

Consideration of IT which solves an agricultural problem

Examination of the solution of an agricultural problem which utilized the agricultural support system

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Abstract—It is examined whether the problem of the agriculture in Japan can be solved with Information Technology. In solving the problem, the specific requirement of the technology was examined. Moreover, the function required for the system used with each operating form of the production, circulation, and sale in agriculture was considered.

Keywords—IT agriculture, Agricultural support system, agRemoni, Text mining, Traceability, User interface

I. INTRODUCTION

Food, energy, and environment are mentioned as a global problem in the 21st century. In particular, the food problem is said to be closely connected with an energy problem or an environmental problem. The agricultural products used as food are grown plants, and these plants are diverted for energy. Moreover, in the farming as a use which increases land and green, the agricultural products themselves are considered by the same positioning as afforestation, and agriculture is used as environmental conservation. On the other hand, there are some problems that is the disappearance of the cultivated land caused by environmental devastation and the decrease of crop yields as food resulting from the cultivation for energy reservation. And many country or various organizations are studying about the problems. Furthermore, a global increase in population is also one of the factors of accelerating the food problem. Fig 1. shows the starvation situation 2012 in the world [1].

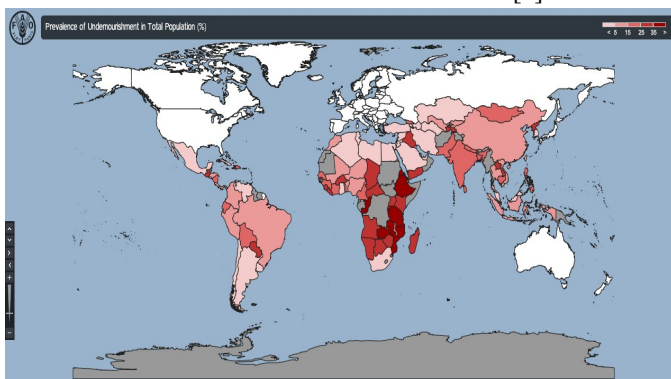


fig 1: the starvation situation in the world 2012 (Ref. WFP)

As shown in Fig. 1, countries in Asia and Africa are classified into the high population of the starvation, and it shows, in these areas, that they are in the state of food shortage.

Transition of the world population is indicated to Fig. 2.

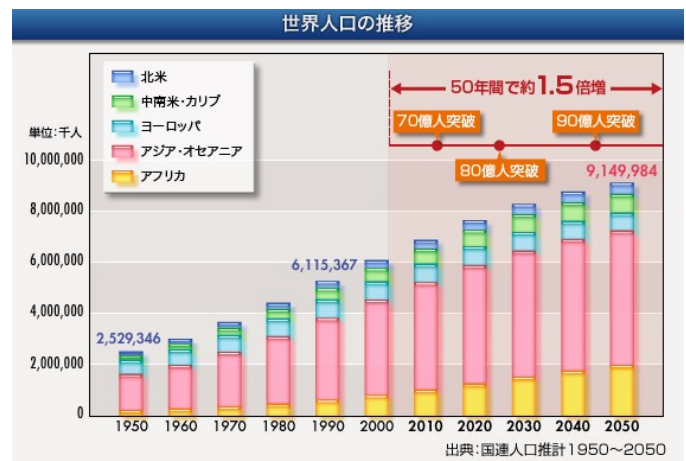


fig 2: Transition of the world population

The increase in population of Asia Oceania and Africa is shown by Fig. 2. Combining with distribution of the starvation situation in Fig. 1, it is clear that the increase of population in Asia poses the problem of the food reservation to the population. Moreover, stockbreeding must secure feedstuff.

Reservation of food is an important problem which protects the life of every country in the world and a life. And a crime, a riot, etc. caused by food shortage are a subject asked for immediate solution, in order not to increase social unrest. The battle with hunger has still occurred and it is not an exception in Japan. The problem of food is also an important subject. When food of its own country cannot be provided, it will depend on import. However, in import of the food from a foreign country, there are risks, such as a problem of impurities and an additive and food terrorism. The example of a global food crisis has occurred from high boiling of the grain prices by speculators. Thus, there is a risk of being greatly influenced by the food situation of a foreign country besides the viewpoint of stability in the food reservation depending on import.

