a certain level of recognition. But the campaign post’s conversion rate was 0.0007%, which did not lead to any specific actions. We

concluded that online and other promotions should continue to increase awareness, but it is unlikely to be effective unless a semi-compulsory Bakong introduction is implemented in certain segments to stimulate action.

- ② Retail micro-businesses are benefiting from the standard QR code (KHQR) that brings together existing electronic payment services, confirming the effectiveness of promoting Bakong’s benefits. In addition, positive feedback on Bakong was received from public hospitals and city buses that had not yet introduced electronic payment services. We confirmed development steps with city bus application providers and paved the way for full-scale deployment next fiscal year and beyond. We confirmed that proactive explanations and building relationships with representative stakeholders, in areas without electronic payments will contribute to business-side introduction.
- ③ The Bakong system will serve as a hub to facilitate data collaboration among private companies, financial institutions, and initiative. We examined utilization use cases related to a) authentication information and b) transaction information, and confirmed feasibility with Bakong members (financial institutions), the Cambodian Credit Bureau (CBC), and fiscal management application providers. There are no major technical hurdles requiring detailed PoC verification, but there are still issues such as conflicts with laws and regulations and the requirement to understand the psychological impressions on general consumers. We must involve other NBC departments related to legal and financial education programs in the Bakong team.

Based on the pilot activities, we conclude that Bakong’s goals should expand in 2 directions: provide financial services to non-bank account holders through the app, and provide a data platform for businesses to promote the value creation via data sharing and utilization among businesses. To achieve this, it is necessary to present clear benefits to consumers and businesses to encourage them to take action. But to acquire the core benefit of the data platform concept and make it valuable, we must expand its use and bring it to the level at which data can be accumulated. Therefore, it is important to work promotions and the data platform concept.

3.3 India

In the case of ODA loan projects, the purpose of which is to provide financial cooperation and for which the recipient bears the obligation to repay the loan, the introduction of innovative technologies through basic research and ODA loan related technical cooperation and their integration into the main project are limited.

Therefore, the ex-JICA ODA loan project "Himachal Pradesh Crop Diversification Promotion Project (hereinafter referred to as "HP State Agriculture Project")" was selected for the exercise of DX pilot activity to examine (1) the leverage of existing ODA loan project through the use of digital technology and (2) the ecosystem platform necessary for mobilizing local companies.

In conclusion, with regard to (1), it was confirmed that it is possible to increase the development effectiveness of existing projects by adding value to them through the introduction of digital technology.

With regard to (2), in terms of structure, it was found that the key was to create a system in which the STI/DX Office would serve as the flag bearer for the promotion of DX projects within the Organization and lead overall discussions, while at the same time creating a system in which the STI/DX Office (Mr. Nagano), the local office (Ms. Furuyama), the section in charge of ODA loans (Mr. Koide) and the section in charge of agriculture (Mr. Nuruki) would collaborate in the planning and implementation of the project. Regarding the handling of deliverables, a system to protect the intellectual property rights of the company is necessary. Finally, with regard to financing, we learned that it is desirable to design a budget that leaves room for the introduction of digital technologies in collaboration with private companies in advance of the project design stage, in order to take advantage of both the relatively flexible design of ODA loan projects and the characteristics of digital technologies that allow for agile development.

In this survey, the HP State Agriculture Project was selected considering the complementarity with the main project, which aims to improve productivity and strengthen marketing, we tested the effectiveness of the solutions of digital tech companies in India against the problems faced in the production phase (upstream of FVC) and sales phase (downstream of FVC) of HP's food value chain (FVC).

In the upstream phase, a digital agricultural map integrating information on farmers, farmland, soil, and crop growth conditions was prepared, taking into account the fact that the number of farmers in charge of agricultural extension staff is large, and effective extension service is necessary to provide sufficient guidance. Due to the limited PoC implementation period, we were not able to verify the efficacy of the digital agricultural map by covering the entire process from sowing to harvesting, and further verification is needed in the future. However, all the agricultural extension officers who were exposed to the digital maps answered that they would like to continue to use digital data for agricultural extension services, which proves the availability of digital maps for agricultural extension. This provided suggestions for the future in terms of the use of digital technology to increase the effectiveness of development.

In the downstream phase, we have connected a HP state farmers' association with online direct sales platforms (DSPs). This is in response to the situation where farmers in HP state are missing out on opportunities to sell their crops at higher margins to the prime market because they do not have sales channels to the prime market despite their geographical proximity to the prime market such as Delhi metropolitan area. However, due to the fact that the relevant DSPs were auction-style, producer group with relatively small quantities and quality-oriented production was not price competitive, and thus decided not to participate in the auction. Since there are many small-scale farmers in HP State, such as the producers' group with which we collaborated this time, it is expected that the HP State Department of Agriculture, in charge of marketing support, will support producers' groups in considering future measures so that producers who place importance on quality, even in relatively small quantities, will be able to sell their

products taking advantage of the geographical advantage of proximity to the prime market. The idea of using an online platform to connect producers and markets for those who do not have access to prime markets is itself an example of the potential of digital to increase development effectiveness.

Indian agriculture is in the midst of an Industrial Transformation (IX). In the past, small-scale farmers sold their products in public markets through middlemen with relatively weak bargaining power. However, as socioeconomic development progresses, more and more consumers are demanding pesticide-free and pesticide-reduced products, platforms have emerged to enable sales without middlemen, and services have emerged to enable data-driven production, leading to the improvement of the status of the producers themselves, which in turn leads to well-being (HX: Human Transformation). It is necessary for JICA to keep up with this momentum and incorporate digital solutions that enable business transformation (BX), IX, and HX, ultimately aiming for the diverse happiness of each individual. It is necessary for ICA to incorporate digital solutions that enable BX, IX, and HX, ultimately aiming for the diverse happiness of individuals.

3.4 Mauritius

The purpose of this study is to examine the possibility of "data utilization" for optimizing disaster risk reduction and mitigation for the future, and the effectiveness of the DLP (also called as "City OS" in Japan) as a mechanism to realize this. The following 2 activities were conducted for the above purpose: ① Verification of the potential data utilization and introduction to optimize investment in disaster risk reduction towards urban development, and ② Embodiment of the potential data utilization in areas related to disaster risk reduction and disaster mitigation in situations other than flood risk visualization.

In the investigation of ①, the flood simulators and urban development/analysis tools were examined, which we have studied on the visualization of future urban flood risk, defined what kind of process and input data to be considered, and what kind of output can be expected, while connecting with related stakeholders for further discussion on the necessity of investment in disaster risk reduction. As a result of the survey and discussions with a JICA's Disaster Risk Reduction Group, it was found that the use of commercially available software alone can provide a simple flood risk simulation in the pilot phase prior to a full-scale conducted by flood control consultants, such as screening of potential sites for cooperation. This means that flood risk simulations can be conducted by using the available software which can save both budget and time compared to dispatching experts on sites. Thus, it can be concluded that digital technology can bring transformation, as well as DX can possibly contribute higher efficiency to the JICA's project.

The survey ② was designed to examine the possibility of data utilization by using the DLP. In the area of disaster risk reduction and mitigation, the acceptability of the platform was verified by the government and citizen users, while the value of the platform was illustrated by UI mockups that focus on the details

and needs of the mechanism for the future platform expansion. As a result, we were able to confirm the high expectations from both the government and citizens in order to materialize the valuable use cases. At the same time, asset maintenance, capacity building, and data acquisition were identified as important points to be addressed in the future. In addition, it is assumed that further expansion across other domains is feasible since there are some close relationships between the Info-Highway initiative in MTCI and the DLP, while one of the factors that restraining the expansion of the Info-Highway is the current vertical division of data collection and utilization among ministries, and this project can contribute to solving this problem, especially the extra demand in the area of tourism.

In fact, the data utilization can effectively solve issues related to disaster risk reduction and mitigation issues in Mauritius. As a result, it has been confirmed to continue on implementing data utilization as a solution, which also includes the study and development of the DLP to realize data utilization in cross-domains and deployment in other countries.

3.5 Vietnam

In the Socialist Republic of Vietnam, the rise in the health risks of residents due to deterioration in the water quality of drinking water caused by the progress of water environmental pollution has become an urgent problem. Until now, the approach to solving problems through development cooperation with the government and other countries has been mainly supported by the hardware side, construction of infrastructure, such as strengthening water purification capacity by establishing and expanding water purification plants, but there are issues such as cost and lead time until effects take place. In addition, as a measure to improve water quality, the Ministry of Natural Resources and Environment (MoNRE) was working on strengthening its monitoring system, but it has only grasped "results data" on water quality and has only been able to come up with symptomatic measures. Specifically, the Environmental Protection Act, which was amended in 2020, defined that the residents should have more involvement in monitoring environmental quality. In addition, under the leadership of MoNRE, the "Environment-related Data Center Business," which is for the purpose of big data utilization /digitalization and utilization of environment-related data including water quality data, was being planned. Under these circumstances, it is expected that by providing the residents with "prediction data" of water quality, they will encourage behavioral changes in residents based on the prediction results, and not only reduce health risks but also raise awareness on environmental improvement among residents.

[Contents of the pilot demonstration]

Based on the background, this pilot demonstration will include (1) input: clarification on the approaching method for collecting big data, (2) process: consideration on development method and selection method of an effective prediction model, and (3) output: verification on mock-up development of a water quality

information application for residents.

(1) Input: In clarifying the approach method for collecting big data, we consulted with counterparts and Kyoto University on the collection method and the target objects for collection of weather data, such as water quality data and rainfall. Then, 8 water quality parameters (pH, temperature, DO, EC, turbidity, NO₃, NH₄, PO₄) and rainfall were selected and obtained as data inputs for the water quality prediction model. The locations were also discussed, and the data was collected at 3 locations which are upstream, middle, and downstream of the Kau River (Thac Gieng in Bach Kang Province, Gia Bay Bridge in Tai Nguyen Province, and Tan Phu in Tai Nguyen Province) as a pilot activity target area. Thanks to Hanoi University of Science and Technology who was the one collected the data, as the new coronavirus prevented the investigation team from conducting on-site inspections.

(2) Process: In developing an effective prediction model, we collected historical data for the last 10 years, which was necessary, from counterparts (historical rainfall data + data from continuous monitoring parameters of 2-3 sites, etc.), and examine the concept and selection method of how to form effective prediction models, which is in accordance with the actual situation, based on the collected big data. Focusing on "turbidity prediction", which is expected to have particularly high expectations from residents, the initial hypothesis was modified, and an initial prediction model was developed.

(3) Output: UI was designed in developing a mock-up of a water quality information application for residents, user Story was virtually created, interviews were conducted with local residents in the pilot target area using the mock-up, and it was verified whether it will lead to behavioral change of residents after confirming the needs for the service.

[Results of the pilot demonstration]

In Vietnam, although the amount of data that can be called "big data" is not accumulated on the part of governments, an environment in which big data can be collected, such as an environment in which 3G or 4G networks for IOTs to use, and a water quality monitoring site, have been developed. Therefore, it was confirmed as a result of this pilot demonstration that it is possible to predict the water quality by using the data, and by disclosing the predicted data to the residents, it can lead to their behavioral change. In particular, the pattern of behavioral change that can be considered by introducing the water quality prediction model is ① the change in the use of water in households with consideration on health, and it is assumed that it will develop to the participation of the initiative at the local level along with the improvement in the water quality environment awareness. However, we think that not only the implementation of the application, but also continuous enlightenment activities for residents will increase the possibility of encouraging behavioral change. Based on the results of this pilot activity, we believe that disclosing information not only to residents but also to private companies and governments could be used in various ways. For example, the revision of the Environmental Protection Law has made penalties more stringent for the private sector and

has incurred cost burdens for compliance. However, this forecast data can help reduce costs in environmental monitoring operations. On the other hand, for the administration including the counterpart of this pilot activity, the big data is accumulated through the environment-related data center business, and the generation of the data for water quality forecast becomes possible, which is considered to lead to the water quality control of the prediction preventive type.

We believe that for JICA DX project formulation in the future, we need not only to focus on new technologies that are difficult to introduce, but also a stance of reviewing existing technologies by combining them with existing technologies.

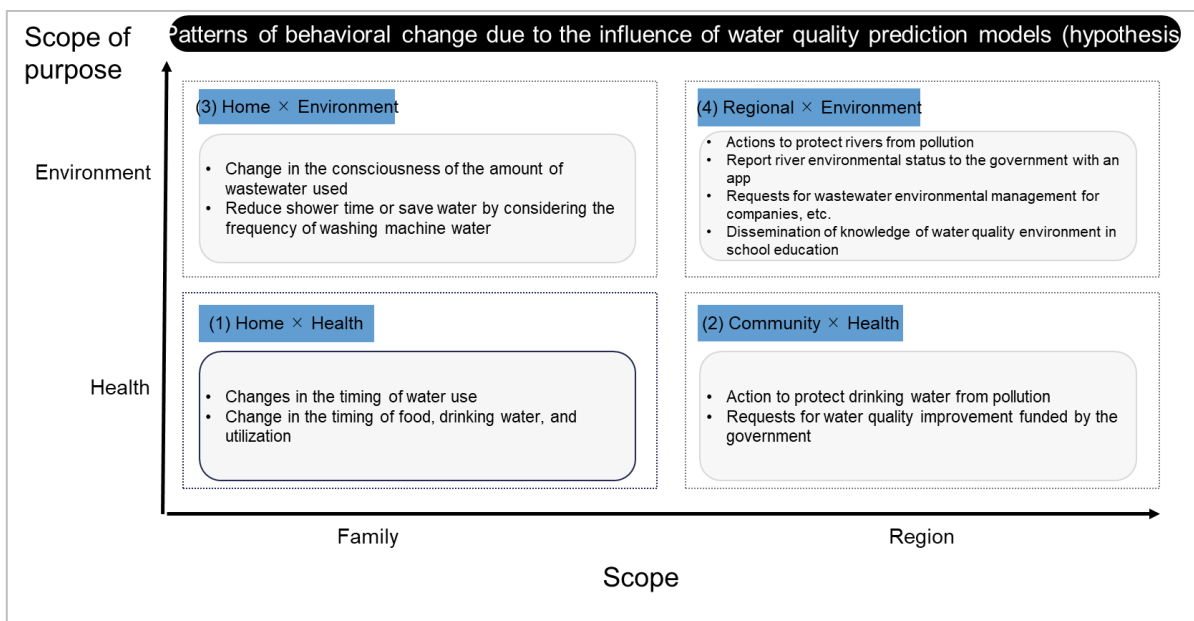


Figure 22 Behavior Change Patterns

3.6 Thailand

In Thailand, various problems on water management at the national level have always existed. In particular, Bangkok suffers from infrastructure problems caused by the rapid development of the Thai economy. One example is water shortage, which is not due to the lack of water sources as in other areas, but it is caused by many cases of water leaks due to the ageing of water pipes. Currently, the average rate of water leakage since 2016 has been recorded at 30%, and only 70% of the total has reached users.

The water supply business in Bangkok and its neighboring prefectures, under the supervision of the Ministry of Interior, is a system in which MWA manages the production and supply of water. One of the main challenges MWA faces is the increase in related costs. Among the total repair costs of MWA, particularly repair costs such as inspections and repairs of pipes and water pipes have tended to increase

over the past 10 years. In addition, high water loss rates not only increase costs, but also affect the loss of revenue opportunities due to increased non-revenue water. Several initiatives have been implemented within the MWA, but the problem of high water leakage rates has not yet been solved. In addition, the deterioration of infrastructure, which is causing this problem, is predicted to deteriorate over time, as more effective and concrete measures are required.

