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Foodtech Sector in Japan

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Maths Lundin

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2-11-19 B102 Amanuma, Suginami-ku, Tokyo, 167-0032 JAPAN

Contents

List of Abbreviations

FY	Fiscal Year (usually the period between 1 April of one year and March 31 of the following year)
HS	Harmonized System
JAS	Japan Agricultural Standards
JETRO	Japan External Trade Organization
MAFF	Ministry of Agriculture, Forestry and Fisheries
MOF	Ministry of Finance
SMEs	Small- and Mid-Sized Enterprises
SMTS	Supermarket Trade Show

1. Executive Summary

Foodtech, the technological transformation of the food sector, is the process of developing, producing and distributing food products using cutting-edge technology. The application of foodtech spans across a number of industries, including food science and the food service industry; it involves innovation at every stage of the food value chain.

Japan's foodtech industry is at the intersection of tradition/rich culinary heritage and innovation.

Japan has today a low rate of self-sufficiency at around 38% on a caloric intake basis and the current food supply level is not sustainable. Japan is working to develop a sustainable agri-food industry in the long run and needs innovation across its entire food value system to be better prepared for the future.

Awareness of foodtech among consumers is growing in Japan but still behind advanced economies, such as the U.S. and the EU. One issue is how food products produced with advanced technologies will be accepted and the taste is key to convincing consumers to try new products.

In recent years, the Japanese Government has taken supportive steps to promote foodtech. In 2020, the *Ministry of Agriculture, Forestry and Fisheries* (MAFF) established the *Public-Private Council of Foodtech.* The council promotes collaboration on foodtech between the government, academia, and industry.

As an example, *Nissin Foods* has been able to successfully cultivate meat by partnering with the University of Tokyo.

Key drivers of Japan's foodtech industry include increasing health and sustainability awareness leading to foodtech solutions that cater to these preferences, government support, labour shortages in the food service sector and collaboration between startups and established companies.

Major challenges in Japan's foodtech industry are being addressed through new technological advancements, including artificial intelligence (AI) and robotics. *New Innovations,* a Japanese startup, will begin offering cooking robots for restaurants (*Asia Nikkei*).

MAFF is actively involved in smart farming initiatives. Smart agriculture is increasingly being used in Japan to tackle manpower shortages. *Legmin*, a Japanese startup, has developed an agricultural robot suitable for the local climate (*Japan Times*).

Japan's foodtech market consists of a large number of segments. One segment is plant-based foods. According to *Statista Market Research,* the market size was estimated at 34 billion JPY in fiscal year 2021 (ending March 31, 2022), and is forecast to grow steadily to 73 billion JPY in fiscal year 2025.

Foodtech trends in Japan include the use of growing alternative protein sources as well as increasing use of automation and robotics in agriculture (Agritech). Growing awareness of the environmental impact of food production has contributed to the development of plant-based and lab-grown meat alternatives. Current products on the market in Japan are still trying to replicate authentic meat flavours, texture and nutrition.

Plant-based dairy products and edible insects are attracting attention. For startups it can be challenging to get innovative food products into the retail segment.

An increasing number of farmers are turning to AI technology to handle labour-intensive tasks

In February 2023, Japan's PM Kishida announced the intention to develop Japan's cultivated meat industry including safety assurance measures and developing proper labelling rules (*Nikkei)*.

The funding for Japanese foodtech startups is expanding. Many startups are focusing on innovation and disruption. In 2022, *IntegriCulture,* a start-up cultivating meat, raised 7 million USD that helped the company to develop its *CulNet System.*

Expanding into Japan's foodtech market can be a promising opportunity for EU SMEs. Japan is known for its advanced technology adoption and a growing interest in innovative food solutions. Some opportunities that EU SMEs can explore include:

- *Innovative food products and technologies:* EU SMEs can introduce innovative food products such as plant-based alternatives and functional foods as Japan's consumers are increasingly getting health-conscious.
- *Smart agriculture*: Japan is investing in smart agriculture and precision farming. EU actors specialising in agritech can offer solutions for optimising production, reducing use of resources and improving sustainability.
- *Collaborations and partnerships.*
- *Sustainable and eco-friendly solutions*: EU companies can find opportunities to align with Japanese consumers' environmental values.
- *Food waste reduction solutions.*
- *Personalised nutrition solutions.*
- *Cultural adaption and localisation*: Adopting products to cater to local tastes and preferences.
- *Research and development capability*: Developing products and solutions tailored to the unique demands of the Japanese foodtech market.

2. Scope of the Report

The aim of this report is to assess the current status of the evolving foodtech sector in Japan. The report provides valuable insights into where the market is developing, which companies are the front runners, future prospects and is targeting EU-based small- and mid-sized companies that are manufacturing foodtech-related products and are seeking to enter the Japanese market or those aiming at strengthening their current position in Japan. The intended audience for this report also includes other actors in the value chain, including innovators and exporters.

a. Methodology

This report uses both qualitative and quantitative methods to evaluate the Japanese market for foodtech products. Data has been gathered by reviewing the existing literature (English and Japanese sources) and conducting interviews with sources knowledgeable about the market. At *FOODtech Week Tokyo 2023* that was held in December 2023, interviews were made with trading companies and manufacturers.

The report offers a market overview with examples of key products, gives understanding of the market dynamics and identifies potential growth areas. The main focus will be on the following sub-sectors:

- Food production
- Agritech
- Food service

Quantitative data on production, consumption and trade have been obtained from several sources, including the statistics of the Ministry of Agriculture, Forestry and Fisheries. Openly available data has been collected from homepages of ministries, trade press, manufacturers, distributors, wholesalers, retailers and trade associations.

