Chapter 3 Elemental Technology

This Chapter discusses the currently available elemental technologies on the management of cropland information that may prove useful in addressing the problems discussed in Chapter 2.

3.1 Fude Polygon

The Fude Polygon (fude is the Japanese term used to refer to a land lot sectioned for the purpose of the management of real estate) is a database of lot information in which the lot shapes are expressed in polygons for all cropland lots. The information is meant as the fundamental cropland information for the Statistics Department of MAFF to conduct the Statistical Survey on Crops, etc. Fude polygons are generated based on satellite images, etc., for approximately 2.9 million sections with ploughland among all the 200-sqm sections (400-sqm sections for Hokkaido) placed without gaps for the entire area of Japan. Fude polygons were created for approximately 30 million land lots as of March 2019, and the information was made available to the public as open data in April 2019.

In order to improve the added value and promote the use of the Fude Polygon, MAFF has established an ID setting rule and set IDs. Specifically, an ID consists of 18-digit numbers, combining a prefecture code (2 digits), coordinates system code (2 digits), and gravity center coordinates (X-coordinate (7 digits), Y-coordinate (7 digits)). The prefecture code is a 2-digit code from 01 to 47 as stipulated in JIS X 0401, coordinates system code a 2-digit plane rectangular coordinates code from 01 to 19, and gravity center coordinates are 7-digit integers generated by rounding off a value expressed in meters using the plane rectangular coordinates to the nearest integer.

Example IDs

Prefecture code	Plane rectangular coordinates system code	Gravity center X-coordinate	Gravity center Y-coordinate	Fude polygon ID
22	08	−117578.46028256	−19029.631903467	2208−117578−019030
22	08	−119130.22143819	−23968.344255435	2208−119130−023968
22	08	−112479.10154812	23808.720650196	2208−1124790023809
22	08	118372.67673206	−21268.398441426	22080118373−021268

(Note) Prefecture code 22 is Shizuoka Prefecture.

Figure 16: Fude polygon IDs (example)

To date, fude polygons have been updated to reflect changes to their shapes due to land lot splitting/merging, etc., by relevant MAFF staff directly checking Earth observation satellite images, etc., and the number of fude polygons updated in a year was only 1/5 of all polygons. However, in fiscal 2018, the Statistics Department of the Minister's Secretariat, MAFF commenced the development of a technique to determine changes to land lots by comparing and analyzing the Earth observation satellite image data utilizing Artificial Intelligence (AI)[4] through a joint study with the National Institute of Advanced Industrial Science and Technology. Using this method, the Statistics Department plans to update all fude polygons every year from fiscal 2020.

It is worthy of note that fude polygons are created from satellite images by visual and manual operations and cannot be treated as survey data (e.g., cannot be used to determine the precise land area) due to the limited spatial resolution and positional accuracy of satellite images, and therefore should be used in combination with other data as appropriate.

Provision of fude polygon (April 2019 to February 2020)

Category	Number of cases
Private enterprises, etc.	271
Universities and research institutions	179
National and local governments	71
Related organizations such as JA	67
Individuals	364
Total	952

Figure 17: Created fude polygons overlaid on GSI Tiles

[4] A computer system function that simulates human intelligence. In computer systems, human's logical thinking for learning new information and making a decision based on it is simulated using mathematics and logic.

3.2 Geospatial information-related technology

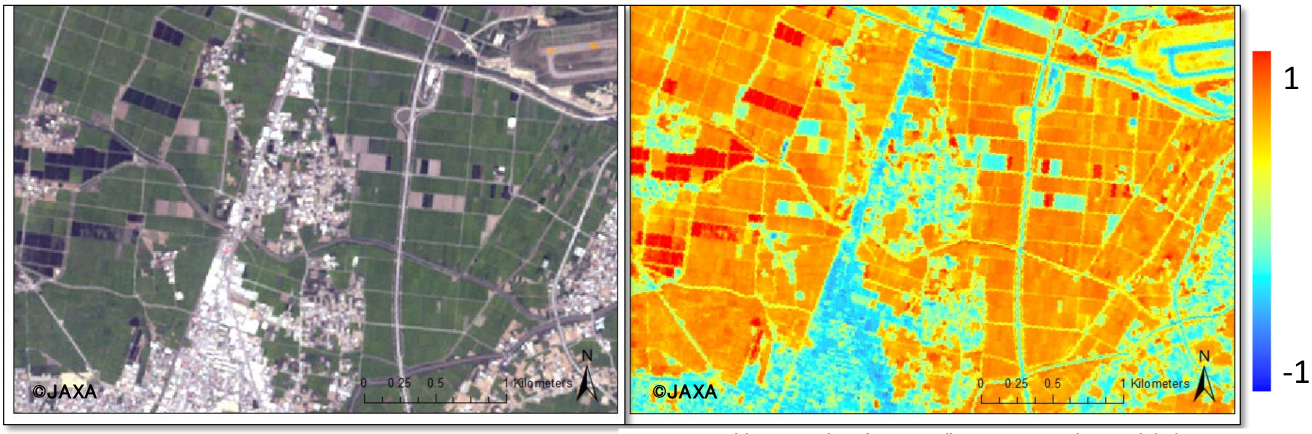
- <u>Remote sensing and satellite images</u>

Remote sensing is a technology to acquire information about an object from a distance, where data obtained using non-contact instruments such as optical sensors and radio wave sensors are used for analysis. Especially, observing the Earth with special sensors installed on an Earth observation satellite is called satellite remote sensing. Sensors installed on a satellite observe electromagnetic waves generated by the Earth or reflected from the atmosphere (e.g., clouds), ocean areas, and land areas (e.g., forests, cultivated lands, cities) of the Earth. These observation data are useful in various fields of studies. In the field of agriculture, forestry and fisheries, the data are used in the estimation of deforestation, desertification, crop planting/growth, and fishing spots. In the field of civil engineering, the data are used for watching the heat island phenomenon, infrastructure (e.g., land subsidence), and air pollution. In the field of disaster prevention, the data are used for keeping an eye on volcanoes and monitoring the state of disasters such as landslides. The Earth satellite observation data are also used in the field of climate change mitigation, for example, for the observation of greenhouse gas concentrations and El Nino events. On top of these, the data are used in the preparation and correction of topographical maps and weather forecasting.