For more than 40 years, Japan has provided support to the MWA, including the Bangkok Water Supply Development Project in 1979. In addition to water supply and sewerage development, the country is also contributing to human resource development and technological improvement in Thailand, such as the Water Supply Technology Training Center Project, and is now capable of implementing technology dissemination to neighboring countries. In recent years, grant aid "8th Bangkok Water Supply Improvement Project" and technical support (completion in 2013) signed in 2009 have been implemented.

In introducing this project, a feasibility study of new technology (AI) was carried out, and it was determined that the preparation level for the implementation of DX by the government of Thailand was appropriate for the issues currently occurring in Thailand. For example, the ageing of infrastructure in Thailand is becoming an increasingly serious issue, and the Thai government is making progress in developing a national strategy and environment that will lead to open data. In addition, as mentioned above, we have continued to support the project, and the relationship between JICA Thai office and the MWA is very good, and we can communicate smoothly. Therefore, we conclude that it is optimal to select the MWA as the counterpart for the country in which this pilot activity is implemented, taking this pilot activity in Thailand.

In addition, it is meaningful as a JICA to implement this pilot project in view of the fact that through this pilot, it will be possible to utilize digitally advanced medium-sized countries such as the country as a test bed for pilot activities and seek ways to provide support to third countries, including backward countries, in the future.

[Descriptions of pilot demonstration]

Based on the background, this pilot demonstration aims to visualize the state of pipelines and ageing conditions through the use of AI's water pipe diagnostic technology, thereby creating changes in behavior in infrastructure maintenance, which mainly involves the prediction and location of water leaks, and prior maintenance of pipelines based on such predictions, and reducing issues such as water leaks and infrastructure maintenance costs. In other words, it aims to shift infrastructure maintenance from "symptomatic therapy" to "forecast and prevention".

In the pilot survey, Bangkok-Noi district was selected as the survey area with high water loss rate. To conduct water pipeline diagnostic by AI, (1) social environment big data obtained from open data and (2) attribute data of water pipes obtained from MWA were collected and input to AI; Social and environmental

data were obtained from open data platforms in Thailand and various external organizations. However, many of the social environmental data in SHP format acquired from open source were evaluated to be unable to contribute to the improvement of the accuracy of the analysis because they did not meet the level of expected data resolution. On the other hand, the water pipeline attribute data obtained from the MWA was highly accurate and could quickly extract the data and contribute to the improvement of the accuracy of the analysis of AI.

The MWA initially had time to acquire data because it had indicated concerns about data sharing. As a remedy, we were able to elicit their cooperation by giving concrete examples of previous projects, highlighting the key benefits to be assumed, and clarifying the data-sharing processes they were concerned about, based on the collaboration of JICA local office.

In addition to the above, this paper also verifies the utilization of social environment open data in Thailand within this activity. This paper investigates whether open data can be utilized in various fields by private enterprises, including interviews, and verifies the future possibility.

[Results of this pilot demonstration]

Through machine learning data processing, the AI model indicated the location where water pipes are likely to break down and the ageing and risk factors of broken water pipes. As a result, in identifying locations where water pipes are likely to break, AI models were able to capture more of the 10% water pipes with the worst condition and found about twice or more than the current model of MWA and about 35% of the total water leakage. It was found that the AI model was more effective in capturing the possibility of water pipe risk failure than MWA model. On the other hand, in "risk factors of ageing", AI can indicate items that can be risk factors, but discussion with MWA experts is more important because the results cannot be predicted.

In addition, the costs from 2019 to 2021 and piping leak costs were analyzed to estimate how much the AI model results presented in this pilot demonstration could affect costs. As a result, MWA expects to be able to reduce the total cost of MWA by up to *(x% sensitive info thus can not show to public)*, between 2019 and 2021, eventually if MWA actually utilizes the new AI model and addresses the problem of piping leaks captured by the model.

The MWA gave positive feedback that the report on the results of this pilot activity was referenced in actual operation, that the water pipe route requiring repair would be selected more appropriately in the future, and that the repair cost would be optimized eventually, and that the infrastructure management cost would be reduced.

In response to the results of this pilot activity, it was found that experts who manages the water pipes such as MWA are likely to reduce infrastructure management costs by making use of AI's water pipeline diagnostic technology to convert infrastructure maintenance from "symptomatic therapy" to "predictive and

preventive". We were considering whether the results could lead to the introduction of AI technology in water pipe management projects in Thailand or other countries.

With regard to the open data environment in Thailand, it has been found that it is likely to be the center of public access for governments, private enterprises, and people, as private companies and civilian services have already begun to be deployed. On the other hand, it can be said that improvement is required in legal, technical and organizational aspects.

Chapter 4 DATA UTILIZATION SURVEY RESULTS

4.1 Data Utilization Concept Study and New Project Ideas

Data utilization concept studies in this project were conducted to see if it was possible to utilize project-related data, use cases, and the mechanisms to do so. Project-related data is defined as data obtained and used in various projects. Both internal and external stakeholders are data users. The project was carried out based on interviews with major potential users and the trends of other donors.

Since the results of the survey in this chapter include the results of studies related to the data catalog system (tentative name) to be established by JICA in the future, detailed information is provided in the attached document (not disclosed).

① Survey through interviews

Twenty-three interviews were conducted with respondents from eight internal departments and five external organizations. The purpose of the survey was to understand the project-related data used in the various projects and the business issues and requirements related to the utilization of such data. Stakeholders outside of JICA were also interviewed about their needs, such as what JICA project data is utilizable or reusable, and what they expect from JICA's DX mainstreaming and open data.

Based on the results of the interview survey, the data used and generated during the projects and the systems where the data was stored are summarized.

In addition, ten major needs were identified based on interviews and discussions within the organization. We used a design thinking approach called affinity clustering⁸, mapping each opinion while paying attention to the similarity of opinions and relationships of cause and effect, and extracting needs by analyzing trends in those themes and opinions. We also accounted for the number of opinions in the interviews and defined them as major needs. As for the main needs, they are related to "improving operational efficiency," "maximizing business effectiveness," and "forming an ecosystem." These were important data utilization topics. In addition, many of these needs are related to case information, case documents, survey data, and monitoring information among the project-related data groups, and we identified a great need for these data groups.

⁸ A method used in the Design Thinking approach to analyze the trends of important issues and needs in the whole by categorizing and organizing them while paying attention to relationships such as similarity of contents and causal relationships.

② Trends and differentiations of other donors

We must consider the trends of other donors while formulating JICA's data utilization policy and open data policy as a data utilization concept. It is necessary to provide data that demonstrates JICA's value and that it is in demand outside the organization, rather than data and services that are already provided by other donors.

The importance of establishing rules for data protection is increasing alongside real-time data acquisition, automation, and individualization of acquisition methods. Other donors have established guidelines and Data Protection Officers (DPOs) for internal data protection, and some have provided advice on data regulations to developing countries.

In the utilization of data, there is an emphasis on providing suggestions for decision making and evaluation, and updating support through the use of big data. In addition, open data is being promoted by many organizations. At the same time, visualization efforts such as dashboards are being promoted. There are several patterns of dashboards, ranging from those that allow users to select their own data sets for visualization to those that provide graphs and other visualizations in the form of previews of predetermined data sets.

We also compared the publicly available data sets with those held by JICA, and discussed the characteristics of the data held by JICA and the types of data that should be made publicly available.

③ Data Utilization Concepts and Use Cases

We examined the concept and use cases based on the data utilization plan. The concept was positioned to achieve "business efficiency improvements," to "maximize business effects," and for "ecosystem formation," extracted as important themes during the examination. The new business use cases that utilized the business-related data was examined from the above three viewpoints, and use case scenarios were summarized with assumed users and usage scenes. Figure 23 shows the use case scenario (assuming technical assistance projects)

◆ Operational cutbacks

Advancing digitization eliminates overlapping surveys by sharing existing survey data by automatically collecting survey data with IoT devices. The Company can improve operational efficiency and reliably collect and store survey data.

◆ Maximizing business benefits

Gathering and visualizing results from the middle of the project makes the PDCA cycle faster than ever and maximizes the effectiveness of our business. The company will also evaluate SROI by region and issue and optimize future business strategies.

◆ Ecosystem formation

The goal is to accelerate the development of supported countries by reviewing measures such as other donors, local NPOs, NGOs, and the local government. The goal is to improve the presence of JICA as a development organization, promote stakeholder participation (NGOs, private companies, etc.), and to improve the effectiveness of businesses through co-creation.

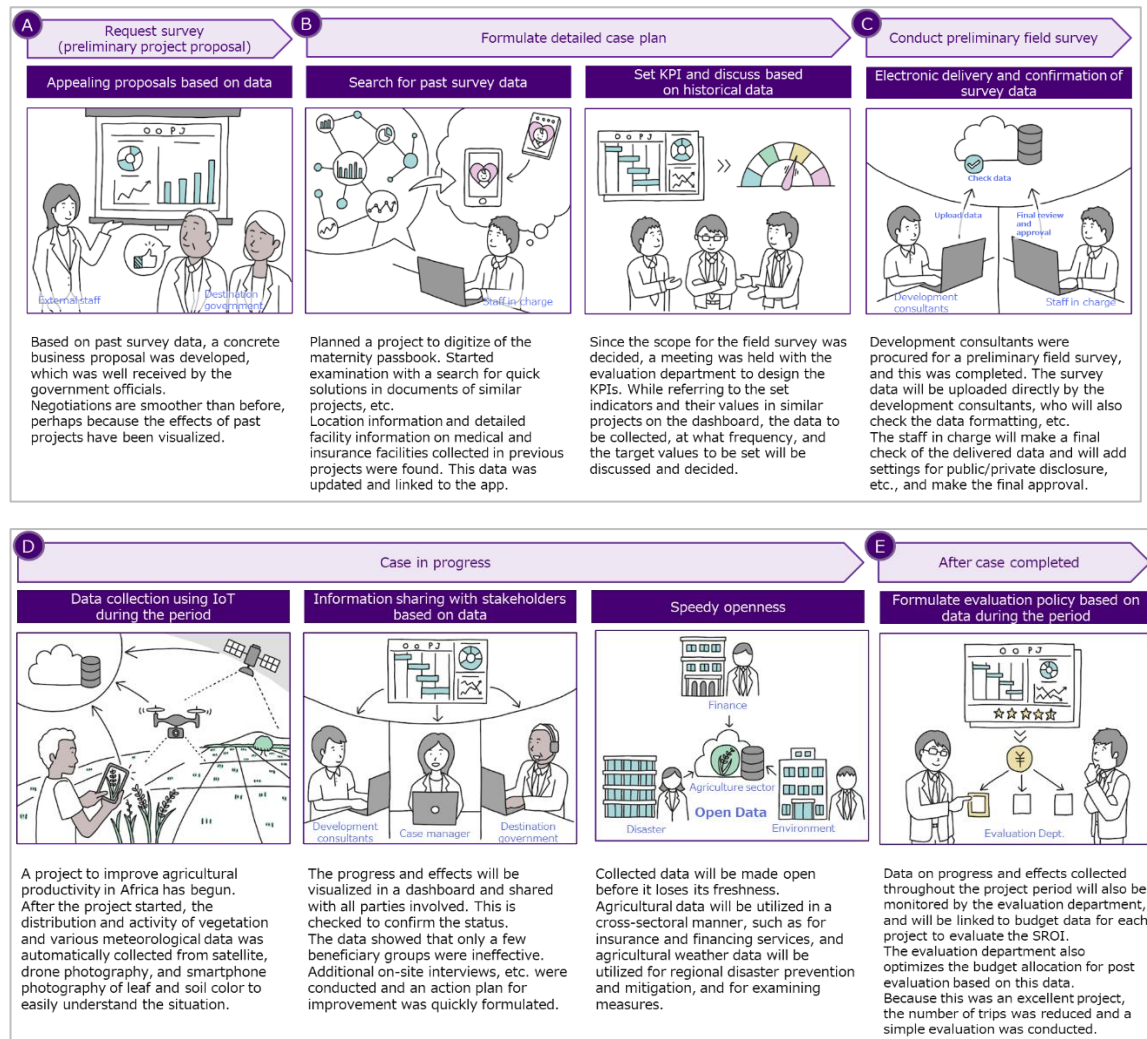


Figure 23 Data Utilization Use Cases in Technical Cooperation Projects

④ Overview of the Business-Related Data Catalog System

We examined business-related data catalog systems as a mechanism to implement the above-mentioned data utilization idea and utilization use cases. The business-related data catalog system collects and stores data such as project information, project documents, survey data, and manages metadata as a catalog so that it can be easily searched, shared, and used internally. Visualization will also be supported so that the data

content (such as GIS mapping; map data with geospatial information and preview it on a map) can be intuitively understood.

Eventually, data collected by JICA will be released as open data to the public to promote participation by stakeholders and to improve business effectiveness through co-creation. In the discussion, we examined the service idea for satisfying important needs, and based on implementation priority, the main services were arranged and summarized in the service concept to be realized and the outline as shown in Figure 24.

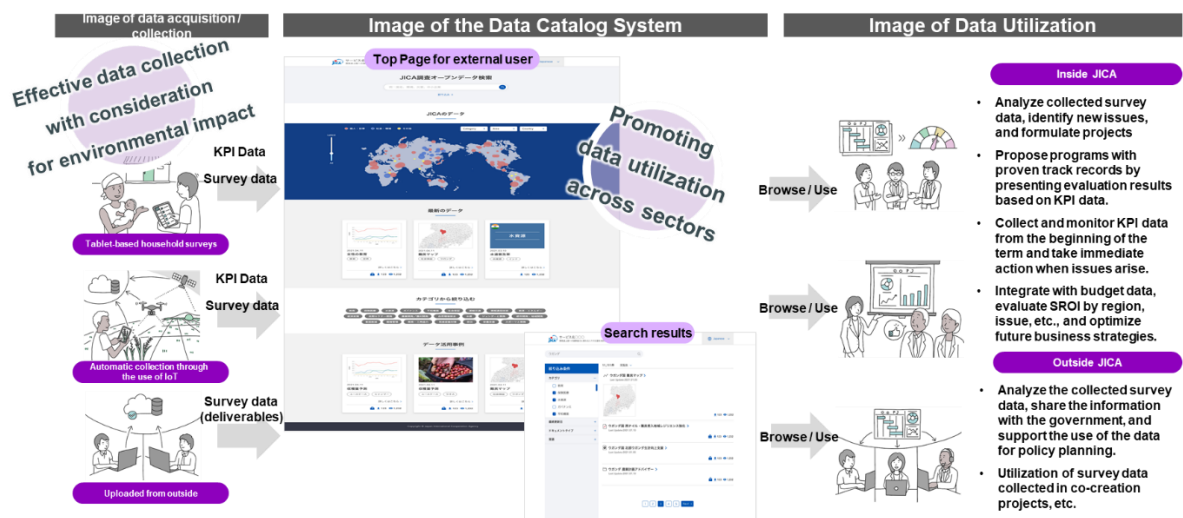


Figure 24 Overview of Business-Related Data Catalog System

Table 6 Proposed business-related data catalog system main service

#	Service	Service Description
1	Similar Case Search Service	Search for cases similar to yours and display case-related documents and investigation data.
2	GIS Mapping Service	Map data and geo-referenced research data into a GIS.
3	External Uploading Service	Allows uploading of survey data for collection from development consultants. Automates data checking and metadata generation.

Based on the aforementioned concept of the business-related data catalog system and its main services, a prototype was created and its effectiveness and operational feasibility were verified through pilot applications. Based on the suggestions and lessons learned, we developed the system plan and studied the system specifications.