Change of the agricultural productions kind for corresponding to change of the production trend of the agricultural products resulting from diversification of food or change of a living environment in addition to a global increase in population also has a risk of accelerating food shortage. Moreover, it leads also to the invasion parasite, the epidemic, and contamination.

穀物等の国際価格の推移

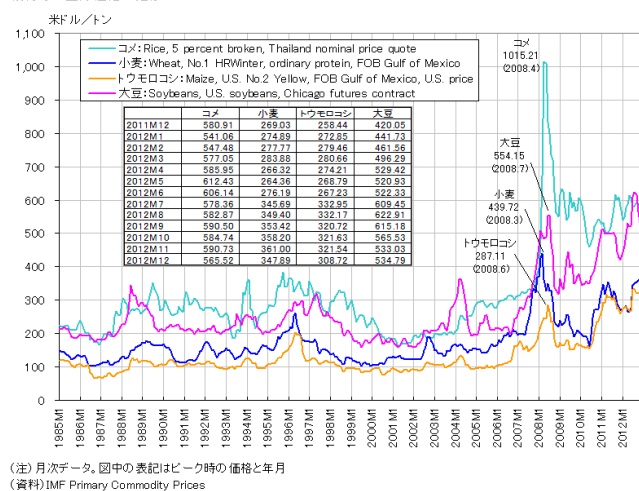


fig 3: International price transition of grain(Ref. IMF Primary Commodity Prices)

A problem including such a future food crisis is the issue which must be solved and is necessary to share as an important subject also in Japan.

食の原材料調達には生物多様性喪失のほとんどの原因に関与

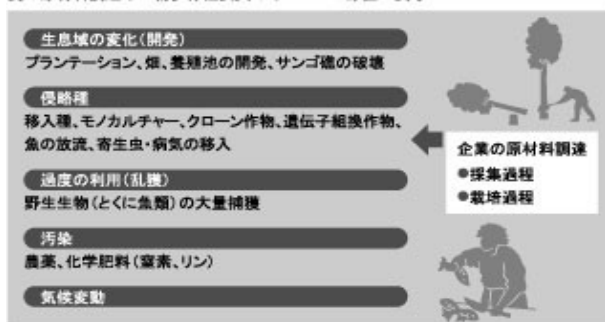


fig 4: Influence of food on biodiversity

II. SUBJECT

Although the food self-sufficiency is a global problem and should be treated in each country, there are many other problems in Japan. Specifically, they are problems, such as a farmer's succession problem, cultivation abandonment by aging, reduction of the reliability about the food resulting from the radioactive contamination in the accident of the nuclear power plant of the Great East Japan Earthquake, and TPP.

The food self-sufficiency ratio of each country is shown in Fig. 5.

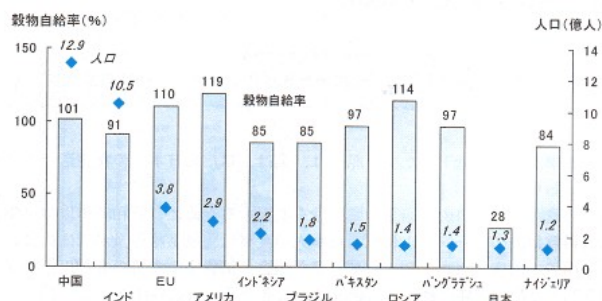


fig 5: The grain self-sufficiency ratio of the main countries with a population of over 100 million(2002) (Ref. FAO)

Compared with a foreign country, especially a grain self-supporting ratio of Japan is low.

Transition of the food self-sufficiency ratio (amount-of-supply base) of foreign countries and Japan is shown in Fig. 6.

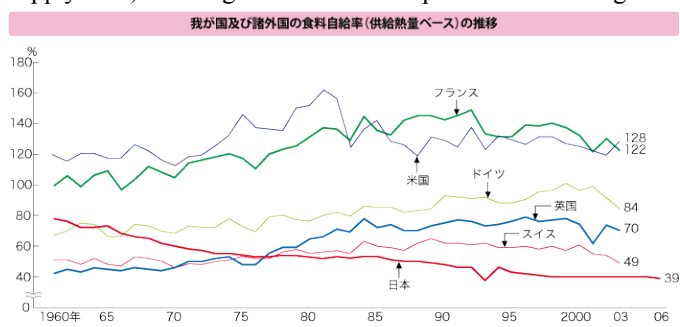


fig6: Transition of the food self-sufficiency ratio (amount-of-supply base) of foreign countries and Japan(Ref. The Ministry of Agriculture, Forestry, and Fisheries "table on demand and supply of food" and FAO)

It is confirmed that its food self-sufficiency ratio is especially low since the quantity of production of Japan is descending. The trend of a farming household, an agricultural worker, and a fundamental farmer in Japan is shown in Fig. 7.