For satellite images, the resolution and the frequency of image taking have improved through the advancement of technologies. For example, the Advanced Land Observing Satellite (ALOS-3) that the Japan Aerospace Exploration Agency (JAXA) plans to launch in fiscal 2020 has a resolution of 80 cm and an observation width of 70 km in panchromatic images, and is to observe the entire area of Japan in 35-day cycles (weather conditions not taken into account). In the case of occurrence of a disaster in Japan, the ALSO-3 is to swiftly carry out emergency observations and provide data to relevant institutions for grasping the damage situation. In addition, private enterprises inside and outside Japan are promoting projects to launch multiple ultra-small satellites and take photographs of the surface of the entire Earth every day in order to acquire bird’s-eye images of various human activities and build a colossal image database to store the images. As for charging, while more and more data are provided free of charge, those with higher resolutions of several meters are provided for a fee.

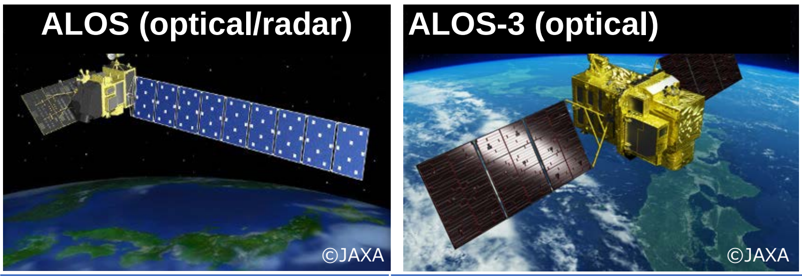
The development of technologies to analyze such satellite images using AI technologies represented by machine learning is also advancing. As an initiative to further improve the efficiency of work for updating the fude polygons discussed above, the development is in progress to enable extraction of changes in fude polygons for the entire area of Japan using a group of ultra-small satellites and updating the shapes of fude polygons using high-resolution satellite images. Other notable initiatives include the development of automatic cropland polygon creation technology using machine learning, initiative to classify planted crops within fude polygons using time-series data obtained by a cluster of high-frequency ultra-small observation satellites, and initiative to improve the efficiency of on-site surveys performed by local governments using technologies such as crop classification.

ALOS optical sensor observation image (resolution: 2.5 m)　　Normalized difference vegetation index* (NDVI; resolution: 10 m)



* Expressed in a number from –1 (lower vegetation activity) to 1 (higher vegetation activity).
Date of observation: August 23, 2010
Area of observation: An area near Sendai International Airport
Scale: 1/25,000

Figure 18: Example analysis using satellite image and vegetation index * Courtesy of JAXA



(Improvements are indicated in red)	**ALOS (Daichi)** Optical sensor only	**ALOS-3 (advanced optical satellite)**
Launch	2006 (operation ceased)	2020
Design life	3 years (target: 5 years)	**7 years**
Spatial resolution	Panchromatic: 2.5 m Multispectral: 10 m (Blue/Green/Red/NiR)	Panchromatic: **0.8 m** Multispectral: **3.2 m** (**Coastal**/Blue/Green/Red/**RedEdge**/NiR)
Observation width	70 km	70 km
Observation of Japan area	Observes the entire area of Japan every 46 days	Observes the entire area of Japan **every 35 days**

Figure 19: Examples of technical advancement in Earth observation satellite
* Courtesy of JAXA

- Geographic Information System (GIS)

The Geographic Information System (GIS) is a system to show satellite images, map data, polygon data, etc., on a computer map to depict the relationship, patterns, and trend of information in an easy-to-understand manner.

Conventionally, three types of GISs have been used: general-purpose GIS that is used in a local environment (or a stand-alone PC environment); individual GIS specialized into individual operations created based on general-purpose GIS; and integrated GIS aiming to share data among multiple operations. In recent years, however, it seems more organizations are using a platform-type GIS which shares data through the intranet and Internet and provides general-purpose functions that can be used in various kinds of operations. Specifically, a typical platform-type GIS provides functions to visualize, manage, and edit satellite images and map data, user management and portal functions, multi-device application, and a configuration-based app development kit. Through these functions, a platform-based GIS enables centralized management of GIS data as well as use on multiple devices from PCs to mobile terminals across departments and organizations while linking with other systems.

Some GIS engines offer commercially available software that comes with aftersales services. Some software is provided as Open Source Software (OSS)[5] which is published free of charge and users are permitted to modify or redistribute the software. Both are utilized by the national and local governments[6].

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[5] Open source software is a collective term for software in which source code (blueprint of the software) is released free of charge under a license in which the copyright owner grants users the rights to modify or redistribute the software.

[6] OSS is used, for example, in the online GSI Maps provided by the Geospatial Information Authority of Japan (GSI) and the United Nations Vector Tile Toolkit provided by the United Nations.

The GSI Maps is an online map system the GSI started operating in 2003, which shows various faces of Japan's land captured by GSI, in the form of maps created by GSI, aerial photographs, and disaster information (https://maps.gsi.go.jp/).

The United Nations Vector Tile Toolkit is a set of programs for independently generating and distributing map data in the vector format to be used in a platform-type GIS. Provided as a part of the UN Open GIS Initiative, the Toolkit offers lightweight tools called Free and Open Source Software for Geospatial (FOSS4G) under the concept of SDGs to realize use in any environment including stand-alone operation environments (https://github.com/un-vector-tile-toolkit).