4.2 Verification of multi-sector data for JICA past projects

Since JICA has accumulated data on multiple sectors in Northern Uganda, the Uganda pilot activity was designed to verify the usefulness of JICA's data and to experiment with case formation and management using the data. For this reason, the Uganda PoC dashboard was created in PowerBI, which JICA already owns, using the data obtained from the pilot activities in Northern Uganda, including data from several projects that JICA had implemented in the past. Lessons learned during this production process and comments from users allows this paper to verify the feasibility and usefulness of analyzing and displaying data by multiplying it with data collected from past JICA projects, and its feasibility and requirements for future dashboards and data.

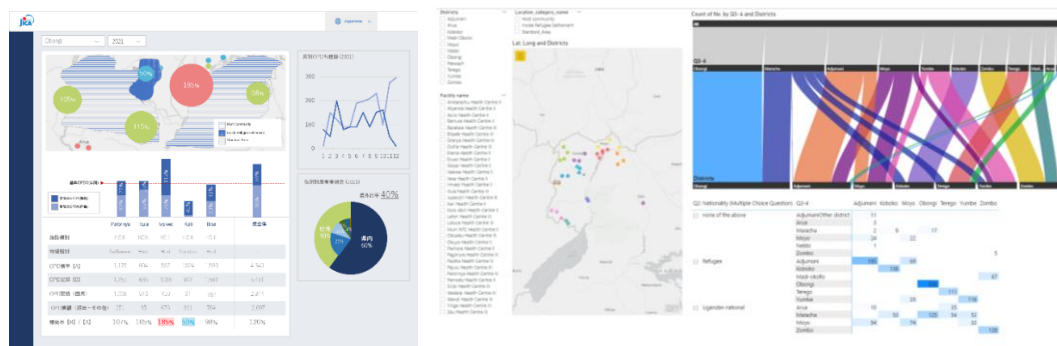


Figure 25 Uganda PoC Dashboard Prototype Production Example

The purpose of the feasibility verification and the usefulness of analyzing and displaying data combined with the data collected from JICA historical projects was to verify the dashboard's usefulness as an analysis/display tool and the usefulness of JICA's collected data. It has been argued that data collected by JICA through the business is not retrieved over time, but that much of the data generated within a particular development research project or local data collected for the project should be evaluated for validity. Actual data was verified during the dashboard production process as to whether the data and assets accumulated so far could be utilized in the pilot activities in Northern Uganda, where multiple projects have been implemented.

To analyze multiple data sets in an integrated manner, it is necessary to arrange and compare them on a common scale, such as time and place. However, data collected in past projects is fragmented (only present in the year in which the project was implemented) and data granularity varies (differences in descriptions such as GPS information-XX rural areas), making it difficult to utilize historical data in pooled analysis. However, we believe that the implementation of a business-related data catalog system may improve this situation. Previously there was no information sharing on which data items had been surveyed in each project, and it is inferred that there was no survey design utilizing data from past projects. But by sharing

survey data from past projects, there will be more room for use since it will be possible to compare regions after investigating common data items, and to easily design areas for survey that assumption integration and analysis with existing survey data. In addition, with the implementation of the business-related data catalog system, "collection and storage of raw primary data," "collection and accumulation of metadata such as data item definitions," and "collection and accumulation of prerequisites such as survey specifications" have improved, and it is desirable to collect and share data in a format that can be understood by third parties and easily reused.

When past data was confirmed, there was a large quantity of post-aggregation data rather than raw primary data, and it was necessary to rearrange it for secondary use.

Barriers to data utilization arise as data granularity coarsens, the definitions of data items to be described later becomes more uncertain and complicated, and it becomes more difficult to understand that data. It is important to collect and accumulate raw primary data and to adjust the contract so that it can be delivered by trusted business operators and subcontractors in charge of actual investigations, and that the contract can be reviewed (including clauses and guidelines).

To accurately understand the data on "collection and storage of prerequisites such as survey specifications," and in consideration of the use cases where the same data items will be surveyed and inter-regional comparisons will be conducted in reference to the past data items in the future, we recognized the necessity of a detailed survey specification concerning what kind of survey was conducted under the conditions (including questionnaire items, the answer form, etc.) in the Survey of Interested People.

Next, to verify the feasibility and requirements of dashboards and data openness in the future, we created a dashboard to visualize the usage of health facilities by combining data from the Ministry of Health, data collected directly from users with IVR, and open data. We also collected opinions from government officials and external parties. We heard opinions that the dashboard display that visualizes the number of users and the ratio of refugees and citizens to the budget of each health facility (created to allow local government officials to see and monitor evaluation indicators to optimize budgets for each health facility) is useful for actual operations. Although some data can be displayed with existing dashboards, there is a need for displays based on actual use cases, such as this one, so that even non-experts can intuitively understand issues and take action. For the JICA dashboard, we believe that it is more meaningful to display analysis results by combining data based on the issues and use cases of each country, rather than graphing a single effectiveness indicator.

The problem of data quality is a concern to open architecture. The data of the Ministry of Health was collected via paper, and there were problems such as low data quality due to human error, etc. There are also concerns about quality, such as whether the data collected with IVR was properly declared by the user or whether many incorrect responses were provided as incentives. As dashboards and data are made open,

high-quality information must be transmitted to maintain reliability as an international development organization. Digital technologies such as satellite and sensor data can be used to guarantee a certain level of quality (as lessons learned from the IVR can be easily answered digitally), but this is a disadvantage, and it is necessary to take measures for each survey's content and methods. It is important for the development of open data that each project examines their survey and data collection methods, evaluate the quality of the survey data, and improve them to secure data quality.

During dashboard production, data provision discussions and data management policies with the Health Department took a considerable amount of time and were a major obstacle and were primarily focused on handling personal data and transferring data to cloud services. There are no agreed documents or licensing agreements regarding data with the counterpart government, but it is necessary to develop them based on the assumption that the data will be utilized in the future. When transferring data to cloud services, etc., there are cases in which the recipient government is regulating the transfer of personal data, etc. across borders, so measures must be implemented in accordance with the legal systems of each country.

Chapter 5 SUGGESTIONS FOR DX MAINSTREAMING

This chapter discusses the suggestions for promoting DX mainstreaming in JICA that were obtained through the pilot activities in this study, based on the specific measures associated with HX, IX, and BX that were organized in the way DX mainstreaming should be described in Section 2.1. First of all, the following seven concrete measures for the realization of HX/IX/BX are listed.

In order to realize the diverse happiness of each individual (Well-being) as stated in the HX, it is necessary to consider seven aspects. (1) Firstly, continuously collect individual data and capture the behavioral changes of each and every government official that support the collection of data in order to provide services optimized for each individual and solve problems. To provide optimized services and create synergy among government agencies across sectors, it is important to build a digital architecture that will serve as the foundation and structure for utilizing data in IX. In constructing the digital architecture, it is necessary to integrate applications and various devices by linking them to IDs, so that they can be managed collectively. (2) Secondly, vertically integrate digital architecture that services can be provided and services can be attracted. (3) Thirdly, integrate data across sectors to create new services and expand the scope of their use. Fourthly, in order to promote these industrial policies, it is necessary not only to improve the capability of government officials but also to design, (4) digital-related systems as a national industrial strategy and make sure to create projects and implement them.

Furthermore, as fifth aspect, an initiative to support HX/IX, it is vital to implement (5) data-driven management and operations within JICA based on data obtained. As sixth aspect, (6) aim to collaborate with different actors. Since over the years, JICA has established long lasting relationships with developing countries, consider the use of DX by collaborating with companies that has cutting-edge technologies or capabilities including startups for further international development. Lastly, when aiming to realize EBPM and the modification of new development methods with various actors, (7) JICA should not only streamline GA class on the portfolio, but also make sure to create added value in projects.

Based on the results of the chapter 2 and the above understanding of the research team, the suggestions obtained from the pilot activities are described in this chapter.

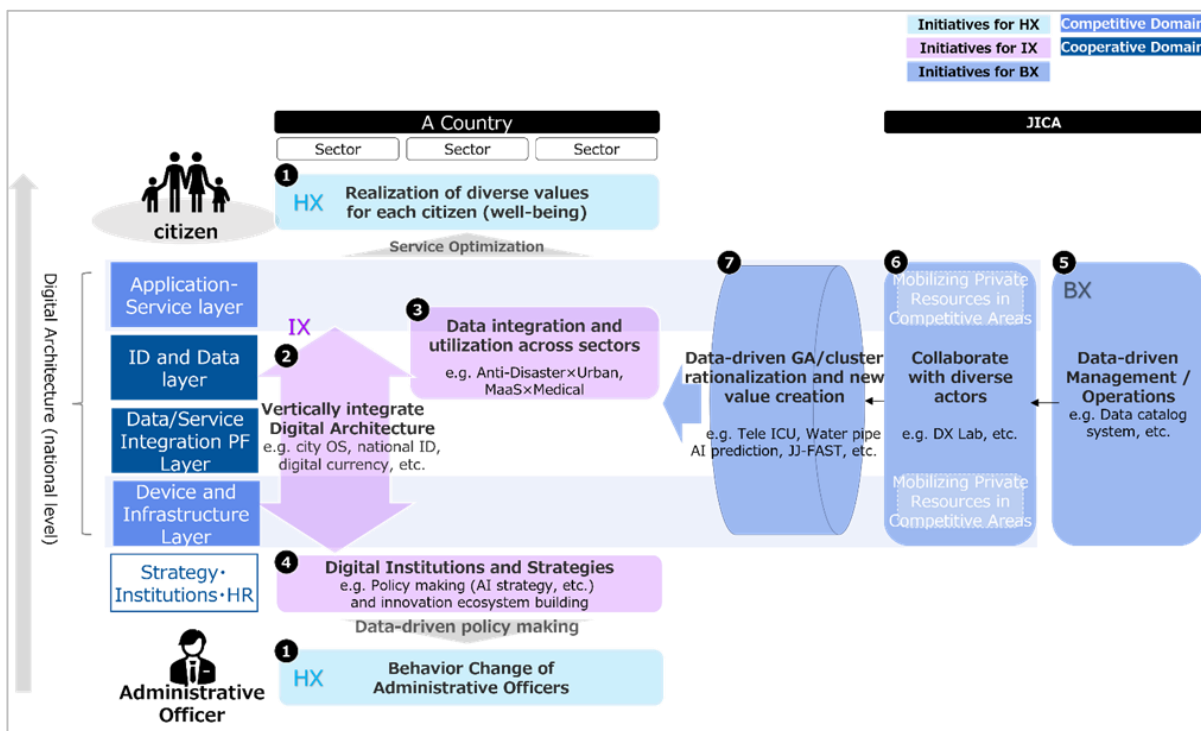


Figure 26 Specific efforts to realize HX/IX/BX

The suggestions obtained from the pilot activities in the six countries are organized in terms of (1) through (7). The explanation is developed based on the summaries shown in the following figures and tables, but for detailed suggestions, please refer to the reports of each pilot in the Appendix.

Human Transformation	1	Realization of diverse values for each citizen (well-being)	<ul style="list-style-type: none"> - While each donor intervenes in the digital sphere, an effective approach is to organize the measures based on the "data value chain," which includes the collection, accumulation, and visualization of data, to find the point of JICA's intervention. In particular, since other donors have not intervened in the area of data acquisition, JICA may be able to provide added value to the recipient government. - To verify the accuracy of the data and to collect the kinds of data that can only be collected from the perspective of the final beneficiary (e.g., satisfaction with administrative services), an approach to have direct data contact with the final beneficiary is effective. 	Uganda (Refugees)
	1'	Behavior Change of Administrative Officers	<ul style="list-style-type: none"> - In order to visualize data in real-time, which is essential for promoting EBPM in government, it is recommended to encourage discussions with counterparts for consensus-building based on a "moving mockup" that can be imagined. Since the number of data sets to be connected is a cost driver, it is important to define the necessary data sets in the final output agreed upon based on the mockup. - In addition to fostering the above image, support should be considered in combination with capacity building to ensure that digital measures do not end up as a one-time effort. - Establishing a system that allows both administrative staff and frontline end-users to check real-time data based on the same decision criteria is effective in practicing EBPM and fostering capability. 	Mauritius (Disaster Mgmt /Urban OS) Uganda (Refugees)
Industry Transformation	2	Vertically integrate Digital Architecture	<ul style="list-style-type: none"> - In considering where to deploy support, it is effective to screen in terms of (1) leadership, (2) infrastructure and human resources, and (3) legal system - Cooperation on vertical integration of digital architecture also has significance for Japanese diplomacy Mauritius - Project promotion requires an approach to explore JICA's points of intervention, based on extensive information gathering and organization, including rational priorities on the topic being addressed, the development of the country's digital infrastructure, and trends of other donors who are implementing interventions in various areas. - It is essential to define the areas of intervention for public institutions in a way that generates synergy with private sector projects, taking into account the separation from the private sector. 	Mauritius (Disaster Mgmt /Urban OS) Cambodia (Finance)
	3	Data integration and utilization across sectors	<ul style="list-style-type: none"> - In order to integrate data across sectors, it is essential to set up use cases that can be shared by all parties involved by examining services from the perspective of user needs without being bound by the existing jurisdiction and industrial structure of government agencies. In the process of service design, a system should be established to identify three types of stakeholders: ministries and agencies that coordinate with each ministry, ministries and agencies that understand the needs and lead the consideration of use cases, and ministries and agencies that lead the consideration of systems. 	Mauritius (Disaster Mgmt /Urban OS)
	4	Digital Institutions and Strategies	<ul style="list-style-type: none"> - Digital policies have the potential to contribute to the improvement of policy capacity, stabilize and develop domestic industries, and boost foreign direct investment and capital inflows by gaining the trust of foreign companies. - In considering digital measures, the success or failure of digital measures in government will depend on whether a certain amount of data flow can be secured after acquiring users and expanding their use. In particular, the government will be required to actively promote the use of digital technology to the segments that are not easily covered by the private sector. 	Cambodia (Finance)
Business Transformation	5	Data-driven Management / Operations	<ul style="list-style-type: none"> - In order to realize continuous project evaluation, it is essential to establish a digital contact point for the continuous collection of data, as temporary surveys are insufficient. - In order to verify the degree of progress in solving local issues and the effectiveness of JICA's various initiatives, it is necessary to clarify the issues to be monitored and the hypotheses of the factors and collect appropriate data. In particular, core data items that should be obtained and accumulated for each cluster should be defined. - When exchanging data with the recipient government, it is important to gain the trust of the recipient government in order to receive the data necessary for analysis. 	Uganda (Refugees) Thailand (AI, Infrastructure)
	6	Collaborate with diverse actors	<ul style="list-style-type: none"> - From the perspective of the co-creation partner, while respecting JICA's traditional processes, it is necessary to flexibly seek quicker ways to formulate deals and contracts that match the business practices of technology companies, and for those in charge to have business-based conversations, timelines, seating arrangements, and consideration for intellectual property. - JICA can fulfill its accountability by utilizing XAI (explainable AI) technology regarding collaboration with AI services that is difficult to explain to the public. In addition, it is essential to have mutual recognition among stakeholders that AI gives hints rather than answers. 	India (PPP)
	7	Data-driven GA/cluster rationalization and new value creation	<ul style="list-style-type: none"> - By shifting from a post-solution approach to a predictive and preventive approach, the range of approaches that can be implemented immediately and at a lower cost (soft approaches) than infrastructure construction and renovation (hard approaches) will increase, enabling the formation of a portfolio of projects based on screening and leading to the rationalization of GAs and clusters. - Even if the technology/solution is "dead" on its own, it can lead to the creation of new added value depending on the combination of ideas. - It is necessary to develop frameworks for information exchange and co-creation with other private sector companies to collect seeds on a regular basis, as well as to carefully examine existing projects as needs, create opportunities for improvement, and design budgets that leave room for the introduction of digital technologies. 	Vietnam (Water/Environment) India (PPP)

Figure 27 Suggestions from the pilot activities

What is Digital Architecture?