The report contains data on foodtech segments, information on startups and established companies in the foodtech sector, and identifies factors driving the market, including trends and challenges.

b. Definition of Foodtech

Foodtech, the technological transformation of the food sector, is a broad and interdisciplinary field that encompasses the application of cutting-edge technology and innovation to various segments of the food industry, from production and processing to distribution and consumption. Foodtech is aimed at improving the way we produce, supply, prepare, and consume food.

3. Introduction to Japan's Foodtech Sector

According to Japan's Ministry of Agriculture, Forestry and Fisheries (MAFF), the worldwide food demand in 2050 is projected to rise 1.7 times that of 2010 due to population growth and economic development [1].

One core issue for Japan is to increase the self-sufficiency rate that stood at 38% on a caloric intake basis in the fiscal year 2022 ending March 31, 2023, unchanged from a year earlier [2]. The government target, set for fiscal year 2030, is 45%.

When calculated by production value, the rate was 58%, a decrease by 5% from fiscal 2021, the lowest since 1965, when comparable data became available. The target for fiscal year 2030 is 75%.

It is expected that foodtech, by leveraging technology and innovation initiatives, will create new businesses that will help increasing Japan's self-sufficiency rate and create a more efficient, sustainable, and consumer-friendly food eco-system.

a. Current Status

Due to limited land for food production, Japan's current food supply is not sustainable. To handle this situation, Japan needs innovation to be implemented across the entire food value chain.

In the *Basic Plan for Food, Agriculture and Rural Areas* approved in March 2020, the Cabinet calls for foodtech, which combines food production and cutting-edge technology, to respond to the diversification and sophistication of the needs of consumers [3]. Necessary measures should be taken for the sound development of the food industry, such as consideration of reducing environmental impact and promoting cooperation with agriculture.

b. Supportive Steps by Government

In recent years, the Japanese Government has taken supportive steps to promote foodtech in Japan. In 2020, the *Ministry of Agriculture, Forestry and Fisheries* established the *Public-Private Council of Foodtech* to promote collaboration on foodtech between the government, academia, and companies [4].

Japan has established government bodies to promote food technology. In 2021, the government published a white paper positioning alternative meats as a solution to help Japan reach the 2050 target for net-zero emissions due to less greenhouse gases being emitted during the production process [5].

In February 2023, Japan's PM Kishida announced the intention to develop Japan's cultivated meat industry including safety measures and developing labelling rules [6].

A roadmap for foodtech promotion was formulated by the Public-Private Council of Foodtech in fiscal 2022. The roadmap that was updated in October 2023 outlines six themes to be addressed, such as [7]:

- Plant-based alternative protein sources
- Insect food/insect feed
- Smart breeding driven by genome editing
- Cellular food
- Automation and labour-saving in the food industry
- Achieving human health through information technology

c. Various Initiatives

Foodtech activity is increasing in Japan. Since 2017, the *SKS JAPAN* conference has been held annually in Japan with the purpose to create the "future of food going beyond industry". This is the Japanese version of SKS, the global summit founded in the U.S.

FoodTech JAPAN, being a leading business platform for the foodtech industry, was launched in 2020 with the aim to respond to various needs within the industry. FOODtech Week Tokyo and FOODtech Week Osaka are held annually since 2020. High demands from the food industry include solutions to cope with labour shortages due to the ageing population.

Several FoodTech Events to promote the foodtech sector have been held in recent years, including one event with MARUI, a major Japanese retail store operator, that together with domestic and overseas food companies displayed a variety of food products.

i. Industry-Academia Collaboration

Industry-Academia collaboration in Japan is leading to food innovations.

The OPERA "Food Cutting-edge Technology Joint Development Consortium", led by Professor Ezura of the Tsukuba-Plant Innovation Research Center at the University of Tsukuba is tackling social issues surrounding food.

In December 2020, the "*Sicilian Rouge High GABA*", a genome-edited tomato, was created by Professor Ezura [8]. This tomato variety is known as the world's first genome-edited crop to be approved for national sale.

Sicilian Rouge High GABA contains four-to-five times more GABA (functional health component) than regular tomatoes. This tomato has potential to prevent high blood pressure. As of June 2022, 16 universities and companies participated in the consortium.

4. Foodtech Market Dynamics

This chapter highlights some aspects of the nature of the dynamics of Japan's foodtech industry today.

a. Key Drivers

Japan's foodtech industry is driven by several key drivers that are shaping the future development.

- *Increasing health and sustainability awareness:* Japanese consumers are becoming more health-conscious and environmentally aware. This has led to a demand for healthier and sustainable food options, driving the development of foodtech solutions that cater to these preferences.
- *Ageing population:* Japan has one of the world's rapidly ageing populations. This demographic shift has led to increased interest in foodtech solutions that address the dietary needs and preferences of seniors.
- *Cultural embrace of technology:* Japan has a strong culture of technological innovation and is known for embracing cutting-edge technologies across various industries. This culture extends to the food sector, fostering innovation and experimentation.
- *Rich culinary heritage:* Japan's culinary heritage is globally renowned, with a wide variety of traditional dishes and flavours. This provides a strong foundation for innovation and a desire to preserve and enhance these culinary traditions through technology.
- *Labour shortages:* The economy is facing labour shortages, particularly in the restaurant and foodservice sectors. Automation and robotics in food preparation and service are seen as solutions to address this issue.
- *Government support:* The Japanese government has been supportive of the foodtech industry through various initiatives, funding programs and regulatory reforms aimed at promoting innovation and growth in the sector.
- *Investment and funding:* Investment in foodtech startups is on the rise, both domestically and internationally. This influx of capital is fuelling research and development.
- *"Globalisation of palates":* Japanese consumers have developed a taste for international cuisines, leading to a demand for diverse and authentic flavours. Foodtech companies are responding by offering a wide range of international cuisines and flavours.

b. Key Trends

Japan has a rich culinary tradition and a strong interest in technology, which has led to the emergence of several interesting food tech trends in recent years.