Geographic Information System

A system to manage and use geographic information

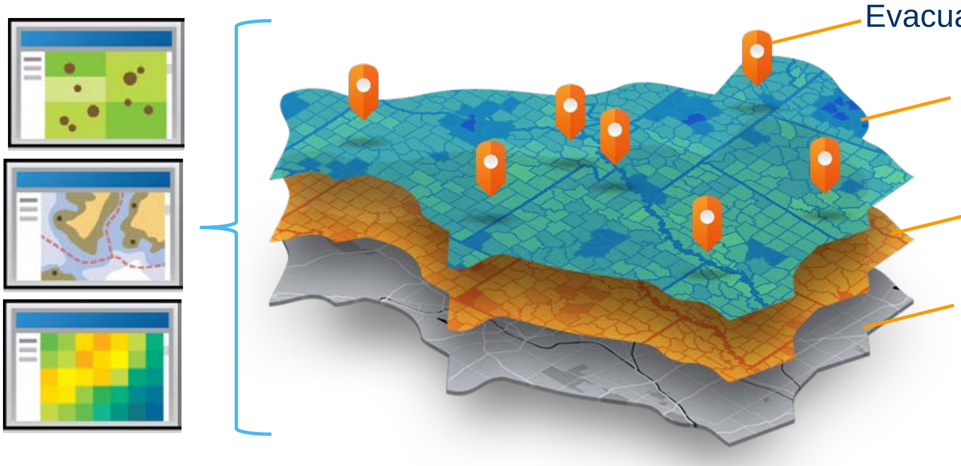

Figure 20: Geographic Information System * Courtesy of Esri Japan Corporation

- <u>High-precision positioning</u>

Combining the electronic reference points (permanent GPS stations; a total of 1,300 points have been established throughout Japan), Global Navigation Satellite Systems (GNSS), Quasi-Zenith Satellite Systems (QZSS) and latest and high-precision map information enables high-precision positioning and automatic driving. For example, the Institute for Agro-Environmental Sciences of the National Agriculture and Food Research Organization has prepared a high-precision positioning manual using commercially available low-price small GNSS receivers, which realizes high-precision mapping of the ground undulations and crop growth unevenness in cultivated land with an error of several centimeters when combined with drone image analysis software.

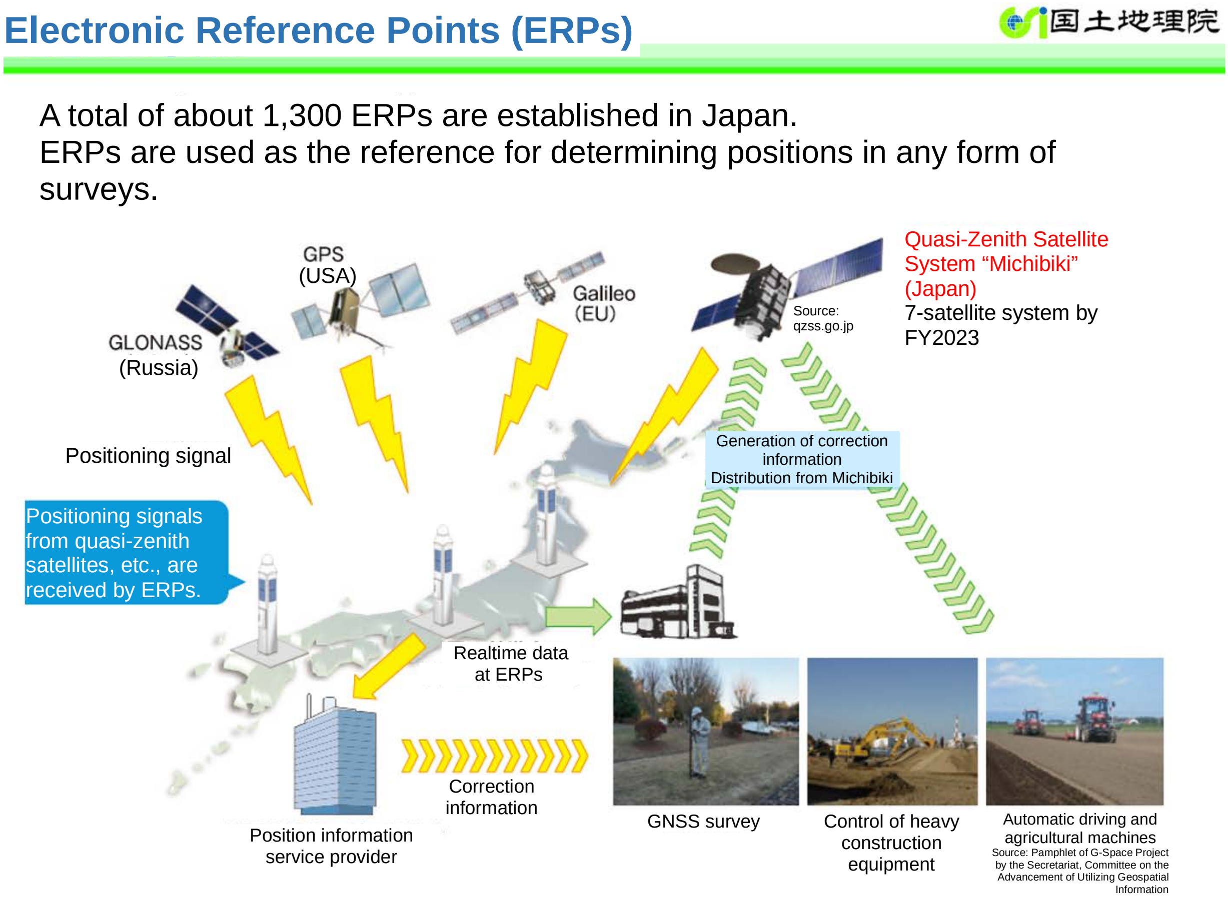

Figure 21: Electronic reference points

* From released material of the Geospatial Information Authority of Japan

3.3 Database-related technology

Conventional on-premise GIS databases in which information systems such as servers and software are installed inside facilities managed by users did not allow viewing or editing map information on the GIS, but use of a cloud-based GIS makes it much easier to view and edit map information via the Internet. This enables, during an on-site verification for example, viewing and editing map information on the field using a mobile terminal such as a tablet that has access to the Internet.

