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The Goals, Issues, and Measures of Foodtech Acceleration

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フードテック推進の目標，課題及び対応策について

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【Abstract】 Foodtech comprises businesses, which facilitate the food supply meeting expanding food demands and realizing environmental protection, and reconcile such diverse consumer demands as health and environmental consciousness. There are still issues to be solved to accelerate the incubation of new foodtech businesses. This paper discusses the direction and goals of foodtech before addressing related business incubation issues.

【Keywords】 foodtech　　innovation　　rulemaking

【要旨】 フードテックは，拡大する食料需要への対応と環境保全をしながらの食料供給と，健康意識や環境意識など多様な消費者の需要に応えるものである．新しいフードテックの事業の創出を加速化するためには解決しなければならない課題がある．本稿では，フードテックの方向性と目標，さらにフードテックビジネス創出に関する課題について議論する．

【キーワード】 フードテック　　イノベーション　　ルールメイキング

1. Introduction

Foodtech constitutes new businesses that contribute to systems of meeting expanding food demand and achieving environmental protection simultaneously. It also expectedly meets diversifying demands of consumers such as health and environmental consciousness. These foodtech technologies have been developing alongside biology and digital technologies.

According to forecasts, worldwide food demand in 2050 will be 1.7 times that of 2010 because of population growth and economic development[1]. While food production must expand, the sustainability of natural capital such as land, water, and biological resources utilized for the food industry is in crisis. Innovatively building a sustainable food system should be vigorously promoted to make the food supply and environmental protection compatible. Japan's Ministry of Agriculture, Forestry and Fisheries (MAFF) published *Strategy for Sustainable Food Systems, MeaDRI* in 2021 to address the necessity of innovation[2].

In addition to the necessity to meet increasing food demand and protect the environment, forecasts expect food-related diseases to pressure health budget. Japan's government formulated *Health and Medical Strategy*, which states that the definition of "healthy food" should be clarified scientifically, and big data is

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necessary to advance healthcare services[3]. Healthiness is one of the demands that consumers have. Thus, the demand for food has been getting diverse such as allergy-free, amusement in food, etc.

New business incubation by foodtech startups is required to solve these social problems. The Japanese government emphasized the year 2022 as "the second founding period," which can produce many startups as they did in the first founding period after World War 2[4].

In May 2022, Japan's MAFF published *Innovation Strategy of Research in agriculture, forestry and fisheries 2022*, which promotes research — especially in such areas as sustainable food systems, healthy food, carbon neutrality, resource recycling, and smart agriculture[5]. *Grand Design and Action Plan for a New Form of Capitalism*, a cabinet decision in June 2022, promulgates supporting checking whether new business models work for foodtech companies[6].

Fostering Japanese foodtech businesses should help solve Japan's and the world's food and environmental issues and activate Japanese industry. This paper introduces the foodtech under research and the goals these technologies are to achieve. It is followed by examining issues in the development of foodtech businesses and the measures to be taken.

2. Foodtech under development and goals to be achieved

This chapter focuses on foodtech under development and related goals, such as sustainable food supply and healthy and rich diet.

2.1. Establishing sustainable food supply that meets the expanding food demand generated by increase in world population

Estimates are that world food demand in 2050 will be 1.7 times as much as in 2010 ; livestock products, particularly, will be 1.8 times[1]. While we must increase food production, the natural asset previously utilized to produce food is under threat. Four of nine "planetary boundaries" — extinction rate, deforestation, atmospheric carbon dioxide, and flow of nitrogen and phosphorus — are no longer intact[7]. This is why the requirement for sustainable food production has been increasing. In addition, the Japanese food industry is now facing price surge in production materials which we rely mainly on imports because of currency depreciation and rising transportation costs. There has been increasing likelihood of unsuccessful purchase of crops from abroad because there are more competitors. Waste reduction measures and replacing materials that are difficult to import with domestic resources seek to address this situation. Lastly, it is becoming more challenging for the Japanese food industry to find employees because the population is decreasing and aging.

Various technological developments such as developing alternative protein sources, productive species, and smart farming strive to meet the requirement of efficient and sustainable food production. Specific examples include plant-based foods, insects, gene-edited fish developed to grow from a smaller amount of feed, cultured meat, and food created by the function of microorganisms. At the same time, there are efforts to decrease the environmental impact by introducing digital technologies to livestock or fish farming. Examples of the measures for import substitution, decarbonization, and reduction in environmental impact are production of feed and fertilizer by recycling food waste, using insects and algae, and developing packaging suitable for long-term storage and transportation.