Some of the key trends include:

- *Plant-based and alternative proteins:* The interest in plant-based and alternative protein sources has been growing worldwide. In Japan, although from a low level, the interest is growing.
- *Technology in agriculture (Agritech):* Innovations in agriculture technology to improve efficiency, reduce waste, and enhance sustainability are trends that are gradually emerging in Japan.

c. Key Challenges

Japan's foodtech sector faces several challenges. These challenges can influence the growth, development, and adoption of food technology. Some of the key challenges include:

- *Taste and texture challenges:* Foodtech companies must closely mimic the taste and texture of traditional foods to gain consumer acceptance. Achieving the desired sensory experience can be technically challenging.
- *Consumer acceptance*: While Japan generally is open to technology, there can be resistance when it comes to new foodtech-based technologies.
- *Cultural preferences*: Japanese cuisine has a strong cultural and historical significance. Traditional food preparation methods and ingredients are highly valued, making it challenging to introduce new and unfamiliar food products.
- *Competitive market*: The Japanese market is highly competitive, with well-established traditional food companies. Newcomers, including foodtech startups, must compete with these established players to gain market share.
- *Regulatory hurdles*: Japan has strict regulations governing the food industry, which can be a barrier to innovation in foodtech. Navigating these regulations and obtaining necessary approvals for new products and technologies can be time-consuming and costly.
- *Consumer education*: Educating consumers about the benefits and safety of foodtech products require significant effort and resources. Many consumers may not be familiar with concepts like plant-based food or lab-grown proteins.
- *High costs*: Developing and implementing food technology can be costly. Startups and smaller companies may struggle to secure the necessary funding and resources to compete effectively.

Despite these challenges, Japan's foodtech sector also presents numerous opportunities for growth and innovation.

5. Food Production Sector

This chapter includes information on the status of plant-based food products and cell-cultivated food products in Japan.

a. Plant-based Food Products

In response to growing health awareness, the demand for plant-based protein sources, although from a low level, is showing a growing trend.

In 2020, the Ministry of Agriculture, Forestry and Fisheries set up a plan to diversify protein sources and promote plant-based foods, positioning alternative proteins as an important segment.

In Japan, the market for plant-based products is estimated to have doubled between 2019 and 2022, reaching a value of 36.9 billion yen [9].

Compared to overseas markets, the consumption of soy-based products in Japan is less regarded as a lifestyle focused on plant-based alternatives but more seen as a choice for a meal [10].

The market size of volume sales for non-animal derived proteins in Japan amounted to 41,100 tonnes in 2022 [11]. Soy protein concentrate had the highest market share among plant-based protein products at 63.3%, followed by soy protein isolate (27.9%), gluten (6.9%), vegetable proteins (1.7%), and pea protein (0.2%).

i. Plant-based Meat Products

Plant-based meat, which is also known as plant-based protein or meat alternatives, are food products that mimic the taste, texture, and appearance of traditional animal-based meat but are made from plant sources.

Plant-based meats are typically made using a combination of plant proteins (soy, wheat, peas, mushrooms), oils, species and binders.

Plant-based meats have been the focus of the alternative protein industry in Japan. Interest in meat alternatives has been growing recently, especially among health-conscious consumers. The number of retailers dealing with plant-based products is increasing.

According to market research firm Seed Planning Co., Ltd., the domestic plant-based meat market is expected to expand to 78 billion yen in 2030, a 2.3-fold increase vs. 2020 [12].

Japan's plant-based alternative meat industry is comprised of trading companies, oilseed crushers, meat processors, food manufacturers, health food manufacturers, and startup companies [13]. Oilseed crushers and trading companies primarily source ingredients (food-grade soybeans) from domestic and foreign suppliers. Oilseed crushers then sell their products to protein manufacturers, who then sell the intermediate products to consumer-oriented food manufacturers.

The shift to plant-based meat in Japan is expected to pick up steam in the years to come.

There are many startups in this segment that are focusing on the household segment. Green Culture Inc. is a startup that launched "*Green Meat"* in April 2021 made from soybeans and pea protein targeting restaurants [9.a.i]. Later, the company released a product for home use.

Daiz Inc. is an innovative company that has developed a proprietary technology for seed germination [9.a.ii]. Germinated soybeans are exposed to precisely controlled environmental factors, including temperature and oxygen to support sprouting [14]. This technology has led to the development of *Miracle Meat,* which DAIZ claims to be superior to other plant-based meat in terms of texture and flavour.

Tastable Co., Ltd., a startup, is engaged in the development of processed products including plant-based meat NIKUVEGE [9.a.iii]. Sojitz Foods Corporation, one of the equity owners, offers several ground meat products under the NIKUVEGE brand with replicated taste and texture of meat dishes without using any animal-derived ingredients.

Major food companies are entering the alternative meat market. Marukome Co., Ltd. is one of Japan's largest miso paste producers [9.a.iv]. The company early entered the plant-based meat market in 2015 by launching their *Soy Lab* brand of ground and diced meat alternatives [15].

In 2018, Otsuka Foods Co., Ltd. released the "Zero Meat" range of plant-based burgers as the company had noticed that consumers were reducing meat intake for health reasons [16].

ii. Plant-based Dairy Products

Compared to plant-based meat products, other sub-segments of plant-based food products are less developed in terms of sales.