In addition, exchange of data via Application Programming Interface (API), etc., enables mutual coordination of information among multiple databases. This would enable automatic acquisition of information from other databases via a network and keeping cropland information, etc., up to date, in place of the conventional method in which staff had to manually import external files and match data, resulting in redundant manual data input in multiple databases. It also becomes possible to easily perform complicated analysis by obtaining and combining cropland information and geographical information on various environmental conditions such as weather and soil using API.

As for database management, it is important to support addition of data items in the future and measures to prevent a reduction in the access speed due to an increase in the number of records or accesses. In this regard, new database management techniques such as NoSQL[7] that enable flexible addition and deletion of data items and acceleration of system have become available.

[7] NoSQL (Not Only SQL) are non-relational wide-area distributed database systems that enable swift and dynamic organization and analysis of data for a substantially large volume without using SQL (database language).

3.4 Identity provider (IdP)

An identity provider (IdP) refers to a system that plays a role in enabling user authentication by providing IDs, passwords, user attributes, and information related to permission of access and editing. Only when IdPs appropriately manage and operate authentication information, farmers, policy implementing bodies, national government, etc., will become able to assess and edit information according to their privilege levels.

For example, a farmer can edit and apply information on the cropland it owns or cultivates at the time of application, and a policy implementing body will become able to update cropland information after receiving the results of on-site surveys for the cropland under its jurisdiction. When creating an account, verification of identity by checking official documents, etc., will enable release of accounts only to actually existing farmers, etc.

Appropriate coordination of IdPs and relevant service providers would further improve the convenience for farmers. Examples include use of Single Sign-On (SSO) which allows farmers to log into various systems without managing multiple IDs and passwords, coordination with various cropland information-related organizations under the consent of farmers themselves, and building a framework cooperating with the common authentication service for business (gBizID).

3.5 MAFF Common Application Service (eMAFF)

The MAFF Common Application Service (eMAFF) is a system that enables agricultural/forestry/fishery workers, etc., to centrally make applications pertaining to various MAFF-related procedures, including applications under laws and regulations and applications for subsidies and grants. The eMAFF improves the convenience for applicants as it makes it possible for the applicants to make applications any time using their PCs, smartphones, etc., and provides one-stop once-only (no need to re-enter registered information) services. MAFF plans to add a feature to eMAFF to realize logging in via the common authentication service for business (gBizID).

The development of eMAFF was commenced in 2019, and the system designing and development are currently underway toward full operation in fiscal 2021.

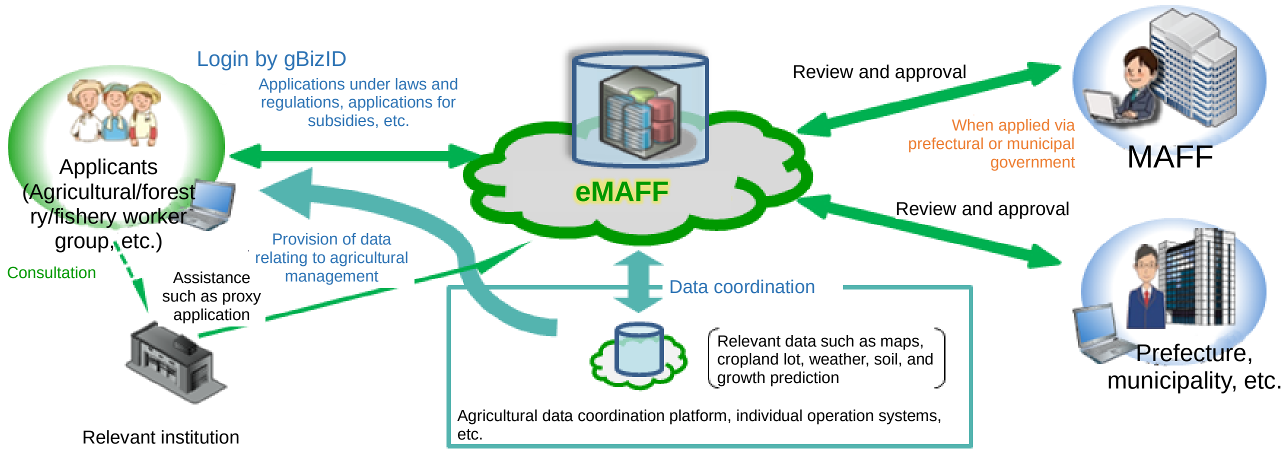

Figure 22: Conceptual diagram of MAFF Common Application Service

Chapter 4 Future Direction of Cropland Information Management

4.1 Vision of cropland information management and uses by Digital Map that utilizes eMAFF and fude polygons

By creating maps linked to cropland information collected by implementing bodies through eMAFF, while utilizing various digital technologies, based on the fude polygons created and published by MAFF (hereinafter referred to as the "Digital Map") and centrally managing cropland information using it:

- ✓ applications will be made online using one platform (one-stop) that enables reuse of already input information (once-only) and intuitive operations looking at a map on a screen, which improves the convenience for farmers;
- ✓ centralized management of cropland information using the Digital Map will make it easy to keep the information up to date and consistent across databases; and,
- ✓ management operations by implementing bodies will be substantially rationalized by, for example, efficiently and accurately performing on-site verifications using the Digital Map displayed on a tablet, etc.

These initiatives allow field staff of implementing bodies to focus on providing farming guidance and dialogs about succession of farm management in the region. As a result, farmers will receive management and technical guidance adequately and the productivity will improve, which contributes to the development of regional agriculture.

4.2 Direction of use of Digital Map in cropland information management

4.2.1 Use of Digital Map to improve the efficiency of operations

[1] From the viewpoints of farmers

In the procedures related to the transfer of rights on cropland, applications for subsidies, etc., the convenience for the users will be improved as the Digital Map simplifies the procedures and enables making applications online using eMAFF which eliminates the need to visit an office of a government agency.

In addition, the workload of application procedures will be substantially reduced as the Digital Map is a one-stop once-only system which eliminates the need for inputting information that has been already input for other applications. Further, convenience will be improved as the Digital Map enables making applications through intuitive operations looking at map information displayed on the screen of a PC or smartphone.