As a first step toward the realization of digitally based nations and cities, each country and city will need to develop and operate an electronic platform that enables developing country governments to integrate and utilize data across domains, and a management system to create a variety of user-driven services. This is the architecture for data utilization (see figure below). This architecture is an evolution of Germany's Industry 4.0 into a new human-centered era, as defined by the Cabinet Office for the realization of Japan's Society 5.0, and has been developed for introduction in developing countries. In addition to the above, this architecture also requires the strengthening of organizational capacity to utilize and create digital services, and the development of rules to ensure that data is used correctly for the benefit of users. In addition to supporting the development of both software and hardware, it is important to separate and organize the platforms and systems as the cooperative domain and the services as the competitive domain.

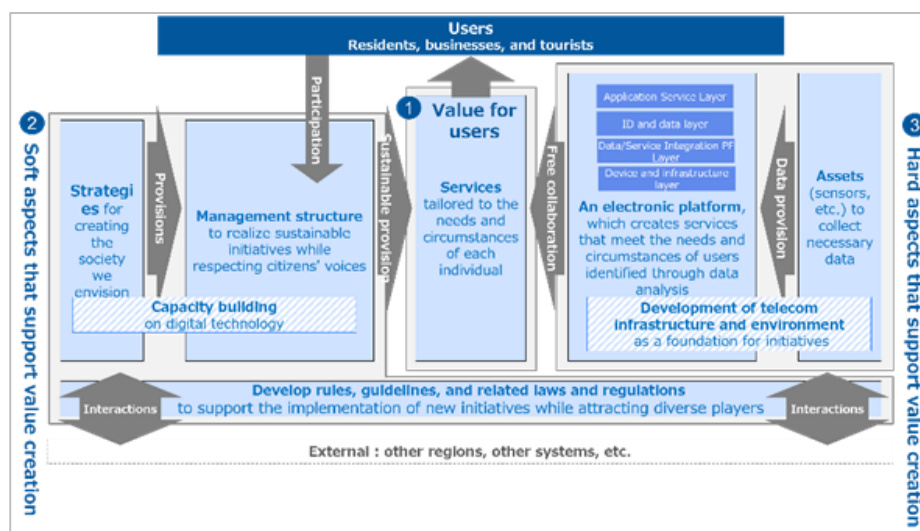


Figure 28 Architecture for utilizing data in countries and cities

In addition, the layered structure that is necessary to realize this architecture, especially in the digital domain (digital collaboration platform), is called digital architecture. The digital architecture is divided into the device and infrastructure layer, the platform layer that integrates data and services, the ID and data layer, and the application and service layer, and it is necessary to consider the necessary functions and the division of roles between the public and private sectors based on the national strategy that each country wants to achieve. The specific functions of each layer are described below. The device infrastructure layer consists of hard assets such as IoT devices that serve as the source of data collection, and functions to collect, control, and manage

data from hard assets. The data/service integration PF layer has the functions of storing, storing, and managing data, and integrating multiple data or services, rather than a single one. Finally, the application/service layer is a digital interface such as an application or website that serves as a direct beneficiary contact point for end users such as citizens, and refers to services, mechanisms, products, etc. that generate external value for end users such as citizens and businesses.

Human Transformation

1): Realization of the diverse values of each citizen (Well-being)

- **In the digital domain, each donor is intervening according to its own objectives. In this context, an effective approach is to organize each measure based on the "data value chain," which includes data collection, accumulation, and visualization, to find the point of JICA's intervention. In particular, since the data acquisition part requires on-the-ground work that other donors have not intervened in, JICA could provide added value to the recipient government by taking on this part.**
- Since the health sector is a life-dependent area, each individual theme is traditionally important as a development issue, and donors often intervene on an individual issue basis, making it difficult to implement measures such as cross-sectional data accumulation. In the Ugandan health sector, where the pilot activities were conducted in this survey, there was a unorganized data value chains in the 91 systems. The health sector, in particular, has a large number of donor interventions related to digitization in the past, and has accumulated more experience in digitization than other sectors. Therefore, systems with different goals are fragmented and built by organizations with different missions, with some donors focusing on interventions in the health sector and others focusing on cross-sectoral interventions such as refugees. As a result, the ministries and agencies in charge of ensuring data interoperability between these systems (which do not necessarily have IT functions) are required to perform very sophisticated system integration and coordination functions. In order to discuss and agree on the points of JICA's intervention among the parties concerned, it is necessary to consider the intervention of each donor at the user level (local to national level) and the data value chain (national to local level) as shown in the figure below. In order to discuss and agree on JICA's intervention points among the stakeholders, it was effective to take a bird's eye view approach by mapping each donor's interventions at 2the user level (local level to national level) and data value chain (collection, integration, accumulation, and visualization) as shown in the figure below. Looking at the example of the Ugandan health sector, as shown in the figure below, it was found that there was a bias in the value chain of data collection

and data visualization in Lv.1⁹ hospitals with weak medical facilities. In Uganda, the data collection in intermediate hospitals such as Lv.2 and Lv.3 is the missing middle where neither donors nor the Ministry of Health have been able to intervene to implement systems, and where the needs of the Ugandan government are the highest. This was the point where the needs of the Ugandan government were highest.

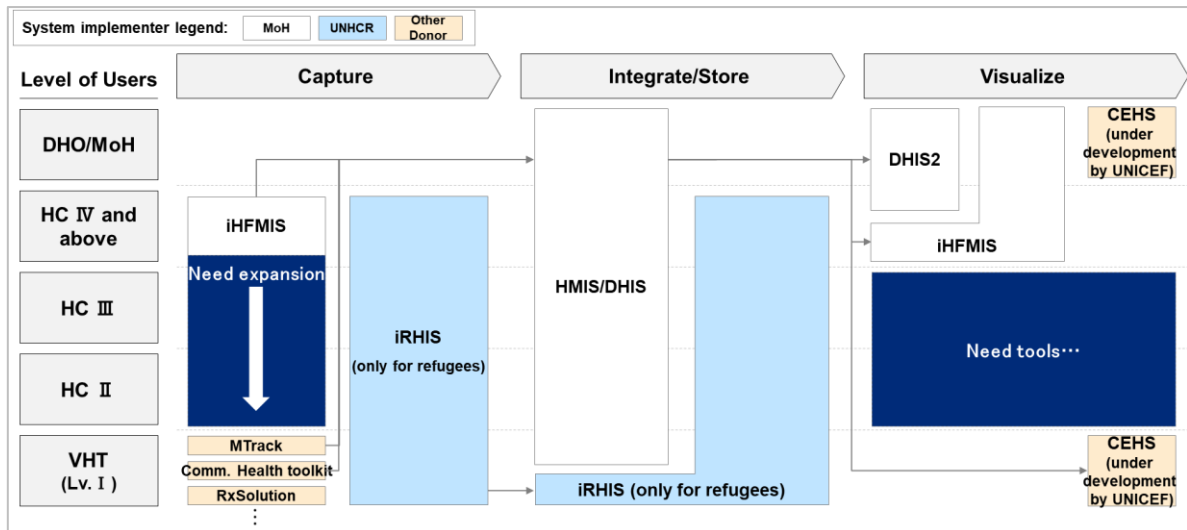


Figure 29 Organized by data value chain

- ✧ Thus, donors tend to collect sufficient data on their own according to the interests of each organization, and there are areas where donor interventions have not been pursued in an approach that respects the existing system and supports the collection of missing data items. In the health sector, where many donors intervene, it is necessary to be cautious about JICA's independent intervention. In situations where data interoperability is not ensured or the granularity of the data accumulated is insufficient, JICA could intervene as a facilitator of communication, for example, by operating a working group to standardize data items and granularity between partner governments and donors. This is also an effective way of providing support.
- ✧ Therefore, it is essential that consultants with strengths in the digital domain intervene in basic research to lay the groundwork for the establishment of a system and capability to promote the digitization of data collection and management processes on the government side.
- ✧ The key to getting the government to commit to digitization is to quantitatively

⁹ In the Ugandan health sector, health facilities are categorized into National Hospital, Regional Referral Hospital, General Hospital, Health Center, and Level I-IV, depending on the function of the facility, the range of services provided, and the number of people covered as the target population. Level I-IV. Level I corresponds to the lowest classification.

demonstrate the benefits of digitization. In the Uganda PoC, the benefits of digitization were quantitatively presented in terms of quality (improvement of the accuracy of the acquired data), cost (reduction of the workload), and delivery (reduction of the lead time for data acquisition), in addition to the necessary costs borne by the recipient government. This made it possible to examine and discuss the specific cost-effectiveness of the measures, and to draw out the commitment of the Ministry of Health.

- As a more macroscopic intervention, an approach such as developing a concept of organizing the entire data value chain is also possible. This could include investigating the interoperability between systems and drawing a cost-effective data flow that maximizes the use of data that can be obtained from existing systems. In this case, the image shown in the figure below should be considered with a view to collaboration not only with the government but also with industry and academia. Since academic institutions are strong in defining upstream data items and the private sector is strong in downstream data utilization, it is important to have a bird's eye view and organize the data by mapping out the policies of each country and sector, rather than necessarily having the public sector be responsible for all data acquisition and accumulation.

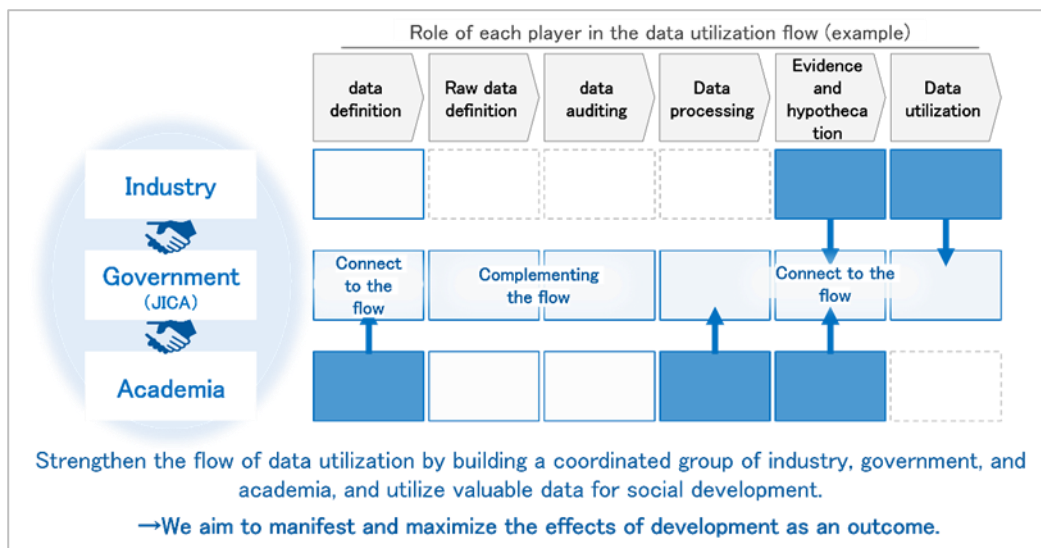


Figure 30 Organization based on industry, government, and academia

- On the other hand, if individual systems are introduced without a wholistic view of the data value chain, not only there will be risks such as duplication with other systems, but also the systems will have low interconnectivity, which will impose a heavy burden on the recipient government. (It is important to note that, when its not well designed, it could be very difficult and labor-intensive to integrate multiple systems and can lead to higher running cost as a whole).
- **In order to verify the accuracy of data and to collect types of data that can only be collected**

from the end beneficiary's point of view (e.g., satisfaction with government services), an approach with direct data contact with the end beneficiary is effective.

- In order to "realize the diverse values of each individual" in the rapidly changing digital age, it is important to have a PDCA (Plan-Do-Check-Act) process to continuously and flexibly improve measures in the course of activities. In particular, it is effective to have a mechanism to continuously collect the responses of the end beneficiaries to each measure. However, there are many cases where intermediate data collectors intervene between the end beneficiaries and the system, and there are hurdles in terms of both accuracy and data items. In Uganda, it was confirmed that the accuracy of data varied among regions and data collectors, and there were data items that could only be picked up from the user's point of view, such as satisfaction with the hospital and waiting time at the hospital. In such cases, an approach with direct data contact with the end beneficiaries may enable more accurate data-based decision-making and service improvement.
- In the case of fields where it is difficult to establish an operation to collect sufficient granular data on a regular basis (e.g., refugee assistance), the challenge is how to collect data without additional workload for the staff in the field. In this sense, it is effective to collect data directly from beneficiaries or citizens in the target area, rather than through the local government, NGOs, or public organizations. For example, IVR (a method of data collection via cell phones), which was tried in Uganda¹⁰, is considered to be particularly effective in collecting data on items for which it is difficult to obtain regular user information (e.g., user attributes and behavioral trends at water supply facilities, measurement of citizens' financial literacy levels).
 - ✧ In this pilot of IVR solution from Viamo¹¹, patients were asked to respond to a survey on their evaluation of the services they received at the facility, and the possibility of utilizing new types of information (information from the patient's point of view, evaluation data, etc.) that had not been readily available to medical professionals was also examined. As a result of the pilot activities, we were able to collect a sufficient amount of data (more than 10,000 inquiries and more than 4,000 complete responses) within a few months after the deployment of the IVR, indicating that there is a certain potential for obtaining a large amount of data using a citizen-initiated data collection method with incentives.
 - ✧ In addition to data collection through questionnaires, the technology can also be used for community-based comprehension tests. Viamo has a presence in 20 countries in Asia and Africa, and the technology could be used in other countries where JICA has projects. Viamo

¹⁰ Citizens can call the toll-free number anonymously and receive a top-up incentive by entering their information along with an automated announcement during the call.

¹¹ Viamo: Viamo is a service provider that enables the provision of information and data collection for citizens of developing countries through the calling function of cell phones. Since its establishment in 2006, the company has been providing its services to donor agencies such as USAID in several countries in Asia and Africa.

has a presence in 20 countries in Asia and Africa, and we believe that it could be used in other countries where JICA has projects.