Alternative milks are well established in Japan. Kikkoman Co., Ltd is the largest player with a market share of about 50% [9.a.v].

Marusan-Ai Co., Ltd. is the second largest domestic soy manufacturer [9.a.vi]. The company is selling a variety of miso products (seasonings made from soy beans) and soy milk.

The demand for oat milk has grown in recent years. Several domestic players have introduced products including Marusan-Ai. Since around 2020, Alpro-branded oat milk is distributed in Japan by Danone Japan Co., Ltd. as importer.

iii. Plant-based Cheese

In Japan, one can find many plant-based dairy alternatives, including cheese substitutes [17].

The *Violife*-branded plant-based cheese imported by J-Oil Mills Co., Ltd. can be bought in many retail outlets in Japan [9.a.vii]. J-Oil Mills began distributing this cheese in Japan in September 2021 in cooperation with the Dutch producer Upfield Holdings B.V.

Sagamiya Foods Co., Ltd., a major tofu manufacturer, is producing tofu-based cheese under the *Beyond Tofu* brand [9.a.viii].

iv. Alternative Eggs

In 2022, Kewpie Corporation, a major manufacturer of mayonnaise sauce, launched *Hobotama* ("almost eggs"), which is a vegetarian version of scrambled eggs for home use made of soybeans [9.a.ix].

Umami United Japan Co., Ltd., a startup founded in 2022, has launched a plant-based solution for egg allergies [9.a.x]. The company's target group is people who has health-related issues with eggs [18]. The company has developed a konjac-based powdered egg alternative named "Umami Egg". By using konjac ingredients, the elasticity of umami eggs is created and by using unique enzymes, the umami is produced, a glutamic acid that gives a pleasant savoury taste.

v. Seafood Alternatives

The number of food alternatives has expanded to also include seafood but seafood alternatives in Japan is still limited. In 2021, Next Meats Co., Ltd., a Japanese food-tech venture company, started selling its canned *NEXT Tuna*, which is 100% plant-based, with low fat and zero cholesterol [9.a.xi].

NH Foods Ltd. is the first major Japanese food manufacturer to launch plant-based sea-food [9.a.xii]. The company has developed a fried fish product that resembles whitefish [19]. The manufacturer has put in significant technological effort to bring out the flavour of seafood and recreate its texture.

Azuma Foods Co., a food manufacturer, has launched the *Marude Sakana* ("tastes just like fish") series consisting of substitutes for salmon, tuna and squid sashimi made mainly from konjac powder [20].

vi. Insect-Based Food Products

Insect-based food products are gaining momentum in Japan as a sustainable protein alternative.

Gryllus Inc., a university-launched startup, is selling edible crickets based on the results of research on crickets accumulated over 30 years at the University of Tokushima [9.a.xiii]. Gryllus is turning crickets into powder that is used to make food products and chocolate.

NTT East Corp. is planning to work with Gryllus to produce crickets for human consumption [21]. The company is aiming to reach billions of yen in sales by 2028.

Japan's edible insect market was valued at about 1.4 billion yen in 2022, according to Osaka-based TPC Marketing Research (Nikkei Asia).

b. Cell-cultivated Food Products

The cellular foods segment is still a niche but has potential to grow over time. Drivers for cultivated food include factors such as, less contamination, few antibiotics and less environmental impact.

i. Cultivated Meat

According to Ajinomoto Co., Ltd., there is a growing interest in Japan in cultivated meat [9.a.xiv].

Cultivated meat, also known as cultured meat, is genuine animal meat that is produced by directly cultivating animal cells [22]. With this production method there is no need to raise animals for food, resulting in less usage of resources.

Singapore is far ahead of other countries when it comes to lab-grown meat. In Japan, IntegriCulture Co., Ltd., a startup developing scalable cell culture technology, has commercialised a system to optimize the production of cultivated meat [9.a.xv]. The company's CulNet System, a cell culture platform technology, has attracted attention from many investors around the world. This system is designed for a wide range of cellular agricultural products, such as food and food ingredients.

In February 2023, the company successfully cultivated foie gras from duck liver-derived cells using its proprietary CulNet system.

Nisshin Foods Co., Ltd. has successfully cultivated meat in collaboration with the University of Tokyo [23].

In 2023, Osaka University Graduate School of Engineering, Shimadzu, Itoham Yonekyu, Toppan and SIGMAXYZ established the "Future Creation Consortium for Cultivated Meat" [24]. The consortium is working towards implementation of edible cultured-meat manufacturing using 3D bioprinting. This technology has been developed by Osaka University.

The consortium plans to showcase the equipment for making meat during Osaka/Kansai Expo 2025 with scheduled commercialisation by 2030.

ii. Cultivated Seafood

A research study on the opinions of Japanese consumers regarding cultivated seafood shows that attitudes are generally positive [25]. Seventy percent of participants showed interest in tasting and sixty percent expressed willingness to purchase cultivated seafood once it is available.

Maruha Nichiro Corporation has entered into a partnership with Singapore-based Umami Bioworks aiming to build the infrastructure of Japan's cultivated seafood industry [26]. Maruha Nichiro has been working with domestic companies on joint R&D of cell-cultivated seafood products [9.a.xvi]. This is the company's first venture into a foreign cellular agriculture company.

Umami Bioworks has been working to develop a cell-cultivation platform since its launch in 2020. The company recently opened a Tokyo office.

6. Agritech Sector

Agriculture once started the development of human society and, over time, has passed through several stages of evolution. Today, the Japanese government and the private sector are taking a variety of measures to further develop the agriculture sector.

Agritech, sometimes referred to as AgroTech, is the use of technologies aiming at increasing farming efficiency and sustainability. This category includes use of field sensors, farm management software and automated machinery solutions.