In the future, the Digital Map will be further developed to enable easy retrieval of cropland information that matches the desirable land conditions of farmer within the region.

[2] <u>From the viewpoints of implementing bodies</u>

In the procedures related to the transfer of rights on cropland, applications for subsidies, applications concerning agricultural insurance, etc., the operational burdens will be reduced as the Digital Map enables receiving applications online using eMAFF which eliminates redundant operations such as reprinting application forms and data matching.

Further, in on-site verifications performed by implementing bodies, the Digital Map enables visual verification of cropland information on a tablet instead of paper maps, which eliminates errors in identifying the cropland to be verified. The Digital Map also enables adding and editing data on site, which substantially reduces the workload on operations after returning to the office.

As regards the updating and managing of cropland information, the Digital Map automates a large portion of it using [1] farmer's application information, [2] satellite images and AI, which greatly improves the relevant operations. As a result, staff of implementing bodies will become able to focus on other important operations such as providing farming guidance and having dialogs about succession of agricultural management in the region, which contributes to the development of regional agriculture.

[3] <u>From other viewpoints</u>

By using the Digital Map to collect various data in real time, performing pluralistic analysis based on the data, and by reflecting the results on agricultural policies, the national and local governments will become able to accurately understand problems and take appropriate action. In addition, keeping the data collected in the Digital Map open to the public encourages research institutions, etc., to make policy proposals based on diversified data analyses.

4.2.2 Potential future uses

[1] <u>Use in on-site verification, damaged cropland identification, etc., using satellite images, AI, etc.</u>

Combining high-resolution high-frequency satellite images with image analysis using AI, geotagged photographs, etc., contributes to improved efficiency in on-site verification and identification of areas damaged by typhoons, etc.

[2] <u>Use in automatic driving, multi-GNSS, drones, etc.</u>

Combined use of latest accurate cropland information with high-precision GNSS, etc., realizes automatic driving of tractors and drones.

In addition, use of aerial photographs taken by farmers, etc., using drones may improve the efficiency of on-site verification, etc.

[3] Use in farmer and cropland planning

Combining the latest and accurate maps with farmer information, etc., may facilitate dialogs about smooth succession of cropland management by local farmers and accurate understanding of the situations related to land improvement programs.

Figure 23: A rural community. Latest and accurate maps are expected to promote dialogs.

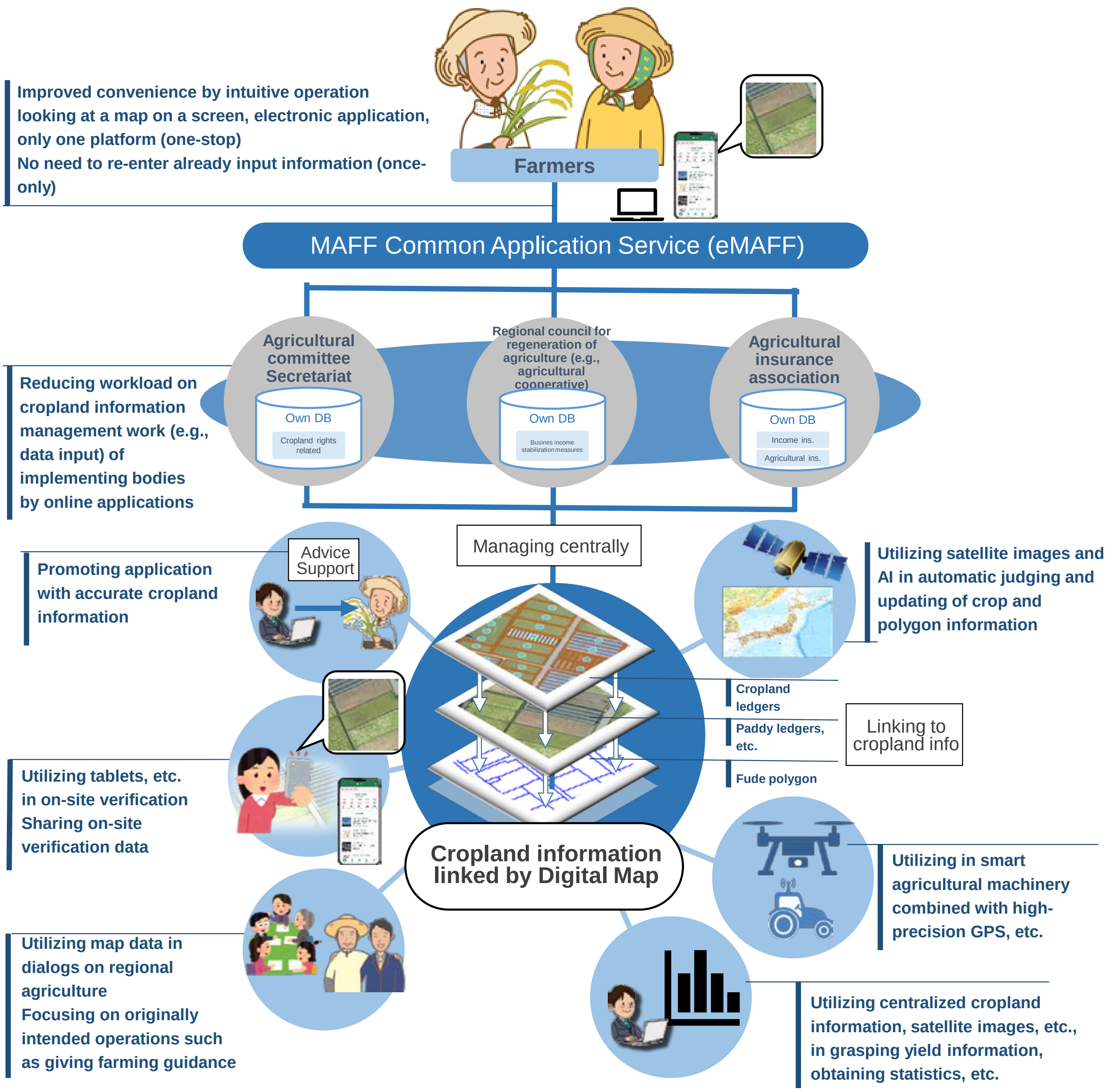

Figure 24: Direction of use of Digital Map in the management of cropland information

Chapter 5 System Requirements of Digital Map

The development of the systems that realize the Digital Map is to go ahead under the principles and the implementation policies below, in anticipation of its potential uses in the field of agriculture and the advancement of technology in the future.