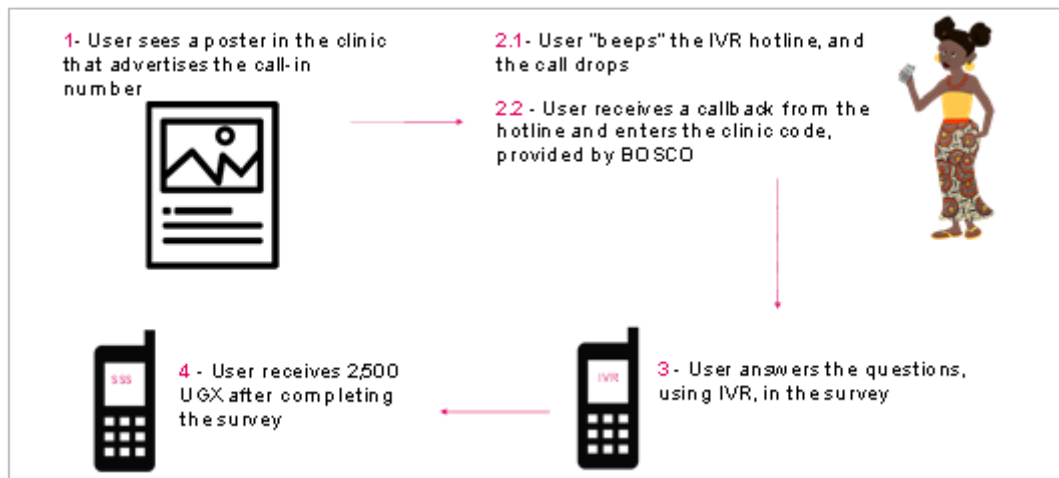


Figure 31 How IVR works (Viamo’s document)

1)’: Behavior change of administrative officers

- **In order to promote EBPM among government officials, it is essential to visualize data related to the needs of government and citizens and the effects of measures in real time. In this regard, the creation of a "moving mockup" that allows us to visualize the final goal will make it easier to elicit the opinions of counterparts promoting digitalization and target users of the system/service on issues in the field. It will accelerate engagement by facilitating discussions to build consensus on digital implementation. This can accelerate engagement. In actual service implementation, the number of data sets (data aggregates/types) to be connected is a cost driver, so it is essential to define the necessary data sets based on the service proposal agreed upon with related parties on a mock-up basis.**
- In the Mauritius pilot activity, a mock-up of a dashboard for government officials was created and presented to examine the value of the digital collaboration platform for them. Especially in improving the efficiency of disaster management in both peacetime and emergencies, assuming that government officials (disaster prevention and mitigation authorities) would use the platform. In order to verify the value of the digital collaboration platform to the government, especially in terms of improving the efficiency of disaster response administration in both normal and emergency situations, we created a mock-up of the dashboard for government officials. We examined the usability and ease of use of the digital collaboration platform for users (mainly government officials related to disaster prevention), as well as the state of the platform from their perspective of whether it would be useful in actual disaster prevention and mitigation administration. This was to visualize the current issues in government agencies working on

disaster prevention and mitigation, and to identify use cases that can be improved and advanced through the use of data. Thereby understanding the existing issues and create solutions that can improve the information sharing among related government stakeholders. As a result, by presenting concrete use cases as mock-ups through this pilot, we were able to share and showcase value creation from the user's perspective. This enabled to clarify the value of "DX" to government officials. In addition, by defining the necessary data items based on the mockup-based service proposal (see figure below), we were able to proceed with the study with a sense of reality, including the scale of the budget that may be required for implementation.

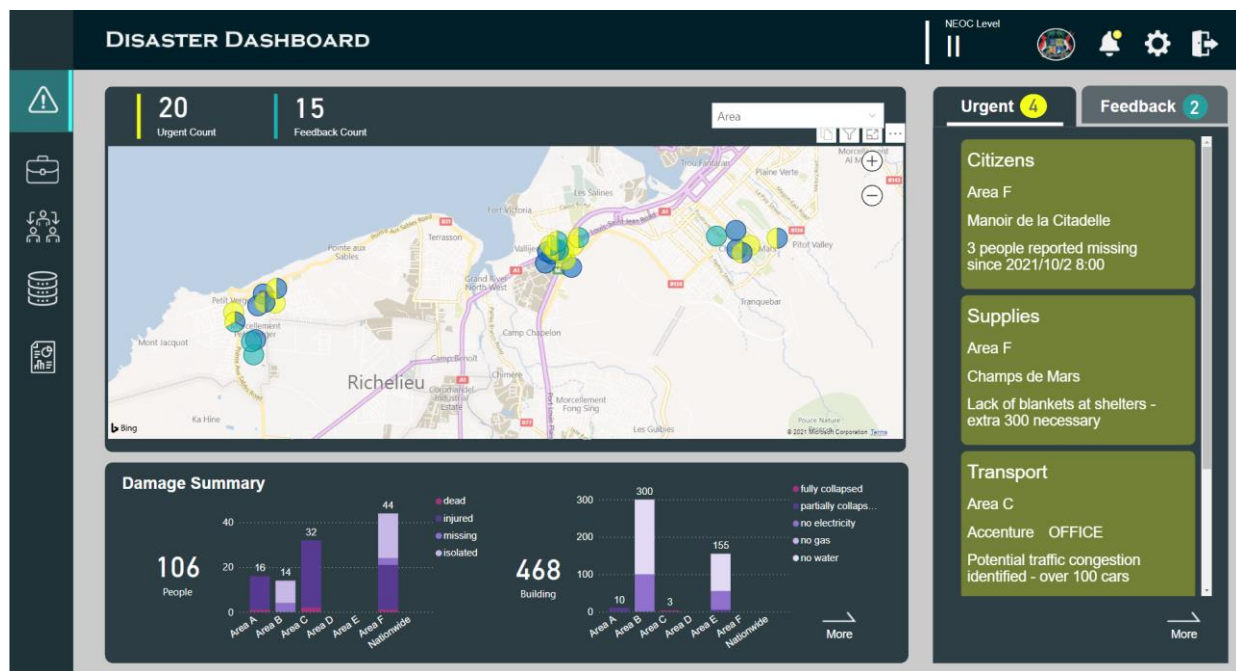


Figure 32 Dashboard image

	Static (base data)	Dynamic (data to monitor over time)	Disaster
National Level Data	<ul style="list-style-type: none"> Topography Rivers and lakes 	<ul style="list-style-type: none"> Forecast (rainfall, wind, temperature, sea level, etc.) Weather monitoring Other monitoring (water, air, soil) 	<ul style="list-style-type: none"> Warnings and bulletins Incidents Damage records (people, buildings) Emergency supplies Analyzed risks
	<ul style="list-style-type: none"> Census Zoning Infrastructure (utility, transport, drainage) Building registration 	<ul style="list-style-type: none"> Personal data (health, properties, finances, location/moves, etc.) SNS GPS data (people, transports, etc.) Imagery data (public cameras/satellite) Utilities Infrastructure conditions Construction/Maintenance works 	
Administrative Documents	<ul style="list-style-type: none"> Policies / Regulations / Agreements SOPs / Guidelines Events Task plans (incl. KPIs, resources) 	<ul style="list-style-type: none"> Teams (incl. location, contact details, assignments, skills) Resources Task progress 	
	<ul style="list-style-type: none"> Research / Field studies / Analysis Reporting Educational/ Training materials Communication (incl. chat, call) Minutes / Decisions made 		

Figure 33 Definition of data items

- **In addition to building the image described above, in order to ensure that the digital measures do not end up as a one-time effort, support should be considered in combination with capacity building for the client to build sustainable operations.**

- In regards to the communication with the government of Mauritius, since we were able to showcase through mockup and as it gave sense of reality, there were lot of interest in realization, thus questions related to technical specifics (e.g., data acquisition and processing methods during power outages, as there was a lot of anxiety about the risk of not having electricity or internet infrastructure or not being able to use mobile devices during a disaster). On the other hand, it was difficult to deepen the discussion on the medium- to long-term vision of data utilization, such as how to utilize the data for disaster prevention and mitigation. Therefore, in addition to capacity building for the development and maintenance of assets, including data and infrastructure, it is necessary to create manuals and provide training on the use of systems and services so that counterpart government officials can feel comfortable using and understand the importance of data utilization. This is vital to make effective decisions based on data at the actual disaster prevention and mitigation sites.

- From the perspective of capacity building, it is also important to consider how to secure the human resources and budget to maintain and manage the digital collaboration platform system. This point has actually been pointed out by the Ministry of Information Technology, Communication and Innovation (MITC). Therefore, in case if Mauritius government request for support and Japanese government decided to supports the introduction of a Digital Linkage Platform(DLP), it is vital to pre-assess. Assessment includes the budget scale and maintenance capacity of the government so that it would be sustainable for their government after development.

If in case of budget and capacity is limited, it is necessary to start small and minimize the project to make sure that its feasible. Meanwhile, make sure to support to strengthening the capacity of related government official through on-the-job training (OJT), so that they will have a capability to enhance and carry out the further development. In perspective of the shortage of human resources within the government, it can be resolved by seeking collaboration with local vendors and having them learn the know-how on system maintenance and management. For this reason, it is also important to understand the situation of local vendors prior to the project.

In addition, by quantitatively measuring the effectiveness of the DLP within the framework of the cooperative project, it can be expected that the fiscal authorities of the destination government will be convinced to take budgetary measures for subsequent maintenance and management.

- As a step to be taken in the future, the government of Mauritius should not only compare the current system (Info-Highway) with the DLP and identify the necessary functions when introducing the DLP as an IT system, but also need capacity building in terms of both data utilization and system maintenance and management. This pilot project was able to share the importance of sharing the concept of "data-driven development" among stakeholders and

designing specific use cases, and were able to gain their understanding.

- **Establishing a system and process that allows administrative officials and field staff to check real-time data based on the same decision criteria is effective in fostering organizational culture and capability to implement EBPM.**
 - In the Uganda pilot activity, we created a mock-up dashboard to promote EBPM among District Health Officers (DHOs) in the health sector in the West Nile region. It verified whether the dashboard would function effectively in improving the administrative officers' budget allocation decisions. As a result, the Ugandan Ministry of Health and local government officials stated that in order to realize budget allocation according to the number of users of health facilities and the attributes of refugees/nationals, it is important to establish a visualization method that "shows data in a form that can be used for decision making" such as changes in key indicators. Especially in order to promote discussions among government officials and health facilities with a common understanding of the current situation and issues and to build consensus and make decisions with a sense of conviction among stakeholders.
 - ✧ Currently, the data visualization tools in the Ugandan health sector are not easy enough to be use at the local field facility staff. As a result, each facility is unable to share with the local administration the requests and issues that they want to communicate through data reporting, and the budget is allocated only from the perspective of the local administration, making it difficult for the facility staff to feel the benefit and importance of reporting data.
 - ✧ When we created a dashboard that shows the gap between the assumed capacity of facilities to receive patients and the actual situation, we received feedback from DHOs such as, "This is useful when discussing budget allocation with the Ministry of Health, donors, etc. If the data can be visualized in accordance with specific criteria and indicators, rather than simple aggregate results, it will be possible for administrative officials in developing countries to link the data to specific discussions and judgments for policy decision-making."
 - ✧ On top of that, the DHO said that by setting up a system that allows each facility to monitor indicators and KPIs with accessible data visualization tools, it will also encourage facility staff themselves to make efforts to improve their operations based on the data. This suggests that EBPM can be implemented not only by government officials who make planning and budgetary decisions, but also by front-line staff who operate public services, who can become important stakeholders and beneficiaries in EBPM practice.
 - Day-to-day decision making by government officials is already being done through data, whether paper or electronic. The acquisition of data that could not be obtained before, the improvement of real time, and eventually the increase in the total volume and distribution of data (data flow) in the entire country or sector will greatly improve the quality of decision making and change the behavior of government officials. Therefore, even with the support of switching data collection

methods from paper-based to simple IT terminals, the actual living conditions and issues of local citizens, which have not been revealed in the past, can be accurately and quickly grasped as digital data at a finer granularity, making it possible to examine and allocate resources to measures that are in line with the actual issues of local society and citizens (EBPM). This will enable us to examine measures and allocate resources in line with the actual issues of local society and citizens.

Industry Transformation

2): Vertical integration of digital architecture

- **When considering where to deploy support for the vertical integration of digital architecture, which will enable the integration of applications and various devices linked to IDs, etc., so that they can be managed collectively, it is effective to screen from the perspectives of (1) leadership, (2) infrastructure and human resources, and (3) legal systems.**
 - Mauritius has a vision and policy documents to promote government digitization, and the government agencies in charge and the higher level agencies that can coordinate the ministries are committed to the vision. The country has the most advanced ICT infrastructure in Africa, as well as the IT systems that form the basis of Digital Linkage Platforms (DLP), such as Info-Highway. Due to the small population, the total number is not large, but there are local vendors and technicians who could collaborate in the implementation, operation, and maintenance of DLP. The coverage of the mobile network is high, and there are citizens who can use the DLP when it is installed. The fact that Mauritius is a small country in a good sense is also an important factor. If Mauritius were dealing with a large country with strong local authority, it may be better to consider local level implementation rather than national level DLP.
 - These various conditions seem to be the necessary groundwork for examining vertical integration support partners for digital architecture in the first place. These screening conditions are summarized in the table below.

Table 7 Screening conditions

1. Leadership

Is there a government agency dedicated to building, promoting, and maintaining a digital strategy roadmap?
Does the agency have a strong inter-ministerial coordination function?
Does the country have a standardized approach to the delivery of government online services?
Are administrative units that can promote effective decision-making being considered for implementation of digital architecture?

2. Infrastructure, Human resources

Does the government have the infrastructure to enable and maintain digital services?
Does the private sector have local vendors with whom it can collaborate in the development and maintenance of digital services?
Does the public have access to and awareness of digital services?
Is there a secure infrastructure to ensure stable digital service delivery throughout the country?

3. Legislation

Does the country have the basic principles to enable data use and digital ID?
Do citizens trust the overall environment for digital services and the country's level of commitment to cybersecurity?
Does the government use and promote access to publicly available government data?
Does the government have a well-established democratic process for passing new regulations?

- On the other hand, in countries where the digital architecture environment is weak (such as Uganda), the foundation for promoting digitalization is not in place, and it is necessary to consider the content of support while paying attention to support from the fundamental preparation. For example, in the pilot activities in Uganda, inadequate power infrastructure and communication networks in rural areas became a hurdle to the promotion of digitalization. In such a country, even if there is a system for data collection and storage established by the local government, it may not be widely used. In Uganda, there is a system developed by the Ministry of Health that allows health facilities to enter and collect patient data, but this system has not been disseminated to field health facilities. In such a country, instead of investing resources in building a new system, we should first identify existing systems operated by the local government that should be disseminated in order to collect basic data (in the case of the health sector, the number of patients, patient demographics, etc.), and then promote their adoption. Support is required to remove obstacles to digitalization, including infrastructure issues.
 - ✧ As for infrastructure issues such as power and communication, off-grid energy companies, which have been expanding in the past 5 years, are actively providing affordable and digitally compatible power and communication solutions to the market. In collaboration with such private companies, we can support the overcoming of infrastructure issues and digitization based on a scheme that does not require large initial investments such as power grid construction, as well as maintenance and usage costs. On top of that, capacity building support to enable users to use the system in the field, such as training for health facility staff and other potential users of the system at the data collection point, is also necessary to promote the introduction of the system in the field.
- **Cooperation on vertical integration of digital architecture also has significance for Japanese diplomacy.**
 - One of the pillars for realizing a "free and open India-Pacific" is the pursuit of economic prosperity, which consists of strengthening (1) physical connectivity through the development of high-quality infrastructure such as ports, railroads, roads, energy, and ICT, (2) human connectivity through human resource development, and (3) institutional connectivity through the facilitation.
 - ✧ For example, Mauritius, which is located in Africa and aims to connect the Indian Ocean with the rest of the world, has an ICT infrastructure called Digital Linkage Platform (DLP). If Mauritius is to be used as a gateway to third countries, it can contribute to the realization of free and open data distribution.
 - This could be an opportunity to promote the Japanese government's DFFT concept and show leadership in data utilization.
 - ✧ The government proposed "DFFT (Data Free Flow with Trust)" at the Davos Forum in

January 2019. The concept is that in the digital society of the future, data, which is the source of competitiveness, should not be held by a particular country, but should be freely distributed in principle, while ensuring privacy, security, intellectual property, and other safety issues.