Japan's Ministry of Agriculture, Forestry and Fisheries (MAFF) supports the use of Agritech and is actively involved in smart farming initiatives.

In addition to the overview of the market size, this chapter presents products and solutions targeting the agritech sector.

a. Market Size

According to Yano Research Institute, the Japanese Agritech & Foodtech market size based on the shipment value at manufacturers is estimated at approximately 71.8 billion yen in fiscal year 2021 [27].

The market size calculated as the total of *smart agriculture* (including precision farming, agricultural drones and agricultural robots), *plant factory* (vegetables grown in full artificial light plant factories), *next-generation aquaculture* (smart aquaculture) and *alternative proteins* is forecast to reach approximately 134.1 billion yen in fiscal year 2025 and approximately 211.3 billion yen in fiscal year 2030.

As reported by Swiss Business Hub Japan, the total size of the domestic AgriTech market was 10.4 billion yen in fiscal year 2016 [28]. The growth potential by fiscal year 2023 is estimated at approximately 33.3 billion yen. Precision farming is expected to grow due to the expansion of unmanned operation systems. Robot technology is prioritised to alleviate physical limitations of ageing farmers.

b. Use of Various Technologies

Japanese agritech companies utilise a broad range of technologies, including Artificial Intelligence, to automate agricultural processes by offering/developing products and services for farmers.

i. Artificial Intelligence

Farmship Inc., an agricultural technology startup, has developed Artificial Intelligence (AI) to assess the growth potential of spinach seedings [9.a.xvii]. The company has developed the technology together with Pi Material Design, an information science startup originating from the University of Tsukuba [29]. The aim is to reduce food loss by increasing efficiency. Farmship's AI system uses photographs to estimate height, width and weight of seedlings in order to predict future growth. The company's technology has been developed in collaboration with the government-backed New Energy and Industrial Technology Organization (NEDO).

How to utilize abandoned farmland is a major agricultural issue in Japan. Sagri Co., Ltd., a smart agriculture data service and platform actor, has developed a solution to take on this issue [9.a.xviii]. The company's services include *Actaba* application and *Detaba* application for farmland management.

Sagri's AI-based technology analyses satellite data to predict if a farmland is cultivated or abandoned. The developed algorithm of the Actaba application gives a prediction of the probability that the land is abandoned. The strength of Sagri's business is the database [30]. The company combines farmland information, such as cultivated area and soil quality with land *parcel data* (information about the rights, interests, and ownership of land) obtained from satellites. Such data, when processed with AI, makes it possible to visualise individual farmland indicators (crop X grows well, etc.).

Inaho Inc., a startup, has developed an agricultural platform around an automated vegetable harvesting robot [9.a.xix]. The company developed an AI-equipped asparagus harvesting robot in 2019, operating under the Robot-as-a-Service business model.

ii. Agricultural Robots

Agricultural robots are showing a lot of promise. MAFF is undertaking various efforts together with companies, universities, research institutes, and other organisations to realise Smart Agriculture that utilises robot technology and IoT to achieve labour-saving and high-quality production. The aim is to maintain Japan's agricultural production capacity as the farmer population is ageing.

Legmin Inc. is a startup aiming to make agriculture more efficient by using robots [9.a. xx]. The company has developed an automated robot that uses an 8-meter-long arm to spray agricultural chemicals as it moves around in a large field [31]. The robots are estimated to cover up to five times more land per farmer compared to non-use of robots.

Agrist Inc., an agricultural startup, has developed a green pepper harvesting robot called "L" [9.a.xxi]. By utilising a combination of cameras, the proprietary algorithm enables the robot to assess the size of green peppers and determine the right time to harvest the crops [32]. The robot, while using pre-fed training data, hangs and runs on thick overhead wires, like a horizontal gondola. When spotting a ripe pepper, a picking tool grasps the pepper, slices through its stem and drops it in an onboard basket. The robot can be working up to 12 hours as long as there is daylight. This technology is a way to solve the labour shortage in agriculture.

iii. Other Technologies

One company with solutions related to cultivation management is Seraku Co., Ltd. that has developed the "Green Monitor" [9.a.xxii]. The Green Monitor is a monitoring system that automatically measures and records the field environment. This system helps farmers to keep track of a variety of variables, including temperature and pH levels.

7. Food Service Sector

Foodtech in the food service sector includes kitchen robotics, restaurant technology and smart appliances. Japan has been somewhat of a pioneer in incorporating robots into the foodservice industry.

a. Cooking Robots

While sushi-making robots gained early prominence in Japan, there has been a growing trend towards developing robots for a wider variety of dishes.

Japan is facing a shortage of skilled chefs and kitchen staff, especially in the restaurant industry. Cooking robots can help filling this gap by automating repetitive tasks.

i. Pasta Robot

The world's first automated pasta cooking robot *P-Robo* was developed by *TechMagic Co., Ltd*. [9.a.xxiii]. P-Robo has been developed in collaboration with E Vino Spaghetti restaurant in Tokyo. All tasks, with the exception of final touches such as adding toppings, are carried out by the robot [33]. The status of pasta ingredients is based on AI image recognition technology. Pasta can be cooked in 45-second intervals.j

ii. Serving Robot

Connected Robotics Inc. is specialised in the development of robotic solutions for the food service industry [9.a.xxiv]. The company has developed the "*Sidedish Serving Robot Delibot*" that automates the arrangement of precooked side dishes. The company focuses on creating robots that can automate various aspects of food preparation, especially in the context of commercial kitchens and restaurants.