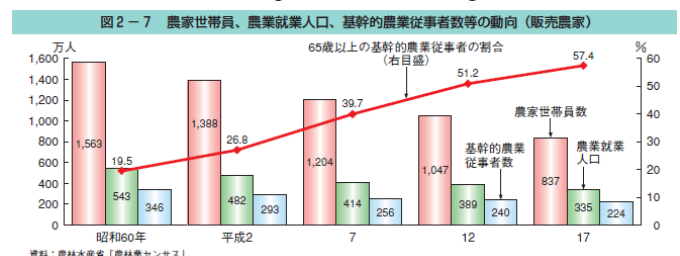


fig7: The trend of a farming household, an agricultural worker, and a fundamental farmer in Japan(Ref. The Ministry of Agriculture, Forestry, and Fisheries)

The number of farming households which was 16 million households in 1985 is becoming about half in 2005, and a farmer aged 65 and over is 57.4%. From this, they are confirmed that the agriculture worker's is increasingly-aging, and the number of agricultural successor is low.

Based on these situations above, the problems of the present agriculture in Japan are as follows.

- Decrease of agricultural yield
- Distrustfulness to products
- Deficiency of new agricultural business formation
- Deficiency of research and development of a new agricultural system which utilized ICT, and business innovation

It is necessary to consider developing the new agriculture using the following ICTs for the reduction of incidence of the farmer who held these problems.

- Creation of new agricultural business which utilized IT
- Realization of environmentally conscious agriculture
- Management and offer of the information of reliability of foods
- Promotion of IT and digitization for the agricultural technology
- Export of the business models to other countries

In order to become attractive industry for a new farmer and to keep the stable production reservation of agricultural products which are not influenced by reduction in a farmer, construction and research of a business model are also a pressing subject.

III. MEASURE TECHNOLOGY TO THE SUBJECT WHICH AGRICULTURE HOLDS

1) Examination of solution for subjects.

The solution examined about the problem in the agricultural field is as follows.

- a) Decrease of agricultural yield
 - Improvement in the productivity by the record which utilized IT
- b) Distrustfulness to products
 - Making structure for guaranteeing the reliability of products.
- c) Deficiency of new agricultural business formation
 - Making the structure which sends seasonal products to consumers.
 - Heighten the agricultural added value
 - Construction of cooperation and a cooperation system with a different field
- d) Deficiency of research and development of a new agricultural system which utilized ICT, and business innovation
 - Unification of research and development, production, and sale
 - Construction of local brands
 - Construction of support organization for the practical use and creation of gastronomic culture
 - Management of intellectual property
 - Export of the consistent production systems which made products the platform

The solution of a) ~ d) about these problems is implemented in each stages, such as research and development, production, circulation, and consumers. These are required not only for the agricultural maintenance of the status quo but also for development.

2) Examination of Information Technology required for solution of a subject

In order to solve the problem in agriculture, the agricultural persons have already been taking various measures. However, the result is not fully obtained. Therefore, the solution which exceeded the conventional framework and utilized IT was examined.

- A) The system for supply chain construction

A process of the production until products reaches consumers from supply of raw material is systematized by utilizing IT. And the problem which may occur is solved.
- B) Digitization of a traditional agricultural technique

In addition to records of the work, a log is accumulated and analyzed from the sensor installed in a farm field, then a traditional agricultural technique is collected. Thus, technical succession and practical use are enabled by digitizing a traditional agricultural technique.
- C) Sharing of information

A neighboring farmhouse shares record of work.
- D) Traceability

Information about products such as production work, farm field, a producer, and transportation can be traced.

E) Signage

When consumers purchase products at a store, a cultivation method is displayed as an advertisement like traceability.