- ◇ In the vertical integration of digital architecture, it is necessary to intervene not only in the narrow sense of digital architecture (device layer, data layer, etc.), but also in the broad sense of architecture support, such as the formulation of strategies to create the society that citizen want. At this time, based on the concept of DFFT, it is assumed that appropriate areas of cooperation and competition will be defined (mainly the application/service layer and the device/infrastructure layer are considered to be competitive areas in the private sector) to promote the construction of a sound digital economy.
 - ✓ It can be pointed out that when a platform with the same architecture is deployed in a country or region, a virtual economic zone is shared. For example, if a company that implements an application on an operating system in the city of Aizu-Wakamatsu deploys a similar platform in another country, the technical and psychological hurdles to deployment in that country will be greatly reduced, and the company may be able to attract foreign investment to Japan and further deploy the advanced example to a third country to form an economic zone. It is possible.
- The key to the vertical integration of digital architecture is the relationship of trust with data providers, and by advocating Opt-in data acquisition that embodies the concept of Society 5.0, JICA can provide support that is uniquely Japanese and distinct from other donors. Through this, JICA will be able to continuously establish its position as a trusted partner in the digital age, and provide an opportunity to embody JICA's philosophy of "Connecting the world through trust" in the digital age.
 - ◇ Opt-in data acquisition refers to an approach to data acquisition that assumes the consent of the individual who provides the data. In contrast, Opt-out data acquisition refers to the approach taken by giant U.S. platform companies and China's state-led DX promotion. This approach is attracting attention from other countries as a uniquely Japanese approach.
- **The promotion of projects for vertical integration of digital architecture requires complex and sophisticated coordination between IT-related ministries and line ministries as well as the policies of top government officials. An approach to explore JICA's intervention points is necessary based on extensive information collection and organization, including the national priority of the theme being addressed, the country's digital infrastructure development, smartphone penetration rate, and data collaboration functions among government agencies, as well as the trends of other donors implementing interventions in each area.**
 - The pilot activity in Mauritius dealt with cyclone preparedness, which is a priority issue for the country. This project involved the vertical integration of digital architecture and data integration

and utilization across sectors such as disaster management and cities. Therefore, in order to estimate the acceptability of the project to the local government, it was important to find out the extent to which the existing IT system was being used and the data was being coordinated among government agencies. In fact, in the disaster prevention and mitigation administration, although data linkage among government agencies is conducted, it is mainly through analog exchange of information using telephones. Therefore, we were able to confirm that the client is receptive to data collaboration, at least between government agencies. In addition, the platform is one layer below the services visible to the general public, and the ministries in charge of the various fields and ministries in charge of promoting digitization across the board, which fully understand the needs and importance of the platform, have shown a high level of interest and commitment. This is one of the key factors in determining whether to intervene.

- Since there are number of related ministries and donors working in each sector, it will be effective to take an approach to create overall optimization by not only collecting information on the current status of IT measures and future plans, and examining strategies for each sector (in this case, the need to realize "Safe Tourism" in disaster prevention and tourism was mentioned), but also by coordinating among siloed government agencies. In the pilot project in Mauritius, JICA designed a systematic framework for the future development of the project, not only by organizing the responsibilities and relationships of the relevant ministries and agencies, but also by intervening as an entity that maximizes the overall effect of the project, including other donors.

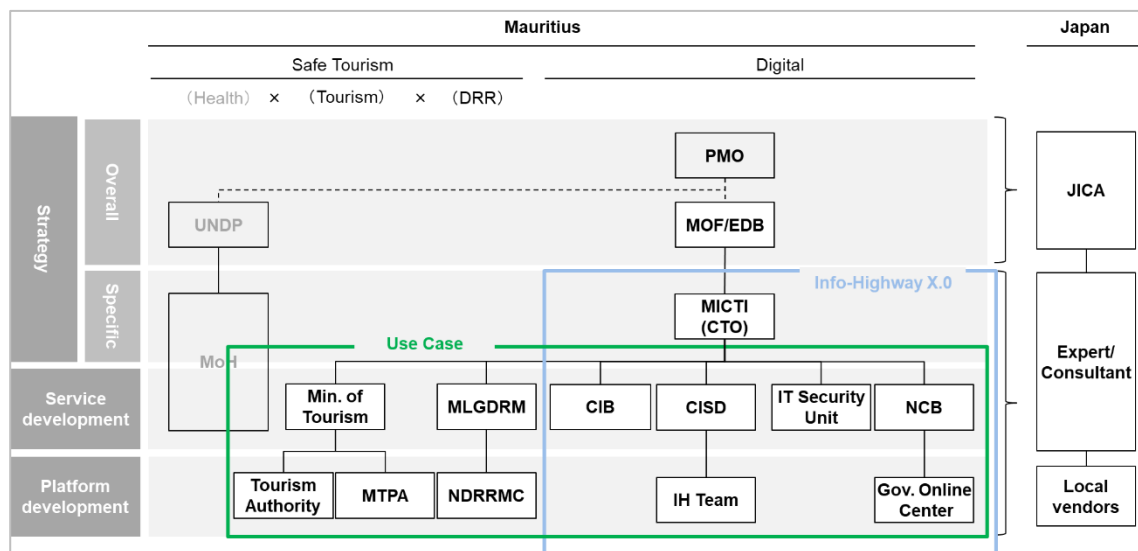


Figure 34 Proposed structure for future efforts

- It is essential to define the area of intervention of public organizations in a way that generates synergy with private businesses, taking into account the separation from private businesses. It is effective for public organizations to set up areas where private companies can cooperate and areas where they can compete based on the digital architecture, and to avoid excessive

competition in the cooperative area and to promote service improvement through fair competition in the competitive area, thereby improving the productivity of society as a whole.

- We supported the promotion of Bakong¹² in the pilot activities in Cambodia. Since the start of the support, there have been some concerns about pressure on the private sector due to the similarity in the application layer of digital services, including applications for the public, with services provided by the private sector. For this reason, in the course of the pilot activities, the Bank shared with the central bank that it is necessary to approach the user groups that the private sector does not target in terms of cost effectiveness (rural residents and non-bank account holders) in the service layer that can also be provided by the private sector. Clearly stating from the government to the central bank's stance to stakeholders, including the central bank, payment service providers, government agencies, and those involved in supporting Bakong, is the best way to avoid misunderstanding and address the concerns of a private sectors.
- In order for Bakong to be used as a system that brings benefits to citizens and private businesses, we aimed to expand the value provided by the platform layer, such as having Bakong take charge of data linkage of IDs and other information commonly used by private businesses (corresponding to user ID authentication in the figure below). In order to establish collaboration with the private sector, we focused more on its characteristics as a platform that connects financial institutions and Fintech companies, and considered that it should become a hub for storing and linking data (authentication information, etc.) that is highly beneficial to businesses for common use. From this point of view, it is important to clearly define the common area where systems and services that creates value by cooperating, where government should play the role for the promotion of digital services within the country in another field or district. By doing so, we can expect to be able to expand the use of systems and services by citizens and companies while gaining the understanding of the private sector. Thus, in order to achieve vertical integration of the digital architecture, it is essential to define the competitive and cooperative domains (see the figure below), and to draw the intervention domains of public organizations that take into account the concerns of the private sector.

¹²A digital remittance and payment system using open-source blockchain, which the National Bank of Cambodia (NBC) has been operating for practical use since July 2019.

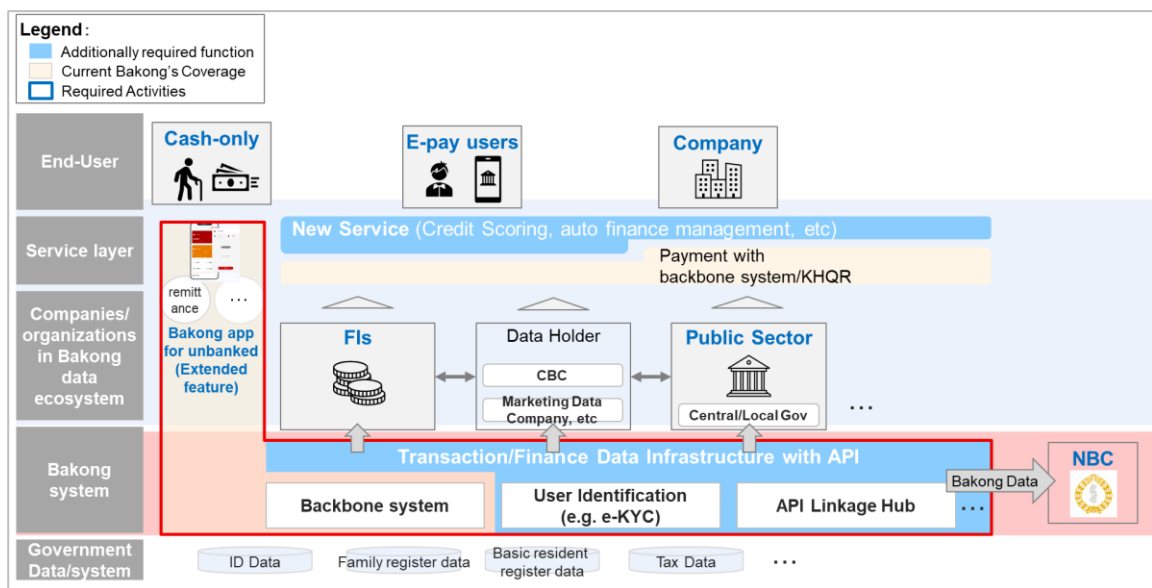


Figure 35 Competitive and Emphasis Areas of Bakong

3): Data integration and utilization across sectors

- **In order to promote cross-sectoral data integration and utilization, it is essential to set up use cases that will gain the sympathy of all parties involved by examining services from the user's needs, without being bound by the existing jurisdiction and industrial structure of government agencies. In the process of service design, the following three types of stakeholders should be identified and structured: ministries and agencies with coordination functions, ministries and agencies that understand the needs and lead the consideration of use cases, and ministries and agencies that lead the consideration of systems.**
- In the Mauritius pilot activity, as one of the cross-sectoral data integration and utilization feasibility studies on disaster risk reduction and urban development, we investigated and verified whether existing digital tools can be used to visualize flood risks based on urban development in the future, such as 30years and 50years from now. As a result, it was found that a combination of existing flood simulation tools and an existing urban development simulator can be used to visualize flood risks in future urban scenarios at a certain level. However, the government of Mauritius (National Land Drainage Authority) did not have a great need for the simulation, and the study did not materialize, because the current task of the government of Mauritius is to identify and address the land vulnerable to flooding at present and in the coming years. When there is such a gap between the needs of the government and the idea of the solution, it is difficult to get positive consideration for the implementation of the solution. In such cases, it is important to continue to carefully explain that the solution will contribute to the government's need to solve the problem, even if it is a roundabout way, while being careful to make sure to not to impose the solution that

they may not need. In this sense, it would be good if JICA could not only dispatch short term experts, but could also actively consider dispatching long-term experts who can gather local needs and information and carefully explain the value of the proposed solution.

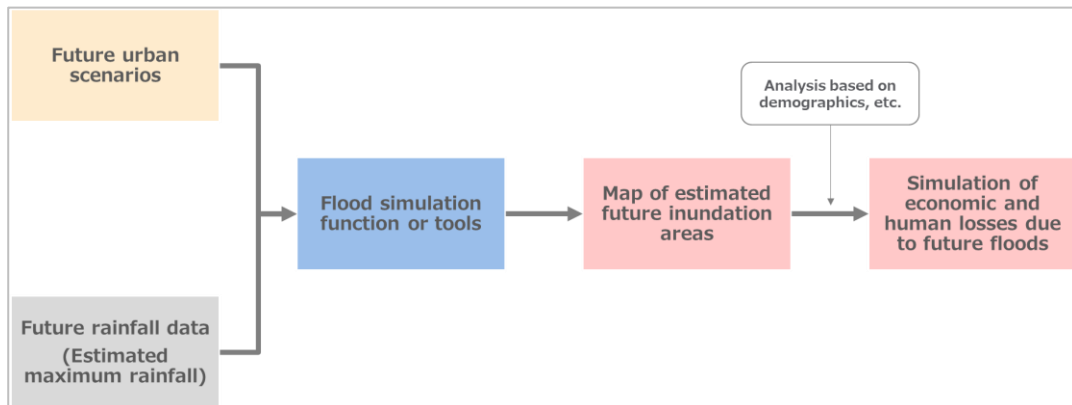


Figure 36 Process of considering solution ideas

- During the pilot activities in Mauritius, a disaster management dashboard to display real-time disaster information was also studied. In the process of service design of the dashboard, it was important to confirm which organization is legally mandated to collect data across sectors, since the required data exists across ministries. In Mauritius, the National Disaster Risk Reduction and Management Act 2016 is the basic law on disaster risk reduction. The National Disaster Risk Reduction and Management Council (NDRRMC) was established by the same law and has been designated as an organization that can assume the coordination function of each ministry. Therefore, the NDRRMC, which has a deep understanding of the needs of the government and has the function of coordinating the various ministries, was chosen as the main stakeholder, which facilitated the study of a "dashboard for the government" that can consolidate data across ministries. We also exchanged opinions with the Ministry of IT, which was in charge of examining the system, to understand the current system concept and future plans, and proceeded with the examination accordingly. In order to promote cross-sectoral data integration and utilization, it is essential to organize the mandates of each ministry and build a system that identifies the stakeholders who are responsible for coordinating ministries, understanding needs, and grasping the current status and future plans for the system.

4): Digital-related systems and strategies

- **The incorporation of digital technology into the system is expected to contribute to the enhancement of policy capacity of developing country governments in terms of improving governance of domestic industries and reducing the burden of system operation. This has the potential to stabilize and develop domestic industries and, as a result, gain the trust of foreign**

companies, thereby boosting foreign direct investment and capital inflows.

- JICA's goal for IX is to transform the industrial structure through the use of digital technology. This kind of activity is an effective approach in developing countries where the industrial structure is not mature and rigid. This section discusses the pilot activity in Cambodia (in the financial sector), where the central government provided support for a digital payment system. However, it is possible that the use of digital technology will also work effectively in other areas as a policy to address the industrial structure that contains vested interests and stakeholders. In other areas as well, the use of digital technology can function effectively (e.g., the elimination of corrupt intermediaries through the digitization of procedures for sending and receiving foreign human resources), and this is a point that should be fully considered at the stage of considering and planning solutions to social issues.
- In the Cambodian pilot activity, we supported the dissemination of Bakong and the increase of remittance data flow. We also discussed how to improve financial policies based on the assumption that transaction volume will increase. Through these discussions, we examined the potential contribution of digital-related policies to the common financial challenges of developing countries: (1) stabilizing monetary policy, (2) promoting the development of the domestic financial industry, and (3) attracting financial investment from abroad.
- First, with regard to (1) stabilization of monetary policy, we discussed how the dissemination of Bakong can contribute to the stabilization of monetary policy in three aspects. Firstly, from the perspective of understanding data on the volume of funds in circulation. Secondly, promoting the dissemination of the local currency by bridging the gap in convenience between the foreign currency. Thirdly, by circulation the local currency, and reducing the resources required to manage cash. Overall discussed the potential contribution of Bakong to the stabilization of monetary policy.
 - ✧ Data on the volume of funds in circulation: In countries where the rate of cash in circulation is still high and the informal sector has a large presence, there is a volume of funds that cannot be traced by the central bank. Especially when US dollar cash is used in the market, as is the case in Cambodia. Understanding the volume of funds in circulation as digital data is the first step for the central bank to consider policies based on a more accurate understanding of the real economy. In the case of a rapid increase in the popularity of private payment apps and services, there is a risk that the Bank will not be able to grasp the volume of funds in circulation in the real economy because the data will be stored only within specific companies, even if digitization progresses. In order to maintain the Central Bank's policy capability, it is important to establish a framework and system connection environment that ensures data linkage to the Central Bank in line with the promotion of financial sector digitization by the private sector.
 - ✧ Promoting the use of local currency: In countries like Cambodia and Laos where foreign

currency is widely circulated in the city. Thus, there is a big difference in value between the foreign currency and the local currency, and the unit of value of the local currency tends to be much larger than that of the foreign currency. Therefore, when citizens and businesses use domestic currency cash, they are subjected to various inconveniences and stresses compared to US dollar cash (carrying, exchanging, etc. many Riel bills), and US dollars are preferred for daily transactions and payments. However, when it comes to digital payments and remittances, there is no longer a difference in convenience between foreign currencies and local currencies, so the riel can be used for transactions in the city without any problems. The central bank is currently adjusting the domestic exchange rate between the US dollar and riel in favor of riel users and restricting the use of small US dollar bills in the city. This will strengthen the incentives for citizens and businesses to use the Riel, which will eventually lead to a shift to the circulation of local currency.