Another product launched by Connected Robotics is a *French Fries Robot* that automatically makes French fries and delivers them to the bagging station.

iii. Automated Coffee Maker

Root C is an AI café robot developed by New Innovations Inc. [9.a.xxv]. The innovator utilises core technologies such as AI, cloud computing and online control to manufacture hardware and build software with focus on labour-saving and automation. The company is developing cooking robots for several restaurant companies, including some foreign companies [34].

Root C is a fully unmanned café stand that allows customers to specify the time and location of their coffee pick-up via an app and receive a specialty coffee brewed at the time of their arrival from a locker without any interpersonal contact. The beans are grounded just before serving to maximise their taste.

8. Regulatory Environment, Tariffs and Taxes

Before making preparations to enter the Japanese market, it is important to first check out the regulation on imports of related products.

When it comes to import of plant-based and cell-cultivated food products, it is necessary to comply with the legal framework, including:

- The Food Safety Basic Law
- The Food Sanitation Act
- The Law Concerning Standardization of Agricultural and Forestry products (the JAS Law)
- The Health Promotion Law
- Food Labelling Law

Detailed information can be found in *The Food and Beverage Market Entry Handbook: Japan – a Practical Guide to the Market in Japan for Agri-food Products and Geographical Indications* [35], published by the Consumers, Health, Agriculture and Food Executive Agency (Chafea) in 2019 (pages 42-57).

The following taxes are imposed when importing products:

- **Duty**: customs value (CIF price including transport costs to the port of importation) x duty rate
- **Consumption tax**: (taxable price + duty) x consumption tax (10%)

It is possible to get information about applicable duties for specified products by using "*My Trade Assistant on Access2Markets*" and filling in the *Country of Origin,* the *Country of Destination* and the *Product Code* [36].

In February 2022, the Ministry of Agriculture, Forestry and Fisheries established a new Japanese Agricultural Standard (JAS) for *Textured Soy Protein Product.* "Soy meat" is defined as a processed product with a texture similar to meat products, but no animal-based ingredients. In case of "Processed soy meat products", use of animal-based ingredients is limited to dairy and eggs [37].

9. Competitive Landscape

This chapter lists domestic key players and foreign companies that have entered the Japanese market.

a. Domestic Key Players

The foodtech market is fragmented with several established major domestic players and many startups. Some of the key players have launched new products to expand their product portfolio and increase their sales.

i. Green Culture Inc.

Green Culture was established in 2011, headquartered in Tokyo [38]. The company is a food technology company and its share capital is 260 million yen. The business line includes development and sale of plant-based products and operation of a plant-based online sales platform.

Founders include rice-cracker manufacturer Kameda Seika Co. Ltd. and Oisix Ra Daichi, a major food delivery company.

ii. DAIZ Inc.

DAIZ was founded in 2015, headquartered in Kumamoto on Kyushu Island [39]. Share capital is 100 million yen. Business activities include development, manufacture and sale of plant-based meat and food products that use functional substances derived from soybeans. Main shareholders include Marubeni Corporation, Kanematsu Corporation, Ajinomoto Co., Ltd. and Roquette Freres (France).

In 2023, DAIZ entered into a partnership with the French company Roquette Co., Ltd. that has expertise in pea-based proteins.

iii. Tastable Co., Ltd.

Tastable, founded in 2021, is based in Tokyo [40]. The share capital is 300 million yen. The equity ownership of the company is: Sojitz Corporation 30%, Fuji Nihon Seito 10% and Unitec Foods 60%. The business line is development, design, and marketing of differentiated food concepts (final processed products).

iv. Marukome Co., Ltd.

Marukome was founded in 1854 and is headquartered in Nagano city [41]. Share capital is 100 million yen. The number of employees is 475 and the sales amounted to 50.3 billion yen in fiscal year 2022.

The company is engaged in manufacture of home- and professional-use miso paste, miso soup and soybean products.

v. Kikkoman Corporation

Kikkoman was established in 1917, headquartered in Tokyo [42]. Share capital is 11.6 billion yen. The number of employees is 7,775 (consolidated basis as of March 2023). The number of group companies is 60. Consolidated revenue reached 619.9 billion yen in fiscal year 2022.

Kikkoman is one of the world's leading manufacturers of soy sauce. The company is engaged in production and sale of soy milk in Japan and Asia/Oceania region.

vi. Marusan-Ai Co., Ltd.

Marusan-Ai was founded in 1952 and is headquartered in Okazaki [43]. Share capital is 865.4 million yen. The number of employees is 444. Domestic revenue amounted to 30 billion yen in 2021.

vii. J-Oil Mills Inc.

J-Oil Mills is an edible oil manufacturer in the Ajinomoto Group, formed in 2004 through the merger of three companies in the oil refining industry [44]. The company is headquartered in Tokyo. Share capital is 10 billion yen. The number of employees is 1,330 (March 2023).

Business activities include production, processing and sale of oils, fats, oilseed meals and a variety of foods.

viii. Sagamiya Foods Co., Ltd.

Sagamiya Foods was founded in 1951, headquartered in Maebashi [45]. Share capital is 80 million yen. Domestic revenue amounted to 36.7 billion yen in fiscal year 2022. The main business is manufacture and sale of processed soy bean products including tofu and thick deep-fried tofu.

ix. Kewpie Corporation

Kewpie was founded in 1919 and is headquartered in Tokyo [46]. The share capital is 24. I billion yen. The consolidated revenue in fiscal year 2022 was 430.3 billion yen. Kewpie is a major manufacturer of mayonnaise sauce. The company is also selling other sauces and various food products.

x. Umami United Japan., Co., Ltd.