5.1 Seven principles of system construction and operation

[1] Accessibility

It is important that users can use the system from a terminal or environment without feeling stress. Also, functions need to be improved along with the advancement in digital technology, while maintaining the quality level of services.

[2] Inter-operability

It is important that multiple systems and organizations can cooperate in terms of the system structure, data format, transmission method, etc., so that the public sector and the private sector can use each other's system functions.

[3] Reliability

It is important that the systems function robustly and data are accurate. Especially, attention needs to be paid to the fact that various entities such as agricultural/forestry/fishery workers, relevant groups, local governments, and the national government input data acquired at various points of time.

For that reason, it will become important to design a system in which the latest data that were certified by a public institution circulate as the official correct data.

[4] Sustainability

It is important that the systems are continuously operated as an administrative service, taking into account the cost-effectiveness. Therefore, the cost-effectiveness needs to be constantly evaluated. The index of evaluation will be how much burden on the operations related to the procedures of MAFF administrations was reduced by the systems.

[5] Scalability

The systems need to be designed, developed and operated envisaging the current and future technology levels so that the systems can withstand an increase in the use of the systems in the future and the database structure, network environment, relevant training, etc., will not become complicated or costly.

[6] Flexibility

It is necessary to continuously repeat the cycle of design, development and operation, instead of "it's done once they are created," so that the systems adapt to legislative and environmental changes in the future.

Additionally, it is necessary to keep improving the flexibility of the system in adapting to changes in the trend of digital technology innovations, system changes, and diversification in user needs.

Regarding the designing of advanced functions, it is also important to conduct Proof of Concept (PoC)[8] while requesting participation of various entities and which will lead to open innovations.

[7] <u>Security and availability</u>

It is important to incorporate latest security technologies and properly allocate the budget and development man hours to the aspect of security from the design stage. It is also important to ensure the systems remain available even in the case of unforeseeable events.

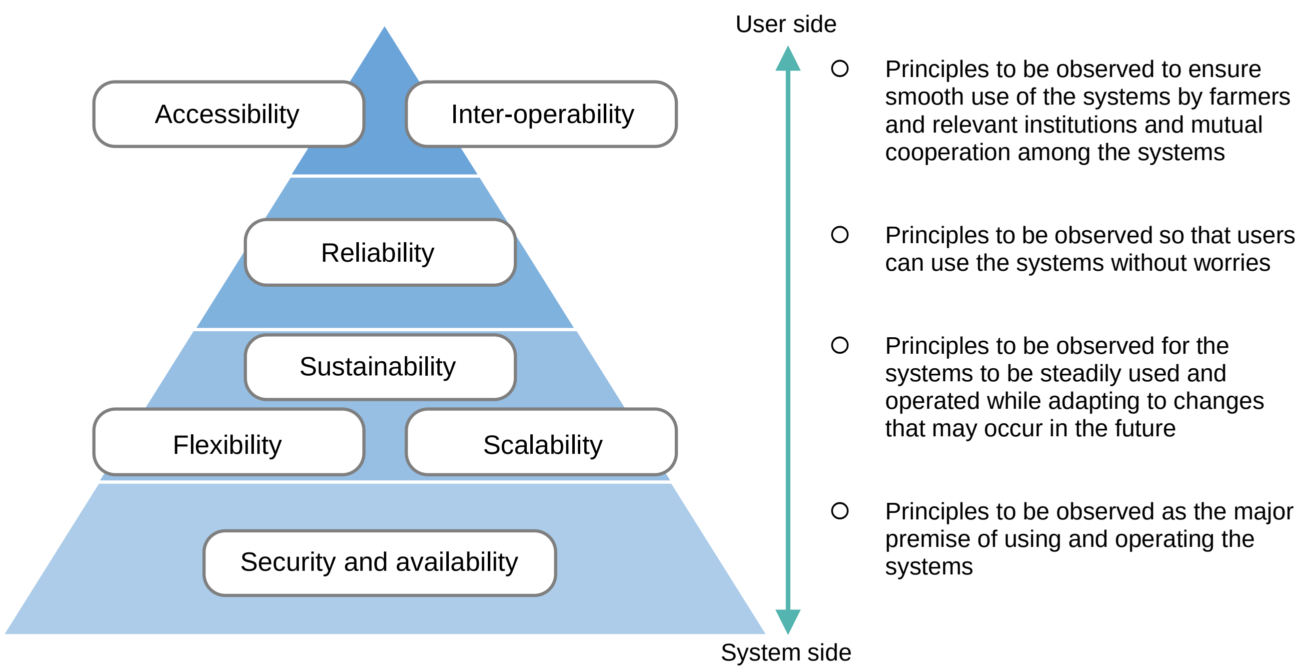

Figure 25: The seven principles of system development and operation

[8] Proof of Concept (PoC) is simplified and partial verification of a new concept or idea to demonstrate its feasibility.

5.2 Implementation policies

[1] Building the cropland GIS "Digital Map" in eMAFF and integrally operating and managing it

The cropland GIS "Digital Map" is to be built in eMAFF where applications containing cropland information are made and integrally operated and managed along with eMAFF to enable intuitive application operations by farmers, etc., looking at map information and updating cropland information based on application information.

[2] Linking the ledgers based on fude polygons, and consolidating cropland information on existing systems

Individually managed cropland information is to be linked based on fude polygons and cropland information on existing systems is to be transferred and consolidated to realize centralized management of cropland information. In so doing, consideration is to be given on how to notify implementing bodies of changes to the situation, keeping in mind that some cropland information was created on the register basis or using existing ledgers (e.g., cropland ledgers, paddy ledgers) and other cropland information was prepared on the current situation basis (fude polygons). An example method of realizing that is managing different levels of information on different layers.