- ✓ In addition, the reduction in the cost and effort of sending and receiving funds through digitalization will lower the burden and cost hurdles for citizens, businesses, and the central bank in implementing bold measures. Such as directly encouraging the exchange of U.S. dollars for riel under the guidance of the central bank. Of course, other challenges, such as consensus-building with stakeholders, need to be overcome in order to implement a half-heartedly mandatory conversion to the Riel, but at least it will contribute to improving the viability of future options for promoting the use of local currencies.
 - ✓ If Cambodia can increase the use of its currency by using digital payment platforms in this way, it will be able to implement an exchange rate policy that allows for moderate exchange rate fluctuations, which will increase the value of the riel as a currency. If foreign companies and investors can see signs of an increase in the value of the riel, it will encourage investment in Cambodia, improve and stabilize the external balance of payments, and help secure a stable supply of foreign currency.
- With regard to the promotion of stable development of the domestic financial industry, we discussed how Bakong can contribute to the promotion of the development of the financial industry from the perspective of ensuring interoperability of financial services, preventing the oligopoly of funds and user bases to specific companies, and avoiding duplication of investment in the systems of private companies.
- ◇ Ensuring interoperability of financial services: By standardizing payment data and fund distribution systems, the government will be able to ensure interoperability even between services of different financial institutions and promote digitization of the entire financial sector in a way that citizens and businesses are not left behind. In countries like Japan, where digital payment applications are widespread, there is a tendency for fragmentation among payment services. In this case, each service provider can promote digitization and data

utilization within the range of users they can reach, but this will be an obstacle to achieving full digitization as services and systems continue to be fragmented (e.g., users cannot send money from company A's app to company B's app, and value exchange and data linkage between users will be confined to each service platform, so users with only company B's payment app will have to pay in cash at stores that only accept company A's payment app).

(3) Private sector

Before the rapid growth of private sector remittance and payment services caused this problem, Cambodia developed Bakong as a function of interbank remittance system, and the Central Bank of Cambodia established KHQR (QR code standard that allows remittance between different banks and payment apps) to promote its spread. In this way, the promotion of service digitization by the private sector was able to push forward the digitization of the entire sector without fragmentation, which can be said to have been an advanced initiative in light of the situation in other countries, including Europe and the United States.

- ✧ Prevention of oligopoly of funds and user base by specific companies: Rapid development of digital services by specific players can easily lead to oligopoly of funds and user base, which can increase the risk that deterioration in the management of specific companies will have a significant impact on the financial system. For example, platforms such as Facebook are prone to network externalities where the existence of a large number of users increases the utility of each user, but the digital payment and remittance market is also prone to monopolization by specific companies. In Cambodia's urban areas, ABA Bank's payment application has been growing in number of users over the past few years. Under such circumstances, there is a risk that the payment system may become dysfunctional in the event of a financial crisis or the failure of a particular company. Although the central bank did not mention this point, perhaps out of concern for the private sector, the fact that the central bank has developed a digital payment platform that can function as an interbank remittance system and a KHQR to ensure interoperability and convenience, in order to prevent bias toward specific players, may contribute to reducing the risk that the financial system as a whole may be affected by the business conditions of specific companies. It can be said that the Central Bank's development of a digital payment platform to perform interbank remittance functions and a KHQR to ensure interoperability and convenience has contributed to reducing the risk that the business conditions of a particular company pose to the entire financial system.
- ✧ Prevention of duplication of investment in the system by the private sector: The establishment of Bakong as a system infrastructure shared by the private sector is expected to encourage Cambodian financial institutions to focus their resources on activities that create high value-added services for citizens and businesses. As a result, a wide range of users of financial services will benefit from digitalization. Financial institutions that are not as financially strong compared with other larger financial institutions in the country, may not

have the capabilities and capital to invest in systems for digitization. As a result, citizens and businesses that use these institutions may be left behind. In order to encourage digitization of the entire financial sector, including wide range of financial institutions, the government should establish and operate a system for common use among the companies. It can help them to overcome the hurdles to promote digitization. In the digitalization of financial services, among the required system investments, inter-institutional remittances and mobile apps and wallets for customers are areas where inefficiencies occur due to duplication of investment among companies. Bakong is opening up these functions to banks, removing the need and cost for financial institutions to develop new ones. This is expected to lead to a reduction in capital investment in areas that do not lead to differentiation and an increase in capital investment in the development of services that truly benefit customers and users.

- (3) With regard to the promotion of attracting financial investment from abroad, we discussed how the strengthening of the central bank's policy capacity and the promotion of stable development of financial markets through (1) and (2) could increase overseas firms' confidence in the central bank and their expectations of financial market stability. Thereby reducing firms' concerns about foreign direct investment and promoting capital inflows. They also discussed how the promotion of stable development can increase the confidence of foreign companies in the central bank and the expectation of financial market stability, thereby reducing corporate concerns about foreign direct investment and promoting capital inflows.
 - ✧ The formation of a stable financial market and economic infrastructure is necessary to promote financial and corporate direct investment from abroad. The proliferation of local currencies through the promotion of the use of digital payment platforms will broaden the range of policy options that the central bank can take and lead to greater macroeconomic influence by the government. Currently, the Cambodian central bank is unable to influence the U.S. dollar, which has become mainstream in the market, and therefore can only use a few instruments, mainly a rigid exchange rate policy, when intervening in the market and economy. This is one of the reasons why foreign companies are reluctant to invest directly in China. In this regard, the mainstreaming of the local currency through the spread of digital payment platforms could lead to the Central Bank's improved ability to intervene in the market, including through flexible exchange rate adjustment functions, and to higher expectations of the market, including an increase in the relative value of the riel, which in turn could lead to capital inflows from abroad and stabilization of the external balance of payments.
 - ✧ In addition, in order for foreign companies to understand the scale of the market and make investment decisions, it is necessary to improve the transparency of actual economic information. The establishment and promotion of platforms that digitize economic activities, such as digital payment platforms, could, depending on their design, lead to the creation of

macro-information data on the volume of funds in circulation and the expenditures and transactions of citizens and businesses, and make visible trends that have been difficult for foreign companies to see in the past. The inability to collect data on economic activities and to properly compile basic economic statistics on an annual basis is considered to be a common problem in developing countries. If data on economic trends, including transactions in the cash-dominated informal sector, can be collected, information on the state of a country's economy can be disclosed both domestically and internationally, and this information can be useful for private companies in making investment decisions.

- Although the Cambodian central bank has decided to introduce a digital payment platform as an important measure to solve the problems of cash-mainstreaming and dollar-dependence, not all countries can expect the same effect from the introduction of a digital payment platform. If other countries debate the pros and cons of introducing a digital payment platform, they should consider the balance between the system operation and operational costs of the digital payment platform that the central bank will have to bear, the expected benefits, the costs that can be reduced (such as cash management operation costs), and the risks. In addition, if there is an existing interbank network, it will be necessary to consider whether or not to introduce a digital payment platform after considering how to avoid duplication of investment in the system.
 - ✧ In this case, it is possible to implement the system without touching personal information related to privacy issues, and in fact, the Central Bank does not have access to personal information in the Bakong system.
- **In considering digital measures, the success or failure of digital measures in government depends on how to attract users and ensure a certain amount of data flow through the system. In particular, the government will be required to actively promote the use of digital technology to the segments that are not easily covered by the private sector.**
 - When JICA aims to intervene in this area in the future, there are opportunities to intervene in terms of supporting the acquisition of users and increasing transaction volume of digital payment platforms and payment systems in the target countries, supporting the development of new services using data, and supporting the development of methods and systems for using data in policy making. Central banks can implement digital payment platforms. When a central bank implements a digital payment platform, the central bank will inevitably aggregate payment and remittance data, so even if other countries introduce digital payment platforms in the future, "how to collect data" and "how to utilize the collected data" will be important issues to discuss, as in Cambodia. Therefore, even if other countries introduce digital payment platforms in the future, "how to collect data" and "how to utilize the collected data" will continue to be important issues as in Cambodia.
 - ✧ In Cambodia, the use cases of retail, transportation, and medical services that can utilize the

data accumulated by Bakong, a remittance and payment system operated by the central bank, were examined. However, the amount of data is not sufficient to obtain effective data analysis results because the amount of transactions is currently less than 1% of GDP. Therefore, it was concluded that it is essential to increase the number of users of the Bakong system and the volume of transactions for any of these use cases.

- In the early stages of launching digital services, local governments, like the central bank in this pilot, are forced to focus their resources on stabilizing system operations, as well as on organizational changes and personnel hiring (e.g., only personnel with specific qualifications can be hired). In addition, the company is unable to define the necessary human resource requirements, and thus is unable to fulfill the capability requirements, which may prevent it from considering new services and benefits. Therefore, support for planning and development of services that define and expand the value provided to users is highly valuable, especially for local governments in the early stages of launching and developing digital services.
 - ✧ Digital services provided by public organizations such as Bakong are always evaluated by citizens and businesses in terms of the merits of using them, so we need to recognize that it is difficult to attract citizens and businesses and promote their continued use of digital services by simply developing and operating systems that are convenient in a limited number of situations and conducting sporadic public relations activities. In order to promote the spread and expansion of the service, it is necessary to provide citizens and businesses with benefits that are "generated through continuous use," such as linkage with credit scoring, which was selected as the most promising use case for data utilization in the pilot activities. The design and implementation of services and incentives that allow users to use their own accumulated data is an effective means of achieving this.
 - ✧ In order to promote digital services, it is necessary for the mindset of government officials and management organizations to be rooted in market-in thinking and behavior (sparing no effort to actively communicate user benefits). Specifically, instead of sporadically sending out advertisements and waiting for the number of users to increase, they need to approach the target companies and government organizations to propose and collaborate on how to introduce the service. The government itself is expected to actively create, communicate, and support the introduction of such services to target groups, such as by standardizing payment via Bakong for low-income people and people without bank accounts in rural areas in cooperation with local governments. In order to support such a change in the management organization, experts with marketing experience can provide support in the form of companionship support through discussions and collaboration for a certain period of time. In this way, it will be an effective intervention.

Business Transformation

5): Data-driven management/administration

- **In order to realize continuous business evaluation, it is essential to establish digital data contact points for continuous data collection, as temporary surveys are insufficient.**
 - In Uganda, we crossed the collected data with the data collected in JICA's past survey projects to examine the possibility of utilizing JICA's unique asset, the past survey data. In the process, it became clear that the data collected in the previous surveys were fragmented and could not be used for continuous analysis of the situation in the partner country and evaluation of the project effects.
 - ◇ For example, due to the reorganization of Uganda's administrative divisions in the past few years, which occurred during the PoC analysis trial, the number of regions where the past survey data could be compared with the latest data was limited. This is an event that can occur in countries other than Uganda.
 - ◇ In order to overcome the challenge of ensuring data consistency, it is essential to not only define data items for measuring outcomes in each area from the top-down (e.g., in units of GAs/clusters) and organize the necessary data system (see details below), but also to develop a system from the perspective of survey methods to reduce the cost of data acquisition by constructing a system that enables continuous data collection even when unmanned and remotely, such as digital maps and satellite imagery data, instead of using bottom-up, human or manual survey methods in each project. In addition, it is also essential to devise a survey method that reduces data acquisition costs by building a system that allows continuous data collection even when unmanned and remotely, such as digital maps and satellite image data, instead of manual and manual survey methods.

- **In order to verify how much progress has been made in resolving local issues and how effective JICA's various efforts have been, it is necessary to clarify the issues and factor hypotheses to be monitored and collect appropriate data. In particular, it is necessary to define the core data items that should be obtained and accumulated for each cluster.**
 - In the Uganda PoC, when we attempted cross-sectoral data analysis, we tried to verify whether there was a relationship between the number of users of each health facility and the status of water supply facilities in the district to which the health facility belonged. At that time, it was necessary to narrow down the factor hypotheses to find whether or not there was a relationship, such as whether general water supply facilities or only sanitary facilities such as toilets would be a factor, and to determine whether or not the numerical values used for analysis and monitoring were appropriate. Without the refinement of hypotheses, there is a risk that inappropriate data items may be identified and used for analysis, leading to erroneous suggestions, so clarification of issues

and factor hypotheses is particularly necessary. In order to utilize data across projects and for each cluster, it will be difficult to define, implement, and operate effective use cases that contribute to solving the issues of the partner country unless appropriate data can be collected after clarifying the relevant hypothesis.

- After defining the target data, it is especially necessary to ensure the objectivity of the accumulated data by unifying and improving the accuracy of the data items collected in the cluster. For example, information on the maintenance status of roads can be used for analysis, but it can only be used for precise analysis if it is linked to geospatial information (coordinate information) that can objectively identify the scope of the target road, not just the road surface. In order to achieve this efficiently, JICA will standardize and share the data items and their collection granularity that are likely to be used in the target countries and across sectors, so that cross-sectoral analysis can be conducted based on highly available data that is objective and consistent.
 - ✧ For example, if the definition and granularity of collected data and survey questions can be shared within the Organization and with consultants via cloud tools, data items can be reflected in real time across countries and sectors when data items and collection methods are updated, and standardization of data collection methods can be achieved more efficiently. For example, in many master plan surveys, it is not possible to standardize data collection methods. Thus, it is worth considering the standardization of social surveys (including household surveys), which are conducted in many master plan studies, into a unified format within JICA. The World Bank has already conducted a similar trial using the SWIFT (Survey of Well-being via Instant and Frequent Tracking) application, and JICA is also experimenting with it.
- **When exchanging data with the other party's government, it is important to gain the trust of the other party's government in order to receive the data necessary for analysis, and JICA's intervention is effective.**
 - In the Mauritius PoC, in order to clarify the functional differences between the existing IT system and the digital collaboration platform, we requested the government of the other country to present the technical documents related to the design of the existing IT system, but it was not easy to obtain them. JICA made a request for them on the occasion of the final report, which was positively considered. It is thought that the lesson learned was that it is quite a hurdle for a private company (including consultants) to access digital-related information that is the foundation of a country.
 - In the Thailand PoC, there was a great deal of resistance to the provision of data at the beginning of the project, partly because the water pipeline map itself is sensitive data that could easily be misused. In this regard, JICA, which has cultivated a trusting relationship with the project through its long years of support, intervened to lower the psychological hurdle to data provision,

shortening the negotiation time and leading to the launch of the pilot in a short period of time. In the process, the private sector also demonstrated expected results during the project formation phase based on the results of analysis of small amounts of data and past analysis cases, and gradually gained the trust of the partner government. In addition, JICA and Accenture lowered the hurdle of data sharing by setting a rule not to hold or view raw data, MWA directly share with the related parties only. As a result, they were able to receive all the necessary data from the counterpart organization and execute the project.