Umami United Japan was established in 2022, headquartered in Tokyo [47]. Main business activities are research, development and sale of plant-based eggs. In addition to umami eggs, the company sells *Umami Egg Flavour* (100% plant-based egg seasoning powder) and *Umami Pudding Mix*. j

xi. Next Meats Co., Ltd.

Next Meats was founded in 2020 and is headquartered in Tokyo [48]. The company started selling meat alternatives in 2020, such as *Yakiniku* (grilled beef) and *Gyudon* (beef rice bowl).

xii. NH Foods Ltd.

NH Foods, established in 1949, is headquartered in Osaka [49]. Share capital is 36.3 billion yen. The number of employees is 27,050 (consolidated basis, March 2023). Net sales reached 1,259 billion yen in fiscal year 2022. The company is engaged in manufacture of processed meats (ham and sausages), production and sale of dairy products and marine products.

xiii. Gryllus Inc.

Gryllus was founded in 2019 and is headquartered in Tokushima city on Shikoku Island [50]. The amount of the share capital is 522 million yen. The company is engaged in manufacture and sale of food ingredients and processed foods using edible crickets. Gryllus is also offering edible cricket breeding management service

xiv. Ajinomoto Co., Ltd.

Ajinomoto is a Japanese multinational food company that was established in 1925 [51]. The number of employees is 34,615 (consolidated basis as of March 31, 2023). The paid-in capital is 79,863 million yen.

The company has identified alternative proteins as a core component for its growth strategy. In anticipation of growing demand in Japan, Ajinomoto has started preparations to develop cultivated meat in addition to plant-based meat alternative products [52].

xv. IntegriCulture Co., Ltd.

IntegriCulture was established in 2015, headquartered in Tokyo [53]. Share capital is 100 million yen. The company is engaged in development of cell-based meat and cellular agricultural products. The company has developed the CulNet system, which is a general-purpose large-scale cell culture technology that can be applied to bio-reagents, cosmetics, supplements and cell-based meat.

xvi. Maruha Nichiro Corporation

Maruha Nichiro is the world's largest seafood company [54]. It began domestic operations in 1880, and has been a global supplier since 1951. The company engages in the fishing, fish farming, fish processing industry and offers frozen and processed food products.

xvii. Farmship Inc.

Farmship was founded in 2014 and is headquartered in Tokyo [55]. Share capital is 100 million yen and the number of employees is 20 (May 2023). The company is developing supply and demand matching systems with AI technology. Farmship has developed technology utilising AI to assess the growth of spinach seedlings.

xviii. Sagri Co., Ltd.

Sagri was established in 2018 [56]. The headquarter is located in Tamba city, Hyogo Prefecture, with branches in Singapore and India. The share capital is 174 million yen. The company is engaged in business creation through satellite data analysis using AI.

xix. Inaho Inc.

Inaho was founded in 2019. The headquarter is based in Kamakura city located south of Yokohama. The company is developing cultivation systems suitable for robot harvesting [57].

xx. Legmin inc.

Legmin was founded in 2018, headquartered in Fukuya city, Saitama Prefecture [58]. The share capital is 305 million yen. The company is engaged in research and development of robots in combination with IoT devices to improve agricultural productivity. In 2023, Legmin received the *Award of Excellence* from Saitama Agricultural University in the innovative agricultural technology category.

xxi. Agrist Inc.

Agrist was founded in 2019 and is based in Miyazaki on Kyushu Island [59]. The share capital is 100 million yen. The company develops agricultural robots and uses AI to analyse images collected by the robots, turning them into big data. According to Agrist, use of the proprietary technology should allow farmers to increase the pepper yields by about 20%.

xxii. Seraku Co., Ltd.

Seraku was established in 1987 and is based in Tokyo [60]. The share capital is 395 million yen. The company is engaged in cloud-based services and is offering the "Midori Cloud" agricultural IoT service to farmers leveraging sensors.

xxiii. TechMagic Inc.

TechMagic was established in 2018 and is headquartered in Tokyo [61]. The share capital is 4.39 billion yen. The company is providing solutions from the aspect of labour costs and raw material costs by realising automation of cooking operations. TechMagic has developed other cooking robot applications including automated seasoning supply and stir-fry cooking.

xxiv. Connected Robotics Inc.

Connected Robotics was founded in 2014 and is based in Tokyo [62]. The company integrates cutting-edge technologies, including robotics and artificial intelligence, to create efficient and precise solutions for the food industry. Connected Robotics has attracted attention globally for its innovative approach to automating elements of food preparation.

xxv. New Innovations Inc.

New Innovations, a startup that provides enterprise-quality automation and OMO (*Online-to Offline business integration*) solutions, was established in 2018 and is headquartered in Tokyo [63]. The number of employees is 30 persons and the share capital is 2.84 billion yen.

b. Foreign Players in Japan

This sub-chapter lists foreign companies already established in Japan or in the process of entering the market.

i. Wada Foodtech Co., Ltd.

Wada Foodtech, a Japanese subsidiary of Hong Kong-based startup Kamakura Foods Co. Ltd., was founded in 2023 and is headquartered in Osaka. Kamakura Foods has developed a technology-based platform for serving lunch boxes automatically [64].

The first hot chain lunch box vending machine in Japan went into operation in November 2017 in Osaka. The machine is monitored and controlled by GPS and cloud-based IoT technology. It takes only 17 seconds to serve a lunch box after customer places an order. This speedy logistics solution platform will help local bento shops compete with convenience stores during peak hours, such as lunch time.

ii. SAS Ynsect

In March 2023, Marubeni Corporation, one of Japan's largest trading companies, signed a letter of intent to collaborate with SAS Ynsect, a French company, to enter the Japanese market [65]. SAS Ynsect, the world leader in the production of insect protein and natural insect fertilizers, operates three incect farms in France, the U.S. and the Netherlands, and has raised $400 million in capital.