F) Creation of local brands

The agricultural products of every place are made into local brands, and high added value is created. Branding which utilized ICT, such as sending a seasonal thing within a season, is performed.

In order to use IT as a tool to solve the problem such as the reduction of incidence of the work accompanying a aged farmer, technical guidance for a new agricultural entry person, farmer's information sharing, reduction of work mitigation cost, and improvement in agricultural technology, solutions listed in A ~ F in above aimed at the substantial back office to a farmer, the increase in efficiency of the productivity by analysis of information about work burden or mitigation, a job improvement, a construction of business model, and the profit are required.

Moreover, IT is expected also as a means to aim at solution of agricultural problems, such as collection and analysis of each information, including preservation of mere data, record not only to the use of back office support but a work day magazine, a sensor, etc., practical use as traceability, and sharing of information.

IV. EXAMINATION OF BUSINESS SOLUTION

1) Examination of a solution to a problem

The problem in the agricultural field and IT for solution can be associated as follows.

- a) Decrease of agricultural yield
 - Improvement in the productivity by the record which utilized IT (A,B,C,D,E,F)
- b) Distrustfulness to products
 - Making structure for guaranteeing the reliability of products. (C,D,E,F)
- c) Deficiency of new agricultural business formation
 - Making the structure which sends seasonal products to consumers. (A,C,D,E,F)
 - Heighten the agricultural added value (B,C,D,E,F)
 - Construction of cooperation and a cooperation system with a different field (B,C,D,E,F)
- d) Deficiency of research and development of a new agricultural system which utilized ICT, and business innovation
 - Unification of research and development, production, and sale (A,C,D,E,F)
 - Construction of local brands (B,C,D,E,F)
 - Construction of support organization for the practical use and creation of gastronomic culture (C,D,E,F)
 - Management of intellectual property (B,C,D,E,F)
 - Export of the consistent production systems which made products the platform (A,C,D,E,F)

The problem solved by IT in the solution about the problem mentioned above is as follows.

- A) solves the problem a), c), d).
- B) solves the problem a), c), of d).
- C) solves the problem a), b), c), of d).
- D) solves the problem b), c), of d).
- E) solves the problem b), c), of d).
- F) solves the problem a), c), of d).

Creation of local brands, traceability, signage, and information sharing are required for solution of a problem in common.

Since the structure of the supply chain is divided into each phase, IT is utilized for making structure for every phase until products reaches consumers from production in the construction.

Digitization of a traditional agricultural technique makes it possible to leave the technical succession which was conventionally dependent on the individual to universal data, and also makes it possible to manage and record the quality of products, the growth record, cultivation method of a process of production. These lead to the improvement of work efficiency of a farmer, the consistent production, and the quality improvement of products.

In sharing of information, a producer, transportation, a processor, a store, consumers require the sharing of horizontal information and traceability respectively, and are needed for future agriculture similarly. A new solution to a problem, technology, and know-how are sharable by farmhouses becoming a group and sharing mutual work record. In Japan, while there is a case where an agricultural technique is taught mutually, technology is inherited for every farmhouse and information sharing with another farmhouse is not carried out in some areas. Therefore, new know-how is produced by sharing of work record, and it leads to improvement in quality, and mitigation of work. In addition, the education of the new entrant to agriculture and succession of know-how are possible.

By offering the information which consumers need based on the information accumulated by sale from production, signage promotes consumption. Thus, practical use of IT in each phase in agriculture contributes to solution of subjects.

2) Countermeasure to solve the problem

In production control, research of practical use of the big data based on the log accumulation using the producer's work record, schedule, work instructions, and sensor and the measure in business have started at present. From the accumulated work record or various logs, work can be improved and business can be improved now. However, the present condition is that only reference and analysis of record of production are carried out, and technology required for the above-mentioned measure is not adopted. Therefore, a subject is solved by the surveillance study which develops the system which adopted IT which solves a subject.

3) Business solution using an agricultural support system

The system which supports agriculture has been developed in recent years. Those systems mainly aim at the collection and analysis of the various data from a camera or sensors like a field server [1] about the temperature, humidity, CO2 concentration. And it also aims at the recording information and utilization of an agricultural work day magazine, monitoring, schedule management and work instructions, work management, etc.. However, it is developed supposing use of a large-scale farmhouse and an agricultural corporation in many cases rather than a system compatible with an individual farmhouse. Therefore, an agricultural support system with easy use by an individual farmhouse needs to be inquired.