6): Collaborate with diverse actors

- **From the perspective of the co-creation partner, JICA should be aware that it is an actor in the market, and while respecting traditional processes, it should be flexible in seeking ways to formulate deals and contracts that are quicker to adapt to the business practices of technology companies. The person in charge should not impose JICA's assumptions, but should consider business-based conversations, timelines, seating arrangements, and intellectual property.**
 - In addition to information gathering and verification surveys, which JICA has a track record in conducting PoC with private companies, it is desirable to leave room for the introduction of digital technology in collaboration with private companies in advance at the project design stage. When the project is led by the recipient government, such as a yen loan project, which can be designed more flexibly than other schemes such as JICA-led technical cooperation. In such cases, it is desirable to design a budget that leaves room for the introduction of digital technology in collaboration with the private sector. This will leave room for agile verification and introduction of technologies that can deal with issues that were not exposed at the time the project was formed, as in the case of the pilot project in India, and thus increase the effectiveness of the development using digital technologies.
 - In addition, if the only acceptable contract method is to transfer all of the provided equipment and deliverables as in the past, digital companies, whose technological strength lies in information assets such as data, analytical models, and codes, may be reluctant to collaborate with us due to concerns about the outflow of intellectual property and the inhibition of technological scale-up. In light of the characteristics of digital companies, a mechanism for handling deliverables that protects their competitive advantage and intellectual property rights would be to leave the intellectual property rights to the company and transfer the ownership and use rights of the digital goods (in this case, digital agricultural map data excluding the source code, which is closely related to intellectual property rights) created through the pilot activities. In this case, it is necessary to incorporate a contractual form that allows the purchase of time-limited usage rights for subscription-type services.

- A quick decision on whether or not to use the data is essential for smooth promotion of the pilot project and technical verification.
 - ✧ When introducing a technology such as machine learning, the first step is to check the accuracy of the existing data. Therefore, it is useful to know in advance what and how much data is available in each country's database, and to be able to link this information to the collaborating companies in order to speed up the decision on whether to apply the technology. It is difficult to know everything in advance, but even simple information can provide sufficient input for the collaborating companies to make a decision. For example, in the case of the pilot project in Thailand, it was effective enough to confirm in advance (1) whether map data exists, (2) whether the data held by the recipient government is digitized, and (3) (if digitized) whether the data can be mapped on a map. In addition, in terms of visualizing the data that has been surveyed and accumulated in JICA's past projects, the development of a data catalog system under consideration by JICA is also expected to function effectively in the future.
- Fracta, the company with which JICA collaborated in the Thailand PoC, is a notable startup company in the United States with its headquarters in Silicon Valley. However, in order for JICA to be recognized as a business partner by these companies, it is essential to deepen the understanding of their business practices, and to have business-based conversations, timelines, and members and organizational structure that are not limited by conventional methods.
 - ✧ In the first place, selecting reliable and high-demand start-ups business partners from among many inquiries they receive based on the size of the business (including its development into subsequent projects), the amount of risk involved, and invest limited resources. When talking to them, it is essential to always keep the conversation on a business basis and be more specific about the opportunity to the extent possible.
 - ✧ High-demand start-ups have a rapid turnover of employees, and their basic behavior is to "think while they run," which means that they are constantly evolving. Therefore, they are not interested in timelines such as "we can start in a few years". It is more important to keep this sense of speed in mind when talking to them.
 - ✧ The organizational structure of the project implementation is also important. In the case of the Thailand PoC, Accenture was brought in between JICA, MWA and Fracta, and by bringing in such an intermediary, Accenture was able to play a coordinating role between the rules and customs of the public sector and the business practices of the startup company. For start-ups, whose basic policy is to make effective use of limited resources, it is necessary to consider a structure that does not require excessive effort to deal with the customs, procedures, and rules of public institution.
 - ✧ On the other hand, the necessity and effectiveness of JICA's intervention were confirmed in the examination of the subsequent projects. As mentioned earlier, in the pilot activities in

Mauritius, there were many pieces of information that could be obtained only by JICA's visit to the field. It is important for JICA to go to the field with the support of consultants at key points of the survey. In addition, once a project is formed, it is assumed that it could be difficult to have only a short-term consultant to build trust with the client, collect information, and lead the discussion in a new digital project that involves many stakeholders. Therefore, it would be ideal to combine this with the dispatch experts who will be there long-term that has strong digital skills.

- **When collaborating with service providers such as AI services, which are difficult to explain to the public, it is essential to fulfill accountability through the use of technologies called Explainable AI (XAI), and to share the stance of seeking hints rather than answers from AI among all parties involved.**

 - While this pilot activity was very meaningful for verifying whether the services of a reliable AI start-up are effective in emerging countries, the detailed process (e.g., what to use as input data) is, of course, confidential. This led to a debate on how JICA, as a public organization, should collaborate with this service provider and the position of AI technology within JICA. Opinions were divided into whether JICA should allow the black box and prioritize effective solutions to social issues when dealing with AI service providers that have patents, or whether JICA should adopt a policy of not relying on the black box and build public goods such as open source through collaboration with universities. It became a point of contention.
 - AI is a technology called "machine learning," which learns autonomously from a large amount of prepared data and refines its judgment. In other words, since humans do not provide the logic, it is naturally impossible for humans to keep it under control. However, if AI is used effectively, it can automate advanced tasks and decisions that rely on the intuition and wisdom of skilled engineers and draw out the latent knowledge of skilled engineers. In the Thailand PoC, a specialist from the Water Resources Group of the Global Environment Department said, "We understood that AI does not give us answers, but gives us hints", thus when using AI, it is important to understand and explore on how to deal with AI in development projects.
 - In addition, even if it is not possible to rationally explain the answers provided by AI at this moment, in recent years, there are development of XAI technology, which explores the rationale for the decisions made by AI. Therefore, it would be effective to ask AI service providers to provide explanations using XAI technology and to have skilled engineers verify the validity of the answers provided by the AI. In the Thailand PoC, we used the SHAP (SHapley Additive exPlanations) method to visualize which factors (e.g., altitude, type of pipeline, distance from the river, etc.) contributed more to the prediction results of the AI model and discussed the results with the skilled engineers of the government. model prediction results.

7): Streamlining GA/clusters and creating new value through data

- **By shifting from a post-solution approach to a predictive/preventive approach, the range of approaches that can be implemented immediately and at a lower cost (soft approaches) than infrastructure construction/renovation (hard approaches) will increase, which will enable the formation of a project portfolio based on screening and lead to the rationalization of GA/clusters. This can lead to rationalization of GA/clusters.**
- In the pilot activity in Vietnam, We tested a new method of supporting residents by collecting water quality data in real-time and providing them with "water quality prediction data" generated through Kyoto University's water quality prediction model through an application to generate behavioral changes in the residents. As a result, it was confirmed that even in developing countries, it is possible to collect big data in real-time using existing digital technology, that it is possible to formulate an initial algorithm for a prediction model using the collected big data, and that it is possible to change the behavior of residents based on the water quality prediction information. As a concrete example of behavioral change, 93% of the residents (14 out of 15) said that the mock-up experience had increased their interest in community health care and that they would "share information with relatives and submit requests to the government. In addition, 66% (10 out of 15) of the residents said that they had changed their domestic water use to be more health-conscious, and that they would consider purchasing drinking water, storing water in advance, or changing their water source to well water, depending on the situation, to reduce health hazards. The part of reason behind the high behavior change was that we developed the mockup app by interviewing the same group, thus they were more involved in the process of the creation.
- By utilizing digital technologies such as IoT and big data, JICA can shift its development assistance from the hard mainstream to the soft mainstream, which is not only highly cost-effective but also expected to produce efficient development effects through timely, speedy, and "total area support". In addition, the digital technology itself can be improved in an inclusive way by receiving regular feedback from the beneficiaries in the target area before its implementation, which will lead to more behavioral changes.

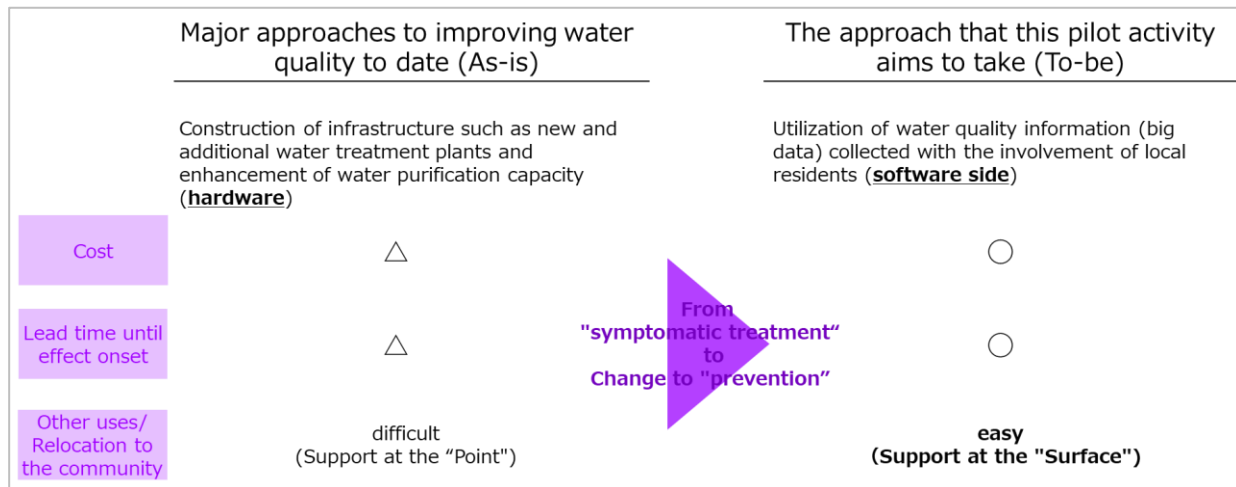


Figure 37 Transformation to preventive support

- In the past, disaster reduction and flood-related assistance has been provided by sending flood control consultants to conduct field surveys after narrowing down the target countries, or by using flood control consultants to narrow down the target countries. However, through the pilot activities in Mauritius, by combining urban development tools and flood simulators, it will be possible to visualize a certain level of flood risk at the screening stage of countries that should send flood control consultants, although there are some limitations. By using such digital technology, JICA will be able to streamline its project portfolio and realize a more efficient use of its resources, for example, by reducing the resources invested in the initial screening and allocating them intensively to full-scale surveys that require more skilled knowledge.

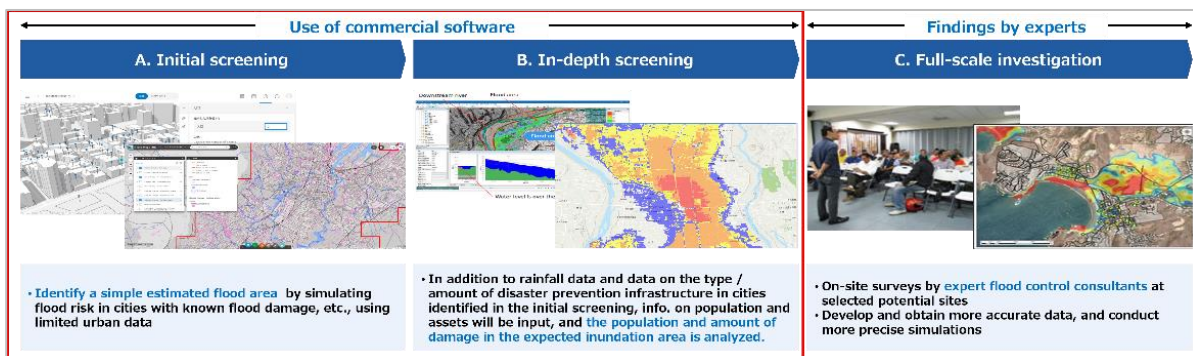


Figure 38 Optimization of screening

- **Even if a technology/solution is "dead" on its own, it can lead to the creation of new added value depending on how it is combined.**
- In Vietnam, we conducted a pilot activity to promote a shift in development methods from the conventional approach of solving apparent problems to a predictive and preventive approach by

utilizing big data. The data itself was collected while utilizing existing data from the past and the sensors of IoT equipment used in the past, and an initial prediction model was successfully constructed. In Vietnam, the technologies and solutions used were not new technologies or solutions, for instance, packaged water quality test reagents widely used in Japan, continuous water quality monitoring equipment with a large product lineup, a water quality prediction model used in Lake Biwa in Shiga Prefecture, and a smartphone application. However, it was found that the combination of these technologies could be a solution that could change the development methodology from ex-post monitoring to predictive monitoring. From these results, it can be said that not only companies with the latest technologies, such as machine learning, but also Japanese companies that JICA has built networks with can be candidates for cooperating and utilizing the technologies, and that there are some conventional technologies and hardware in Japan that can be utilized for data collection. The discovery of domestic companies is also an effective way to collect seed information. When JICA's business departments formulate DX projects in the future, it will be important to have an attitude of reviewing existing technologies in combination, rather than focusing only on new technologies that are difficult to introduce.

- **It will be effective to establish a framework for information exchange and co-creation with other private companies to collect seeds on a regular basis, and to examine existing projects as needs, create opportunities for improvement, and design budgets that leave room for the introduction of digital technology.**
 - In India, in collaboration with overseas offices and the Issues Division, we selected projects by preparing a list of existing projects and issues that could be addressed digitally. We believe that preparing a list of existing projects and issues is an effective first step in gathering information on promising projects. The STI/DX Office should continue to collect information on new and existing projects that are compatible with the introduction of digital technology and in which the recipient organization may be interested in the introduction of digital technology, and accumulate this information as information on promising projects for the introduction of digital technology. In order to do this, the business units need to feel that sharing information on ODA projects that can be combined with digital projects with the STI/DX Office will be beneficial to them as well. For example, by creating a dedicated DX co-creation team in the STI/DX Office with budget and human resources from other departments and promoting collaboration with the business units, the business units can obtain information on companies that can be called digital partners, receive consulting services from the STI/DX Office regarding the composition of digital projects, and, as a result, be able to offer support in service design and tech-related fields. As a result, there is a possibility of receiving service design and tech support without having to outsource.
 - After the selection of the target project in India, the JICA India Office and the consultants had

information on digital technology companies in India, which was useful in selecting a company to collaborate with when considering potential solution providers for the project. As for the collection of information on promising seed companies, it is important for the STI/DX Office to create a system and communication opportunities to continuously collect and accumulate information on private companies within JICA that can provide excellent digital technology for development issues in each country. It is also important to create a system and opportunities for communication within JICA to continuously collect and accumulate information on private companies that can provide excellent digital technologies to address development issues in each country. The information on promising companies found from overseas offices, consultants who have networks with DX-related companies around the world, SMEs, SDGs business support projects, etc. should be continuously listed and shared with the departments in charge of projects. This will lead to an increase in the number of projects and companies that can be matched. In addition, once this system of information sharing takes root, overseas offices and task forces will be able to collaborate with digital companies autonomously and utilize their technologies. In order to achieve this, it is essential to increase the number of points of contact between JICA and DX-related companies. In addition to holding seminars for companies, it is important to increase communication with DX-related companies and deepen understanding on both sides by communicating JICA's excellent DX projects and collaboration schemes with JICA to the outside world and providing a mechanism for interested companies to contact JICA immediately. It is also important to increase communication with DX-related companies and deepen understanding on both sides. Then, JICA should visit promising companies individually and present business proposals based on the business issues and prospects of the companies and the value that JICA itself can provide to the companies.

End