[3] Realizing viewing and editing by municipalities and on site, etc., using a hybrid LGWAN-Internet method

While local governments use a LGWAN environment to carry out relevant office work, they still need to use the Internet to view and edit cropland information on the field using a tablet, etc. Therefore, a hybrid LGWAN-Internet method is to be adopted. Deliberations on how to connect the LGWAN to the public cloud are currently in progress at the Minister of Internal Affairs and Communications: necessary consideration is be given based on the result of the deliberations.

[4] Ensuring Single Sign-On (SSO) by IdP established by MAFF and METI, privilege-based viewing and editing, and security that does not rely on network isolation

Doors are to be left open to the possibility of various entities such as agricultural/forestry/fishery workers, relevant groups, local governments, and the national government accessing public and private online services via IdP established by MAFF and Ministry of Economy, Trade and Industry (METI). Viewing and editing of various kinds of information under the consent of farmers and the authority of institutions are to be enabled. Consideration is to be given adopting a security model such as Zero Trust[9] that does not rely on network isolation.

[5] Managing and updating data by various entities (data governance)

Data are to be continuously maintained by updating data using application information provided by agricultural/ forestry/fishery workers and inputting the results of on-site verifications and cropland-related administrative work in eMAFF. In so doing, on the premise that various entities manage and update data, the update history (amendments, date and time, name of person who made the amendment, etc.) of information on the systems is to be made available for checking, and consideration is to be given to standardization of cropland data. In addition, polygon data are to be updated and made more precise by employing various technologies including the technique to extract changes in the fude polygons through analysis of satellite images that is currently in progress.

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[9] Zero Trust is a network security model based on strict ID verification processes. The model adopts an approach where access is granted after thorough authentication, authorization and encryption, assuming that "none can be trusted (Zero Trust)," instead of a security measure assuming anybody in the company can be trusted.

Chapter 6 Future Initiatives

This Chapter outlines the matters that should be further considered based on the discussions in Chapters 4 and 5.

6.1 Surveys on actual situations

6.1.1 Linking fude polygons with various kinds of cropland information

Fude polygons consist only of coordinates information of a plane rectangular coordinates system, and are not linked to lot name and number. To make the fude polygons more useful, it is necessary to provide the fude polygons with lot name and number information through reverse geocoding[10], etc., and thereby make the fude polygons the keys of linking to various kinds of cropland information.

In existing ledgers, some ledgers use different names to manage the same lot. In this case, since machine matching of information among ledgers is difficult, each lot in the ledgers is to be linked to fude polygons first. In so doing, consideration needs to be given on the ideal method of linking to minimize the workload.

It is worthy of note that land lots on cropland ledgers (based on real estate register) may not perfectly correspond with land lots on fude polygons (based on aerial photographs). This point needs to be taken into account.

6.1.2 Designing cropland-related database and ID systems

Fude polygon IDs contain the location information, and may change due to the transfer of plate, etc. In addition, cropland lots may change every year, as it is possible that some lots become merged to make a larger lot and a lot is used in sections for the purpose of crop rotation, etc.

Accordingly, consideration needs to be given to how to design a cropland information database and ID systems for roughly 30 million lots that may change at any point in time. In so doing, municipalities will be required to refer to the history information of each cropland, and therefore consideration needs to be also given to measures assuming handling cropland information as time-series data and overlaying them on geospatial information established by other bodies, including maintaining consistency with the national coordinates[11].

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[10] Geocoding is the process of providing a location indicated by address, lot name, landmarks, postal code, etc., with a pair of coordinates. Reverse geocoding is the process of acquiring address from the latitude and longitude information. Geocoding and reverse geocoding require dictionary data in which the address corresponds to the latitude and longitude information, and the accuracy of the dictionary data determines the accuracy of geocoding and reverse geocoding.

[11] National coordinates are the reference coordinates of a country, specifically, those that express a location by the latitude, longitude, height, or equivalent coordinates (numbers) in the country. In Japan, the latitude, longitude, altitude, plane rectangular coordinates, and geocentric cartesian coordinates that conform to the references stipulated in Articles 11 of the Survey Act are the national coordinates that are used not only in surveys but also for expressing locations in various laws and regulations and in private maps and drawings. If

6.1.3 Standardization of cropland-related data

Cropland-related data are currently managed individually and not standardized. Therefore, consideration needs to be given to standardization of them assuming utilization in the future and coordination with other relevant categories such as real estate registration.

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one location is provided with multiple sets of coordinates, that will cause social confusion; using coordinates conforming to or consistent with the national coordinates allows people to use position information without a worry.

6.2 System development, data transition, training, PoC

6.2.1 Second-period development of eMAFF

The second-period development of eMAFF needs to be systematically conducted after the first-stage development that is planned to be completed in fiscal 2020. The second-period development includes remodeling and improving the systems to link application data with cropland ledgers DB and GIS, data transition, and linking the fude polygons with various ledger DB. In so doing, consideration will be given on implementation of functions toward displaying cropland information in on-site surveys and utilizing geotagged photographs taken by farmers or implementation body staff, while keeping in mind cooperation with the MAFF App, etc.

In addition, training of staff of implementing bodies, etc., will be required so that eMAFF will be actually utilized in the field.

6.2.2 Cooperation among individual systems

Regarding cropland GIS established by implementing bodies and relevant institutions, a system for implementing entities to match data via eMAFF through API connection, etc., needs to be established, while giving consideration to consolidating them in the future.

6.2.3 Conducting PoC in anticipation of effective utilization of cropland information

To achieve effective utilization of consolidated cropland information, PoC needs to be conducted to demonstrate utilization of cutting-edge Earth observation satellite imaging and image analysis technologies such as AI as well as data coordination with other industries. Especially, when utilizing AI, PoC may also be required about efficient collection and management of teacher data.