Japanese food industry should take measures to implement these new technologies. As for cultured meat, the authorities must make a rule about how to secure food safety and label it because it is food that people did not consume previously. In addition, it is necessary to achieve the way cultured meat industry and livestock farming are compatible since both aim to meet increasing food demand. As for smart food manufacturing, artificial intelligence and robot technologies should be more customized to food manufactur-

ing sites and verification tests to ensure human security should be done. Regarding complicated processes that are difficult to substitute with robots, there should be more research to enlarge the scope that robots can handle. As for smart farming, there should be more site implementation of existing technologies such as drones for precise distribution of pesticides and robots for weeding. In the future, the Japanese food industry should better promote research about insect image diagnosis, livestock management using artificial intelligence, and smart aquaculture.

2.2. Achieving a healthy and rich diet that can meet various needs

Highlighting a healthy life expectancy is increasingly important in an aging society. Investors are interested in food and beverage manufacturers tackling health and nutrition issues. Across the 52 Organization for Economic Cooperation and Development countries, an anticipated 8.4% of health budgets will deal with the harmful effects of being overweight between 2020 and 2050. This ratio translates into a 3.3% reduction in GDP due to lower employment and reduced productivity[8].

Japan's Ministry of Health published *The plan for extending healthy life expectancy*, which states the necessity of creating an environment that unconsciously leads to a healthy diet. Establishing and utilizing more evidence for achieving a healthy diet is required for this to occur. At the same time, consumers should be more exposed to healthy diets. The health food business has been getting more attention as the importance of preventing rather than curing disease is the focus[9].

In addition, what people value in diets has been diversified, such as healthiness, low environmental impact, cultural transmission, and amusement in cooking. There is also a need to provide diets for those with restrictions like swallowing difficulties and food allergies. Solving food access difficulties for the elderly is an important issue, too.

Innovators use genome editing to produce healthy food like plants with high nutrients. Moreover, the "perfect meal" includes all necessary nutrients and a limited amount of fat, sugar, and protein to adequate intakes. There is also software that analyzes the correlation between a user's diet and health record and offers personalized nutrition recommendations. Ultimately, the improvement in mass spectrometry has accelerated the research about food nutrients and functions and resulted in the accumulation of information about the values of Japanese food.

Japan's National Agriculture and Food Research Organization maintains a database of food, microbiomes, and health, which relates to producing services that recommend a personalized diet[5]. Although the app technology exists, it is hard for consumers to accept without the ease of tracking health records via noninvasive measurement instruments and obtaining recommended meals through smart home appliances.

3. Issues and measures for foodtech business incubation

The foodtech business is still under development. Compared to other fields, foodtech startups have difficulties commercializing because of the long experimentation time or the need to secure safety. This chapter discusses the issues of foodtech commercialization and the measures to take to solve them.

3.1. Finance

It is difficult to commercialize foodtech because it takes time to establish the rules and obtain consumer acceptance. Also, funding is vital from the conceptual stage to the commercialization stage. The EU's "Farm to Fork Strategy" proposes providing 10 billion euros for research, food innovation, bioeconomics, etc[10]. At the same time, Singapore's "GROW" program offers foodtech startup support via accelerators and funding[11].

According to AgFunder, investment in foodtech has

been growing. In 2020, the investment in Japan ranked 13th among countries, but in 2021 it was below 16th [12]. Japan's MAFF supports research and business feasibility studies related to foodtech. As the government's system decreases the risk of private investment in foodtech startups, Japan Finance Corporation invests in the investors who invest in food businesses.

3.2. Open innovation

Accelerating foodtech innovation requires identifying partners who can commercialize, produce on a large scale, and find a place to sell. It is hard for startups to find a retailer to sell their products and make them known to consumers. So, it is beneficial to collaborate with retailers to develop and sell products. For example, Gryllus, a Japanese startup which produces and sells edible crickets, collaborated with Ryohin Keikaku, the retailor with the MUJI brand, to sell cricket crackers in 2020. The CEO of Gryllus, Inc., Mr. Watanabe, said there was a complete difference in consumers' reaction between selling by an unknown startup and selling by Ryohin Keikaku[13]. In 2022, Gryllus, Inc. started selling its products at FamilyMart, a convenience store in Tokyo.

It is also effective to work with chefs to develop a tasty product. Green Culture, Inc., a plant-based startup, offers products at the Hotel Century Southern Tower restaurant. Fuji Oil Co. presented its plant-based food strategy at a tasting event to expand its sales at the prestigious New Otani Co. hotel. Sakana Farm, Inc., a land aquaculture startup, collaborates with chefs to find a way to grow fish of the quality they demand.