In this research, solution of a subject is tried using the system of NTT Facilities Inc., agricultural support system "agRimoni" [2]. "agRimoni" is a system which can perform production control, production records (a work day magazine, a log, etc.),

schedule management, the state of a field, the training situation of products, etc. Based on "agRimoni", functions required for each phase, such as traceability, digitization of a traditional agricultural technique, supply chain, signage, and improvement of the added value by a new business construction, would be developed.

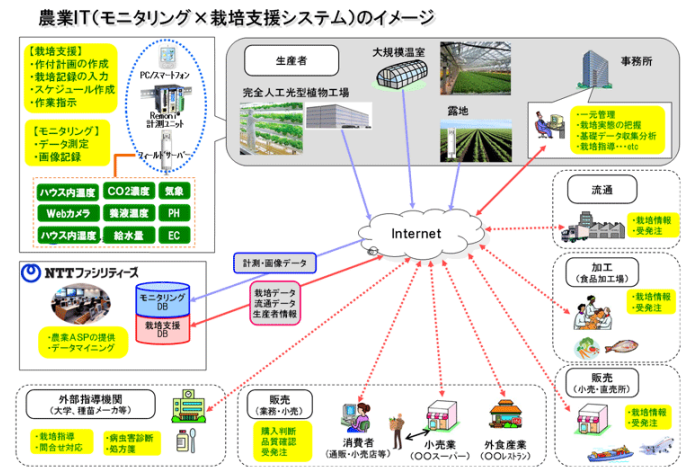


fig 8: The outline of agRimoni(Ref. NTT Facilities Inc.)

V. THE FUTURE DETAILS OF RESEARCH

In order to solve the subject in the present agriculture, surveillance study about the following five items is planned.

1. Research on the supply chain system of agricultural products

Since there is no research in consideration of a supply chain until it reaches shipment, processing, sale, and the consumers of products, the development of supply chain which utilized IT is planned.

2. Research on digitization of a traditional agricultural technique

Agricultural techniques differ for every area and are handed down individually. The technology, the culture, and the wisdom which have been accumulated over long years since agriculture started are included in these traditional agricultural techniques. Since it is reflected in future agriculture, the data creation and the structure by picking up and digitization of these traditional agricultural techniques are built.

Research concerning IT practical use for a producer's information sharing and the technical improvement

The inspection of the work record (work day magazine) by the farmhouse which became a group regionally for the purpose of sharing of the agricultural technique currently handed down at each farmhouse would be enabled. Development of new agricultural technology is aimed at by this information sharing.

3. Study of information disclosure to consumers from the work record and work diary on agricultural products

Records at each process, such as cultivation of products, harvest, and shipment, and other "information which can ask for public presentation" would be investigated. Its open method and means would also be examined. The structure by which consumers can purchase a product in comfort is built.

4. Study of signage agricultural products

Creation of the structure which aimed at the interactive system which made signage and traceability cooperate to research of 4 mentioned above.

Here, in these cases, a system user is an elderly-people user unfamiliar to IT. Therefore, it may become the systems development in consideration of the apparatus development including a user interface. The solution in consideration of these of a subject is required.

VI. AT THE END

Agriculture of Japan has many problems, such as a successor's absence, a farmer's aging, and reduction of the quantity of production. For example, technology is going to be lost by the successor's absence problem. Thus, solution of the problem in agriculture is a important subject for Japan.

Many of agricultural support systems have been developed as a system for a large-scale farmhouse or an agricultural corporation in such a background. However, mitigation of a farmer's work burden could be aimed at by building the system which is easy to utilize at the farmhouse of the individual supporting agriculture of Japan. Moreover, from this, good influence will also affect the increase in farmers, and technical succession. In addition, in the function of an agricultural support system, the use which was conscious of the supply chain, and the practical use which paid its attention to each phase of production, circulation, processing, and sale are expected. By the systems development for the multi-direction information sharing, construction of an agricultural support system utilizable regardless of an agricultural scale is expected. Thus, the contribution of IT to lowering the barrier about entry to agriculture, and the environment and the systems configuration which increase a farmer is large.

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