6.2.4 Other matters to note

Extra attention needs to be paid to the handling of personal information in the establishment of operation of the systems. Thorough studies and consideration will be required on a wide range of matters, including identifying what kind of cropland information falls under personal information and how to anonymize and conceal information. In addition, attention needs to be paid to cases where data that alone do not fall under personal information lead to identification of an individual when combined with other data.

Some old farmers may find it difficult to make online applications. As such, when managing cropland information via eMAFF, consideration needs to be given on how to address the digital divide.

Another matter to consider is how to evaluate and improve the quality of data, in a bid to continuously make improvements to the quality of data. For example, a system to comprehensively evaluate various kinds of information and reflect them in databases will be required, including information provided by applicants, reflection of results of on-site surveys conducted by implementing bodies, utilization of geotagged photographs taken by farmers or staff of implementing bodies, and utilization of analysis results of satellite images using AI.

Regarding AI, the key to utilize it is construction of learning data sets. Therefore, attention needs to be paid to whether teacher data suitable for learning already exist on site and whether it is possible to gather teacher data in an efficient manner.

Chapter 7 (Reference 1) Committee Members

The members of the Committee are as shown below (listed in no particular order and without honorifics).

[Persons engaged in the management of cropland information]

Shota Izumi	Director, Secretariat, Kanagawa Prefectural Atsugi City Agricultural Committee
Takahisa Saito	Chief, Business Section 1, Gunma Prefecture Agricultural Insurance Association (NOSAI Gunma)
Hirotaka Sugawara	Director, Department of Agriculture and Forestry, Hanamaki City, Iwate Prefecture
Tomonobu Tsuzawa	Director, Information System Promotion Office, Planning and Training Department, National Agricultural Insurance Association (NOSAI Association)

[Relevant enterprises, etc.]

Hiroshi Enohara	Managing Director, Accenture Japan Ltd.
Toshio Okumura	Advisor, Business Strategy Office, Solution Busines Department 1, Remote Sensing Technology Center of Japan
Ikuo Koboku	Advisor to General Manager, Public Sector, Amazon Web Services Japan K.K.
Yosuke Sakurai	Section Chief, Platform Solution Group, Esri Japan Corporation
Shunsuke Tsuboi	President and Representative Director, Sagri Co., Ltd.
Yuuya Doi	Manager, Solution Business Department 2, Common Solution Business Division 1, Fujitsu Limited
Katsuhiko Fujii	Senior Manager, PwC Consulting LLC Japan
Nobuki Fujinaka	Director, Design Japan Promotion Office, Public Sector Business Division, Microsoft Japan Co., Ltd.
Kosei Miyazaki	Data & Science Solutions Division, Yahoo Japan Corporation
Naoki Miyashita	Director and CTO, Axelspace Corporation
Osamu Yamanokuchi	Director of Business Development, Public and Medical Sales and Marketing Division, Enterprise Business Headquarters, IBM Japan, Ltd.
Yoshinori Yamamoto	Section Chief of Public Solutions, Public Relations Department, Public Relations Division, Panasonic Corporation

[Relevant research institutions]

Nobusuke Iwasaki	Unit Leader, Institute for Agro-Environmental Sciences, National Agriculture and Food Research Organization
Toshikazu Seto	Project Assistant Professor (Lecturer), Center for Spatial Information

	Science, The University of Tokyo
Masuo Takahashi	Chief Researcher and Developer, Japan Aerospace Exploration Agency (JAXA)

[Related ministries and agencies, etc.]

Kenji Hiramoto	Chief Advisor to Government CIO, Cabinet Secretariat; Advisor to CIO, METI
Hisafumi Mitsushio	Advisor to Government CIO, Cabinet Secretariat; Advisor to CIO, METI
Kentaro Kitahara	Section Chief, Administrative Information System Planning Section, Administrative Management Bureau, Ministry of Internal Affairs and Communications
Fumiyasu Ichiki	Advisor to Director, Geospatial Information Planning Office, Planning Department, Geospatial Information Authority of Japan, Ministry of Land, Infrastructure, Transport and Tourism

[Ministry of Agriculture, Forestry and Fisheries]

Takao Shinobu	Deputy Director General for Cybersecurity and Informatization and Director for Official Document Inspection, Minister’s Secretariat
Tomoyuki Araki	Director, Policy Planning Division, Minister's Secretariat
Takuro Mukae	Director for Planning, Policy Planning Division, Minister's Secretariat
Mikihisa Hiratori	Director for Planning, Policy Planning Division, Minister's Secretariat
Haruchika Hatakeyama	Deputy Director, Director for Planning, Policy Planning Division, Minister's Secretariat
Yoshiyuki Mitsuhashi	Deputy Director, Production, Marketing and Consumption Statistics Division, Statistics Department, Minister's Secretariat
Masanori Nanri	Senior Specialist for Management, Cropland Policy Planning Division, Management Improvement Bureau
Fujio Kuboyama	Director, Office for Agricultural Management and Income Insurance, Agricultural Insurance Division, Management Improvement Bureau
Tadashi Matsuzawa	Assistant Director of Agricultural Insurance Division, Management Improvement Bureau
Naoki Fujiwara	Assistant Agricultural Insurance Supervisor, Management Improvement Bureau
Yosuke Mizuta	Assistant Director to the Counselor, Direct Payment for Land-extensive Farming Office for Counsellor to General Affairs and Direct Payment for Land-extensive Farming for Director-General for Policy Planning

Chapter 8 (Reference 2) History of Committee Meetings

The 1st meeting Thursday, November 28, 2019

Main agenda: Current situation of the management of cropland information

The 2nd meeting Wednesday, December 18, 2019

Main agenda: Major digital technologies that contribute to solving problems in the management of cropland information

The 3rd meeting Thursday, February 20, 2020

Main agenda: Direction of the report of the Committee

The 4th meeting Monday, March 16, 2020 (held on paper)

Main agenda: Report of the Committee

The materials of the Committee meetings above are available from the URL below.

http://www.maff.go.jp/j/kanbo/dmap/191127.html