As for facilities by big companies, Fukushima Galilei Co., Ltd., installed MILAB, a food innovation platform that offers facilities in real food factories for research and experimental making[14]. Juchheim Co., Ltd. started a foodtech innovation center that allows member companies to use facilities and undertake B2B sales of startups' products[15].

Increasingly, food manufacturers and retailers invest in foodtech startups and support their growth. Examples include corporate venture capital funding by Oisix Ra Daichi, Inc.[16] and Ajinomoto Co., Inc.[17] The AgFunder SIJ Impact Fund, started in March 2022 via SDG Impact Japan, Inc., and AgFunder Asia Pte., Ltd. They announced the first close, receiving investment from Meiji Holdings and Asahi Group Holdings, a confectionery company, and a beverage company, respectively[18].

3.3. Strategic rulemaking

Sometimes a new rule is required when a novel food forms from new technologies and there is a safety concern. If there is a rule delay and the startup's product launch is unclear, this damages startup predictability and investor credibility. Thus, it is essential to organize the business environment of startups by making a rule.

Whether legislation by the government is necessary or new guidance under existing regulations is sufficient depends on how much safety risk a new product has. For example, it is necessary to examine cultured meat's safety and determine new rules to ensure protection because consumption of this product is novel. Because people currently eat insects in some regions in the world, there is no discussion of new safety legislation for this item in Japan at present. The insect working team of the Private-Public Council of Foodtech settled the guidelines for cricket producers in July 2022[19].

New legislation for securing plant-based food safety is also not discussed in Japan since plant-based food consumption is widespread. In 2021, Japan's Consumer Affairs Agency published a Q&A for labeling plant-based food[20]. In 2022, MAFF established the Japanese Agricultural Standard of soy meat and discussed its internationalization[21]. Plant-based foods-Terms and definitions was proposed and addressed at an International Organization for Standardization Technical Committee meeting[22]. Japanese experts joined the discussion based on the opinions of Japanese man-

ufacturers of plant-based food. As for setting up rules, international harmonization is necessary because the application of different regulations according to countries increases the cost of selling products abroad.

3.4. Establishing consumers' understanding

It is difficult for people to accept food they have never consumed. In a 2020 survey of Japanese in their 20s to 40s, more than half (55.6%) wanted to eat plant-based food. However, the proportion of those who did not want to eat insects (45%) was larger than that of those who did (30%). As for cultured meat, genome-edited food, food with sufficient nutrition, and fish from land aquaculture, those who neither wanted to eat nor refuse it accounted for the largest part[23].

A survey by Japan's Cellular Agriculture Institute of the Commons reveals that the most worrying concern regarding cultured meat is safety[24]. Thus, measures that promote safety, appropriate labeling, consumer disclosures, and communication are crucial to credibility and acceptance as discussed in 3.3.

As for genome-editing technologies, Japan's MAFF does outreach activities, where experts provide scientific expertise, explain the rule, and communicate with consumers[25]. Regional Fish Institute, Ltd.is solidifying its credibility via labeling and traceability so that the products are delivered only to consumers who want genome-edited goods.

Takei and Iijima (2019) argue that targeting only those willing to eat insects is effective for insect producers. They segmented university students by food tastes and investigated which segment was most likely to accept insects. Specifically, the researchers segmented 972 students into "conservative," "cost-conscious," "health-conscious," and "curiosity-conscious." "Health-conscious" and "curiosity-conscious" were not much influenced by price and can be the potential target of insect food. "Health-conscious" was more likely to react to terms like "organic" and "natural food."[26]

To increase the sales of never-before consumed food, they must be exposed to consumers more to become known. Further, the social impact of these new foods, which is the current food system's problem must be addressed more. As stated in 3.2, collaboration with retailers and restaurants is essential. Because the food system problem is long-term, consumers are not likely to have a sense of crisis and do not often change their purchase behavior. Currently, measures are emerging, such as introducing incentives that can change consumer purchase behaviors. For example, Aya Town, Miyazaki prefecture Japan has an app to offer points for individual behaviors such as purchasing healthy food and local food and reducing food loss[27].

4. Conclusion

Foodtech businesses vigorously aim at achieving sustainable food supply that meets expanding food demand and realizing healthy and rich diet that can meet various needs. So it is strongly expected that the measures to solve issues of foodtech commercialization are taken, such as financing foodtech startups, open innovation, strategic rulemaking and establishing consumers' understanding that are discussed in this paper.

Disclaimer

This paper expresses the author's opinion and does not reflect the opinions of the organization the author belongs to.

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