Marubeni and Ynsect will contribute to the establishment of a sustainable aquaculture industry and supply chain in Japan.

iii. Huel Japan Ltd.

Huel, manufactured by Huel Ltd, founded in 2015 in the UK, is positioned as a complete nutritional meal replacement available in powder, protein shake and protein bar made from oats, rice protein, pea protein, sunflower and several dietary supplements. The product's name is a portmanteau of *human fuel.*

In 2019, Huel Japan Ltd. was established, based in Tokyo [66]. Initially, products purchased through the Japanese-language website (order page) were shipped from the UK. In 2022, however, a distribution center was built in Japan and products will be shipped directly to Japanese customers.

iv. Danone Japan Co., Ltd.

In recent years, oat milk has grown in popularity in Japan due to the market entry of large actors including Danone. The company's Japanese subsidiary, Danone Japan, is engaged in production and marketing of chilled dairy products, and import and distribution of plant-based food products under the brand *Alpro.*

Danone Japan, based in Tokyo, was established in 1992 [67]. The share capital is 300 million yen and the number of employees is 392 (April, 2023). The Alpro-branded oat milk was launched in Japan in 2020. When surveying Japanese customers' needs, the company find out that health is a major motivation for purchase with focus on getting nutrients like proteins.

At the high-end retailer Shell Garden, one litre of Alpro oat milk retails at 537 yen including consumption tax, imported by Danone Japan from Thailand.

v. Monday 2 Sunday AB

Monday 2 Sunday AB is a Swedish company trading in food products and a group company of Humble Group. The company is exporting Pandy-branded healthy sweets from Sweden to Japan.

The importer is Heritage Japan Co., Ltd., headquartered in Nagoya [68]. The company was founded in 2005 and the share capital is 10 million yen. Heritage Japan is engaged in food product development, and import/wholesale of foreign food products.

Some of the Pandy-branded products distributed in Japan are gummy candies with reduced sugar amount at less than 1 gram per package (50 gram) and contain less than 85 kcal. The gummies that have a high dietary fibre content at 29 gram per package are produced in Sweden.

10. SWOT Analysis

The SWOT analysis below is performed from the EU perspective.

The Japanese market for foodtech products and solutions offers a number of benefits to small- and mid-sized EU exporters and other actors, but it also has some challenges.

Strengths:

- EU is often at the forefront of *technological innovation* that can be advantageous in the foodtech sector.
- EU-adopted *sustainable and environmentally-friendly practices*, which could act as selling points towards Japanese consumers.
- Stringent food industry *quality and safety standards.*
- *Research and development capability* that could tap unique demands of Japan's foodtech market.
- *Collaboration opportunities* between EU and Japanese companies & research institutions.

Weaknesses:

- *Understanding and adopting* to the unique Japanese business culture can be challenging.
- *Distribution challenges* due to dominance of established local distribution networks.
- *Technology adoption pace*: Need to assess the market's readiness for specific foodtech innovations.

Opportunities:

- *Plant-based and alternative proteins* as the interest in such products is growing in Japan.
- *Personalised nutrition*: Tailoring food products to individual preferences and dietary needs is gaining traction.
- *Collaboration with local producers* can be a strategic opportunity.
- *Food waste reduction technologies*: Japan has a growing focus on reducing food waste.
- *Innovative food technologies* in areas like precision agriculture, food processing and food safety.
- Growing demand for sustainable and eco-friendly food technologies.

Challenges:

- *Navigating complex regulatory processes*, including compliance with local standards, can be time-consuming.
- *Strong competition* as the Japanese foodtech market is high amongst many players.
- *Exchange rate fluctuations* can impact the cost of imported products and affect pricing strategies.
- *Cultural mismatch*: Differences in business culture and consumer preferences can impact the ability to connect with consumers and business partners.

11. Overview of Opportunities for EU SMEs

a. Future Prospects of Japan's Foodtech Sector

The global foodtech market is forecast to expand from 247 billion USD in 2024 to 342 billion USD in 2027, an increase by 95 billion USD (38.5%) [69].

In recent years, a number of Japanese startups have been founded in the foodtech segment and major food manufacturers have launched related products.

The future prospects of Japan's foodtech sector are promising, driven by innovation, sustainability and investment opportunities. Japan represents a significant market for the EU, and the growing interest in foodtech presents opportunities for EU SMEs to introduce novel products and technologies to Japanese consumers.

b. Key Success Factors

To succeed in the Japanese foodtech market, EU SMEs need to understand Japanese consumer preferences, adhere to Japanese standards for quality and safety, and build strong partnerships with local importers, distributors and retailers.

Key success factors include:

- Attending or exhibiting at trade fairs in Japan is an effective way to find buyers and importers for your products. Building personal relationships is important in Japanese business culture, and trade fairs usually provide an opportunity for direct interaction.
- *FOODtech Week Tokyo* is held annually in Tokyo since December 2020 (see *12.b.i*). Products exhibited in 2023 included cooking robots and solutions to reduce food loss and waste.
- The largest trade fair for food products is *FOODEX JAPAN (12.b.iii)* that is held annually in March in Tokyo at *Tokyo Big Sight*. This exhibition is well-suited for EU SMEs producing plant-based and cell-cultivated food products who are looking to break into the Japanese market. Most of the attending buyers are Japanese. By taking part in *FOODEX Online Product Registration & Matchmaking Program,* it is possible to register products including sales points, and pre-book meetings at the fair.
- Attending trade fairs also enables you to gather valuable market insights and observe the latest trends.
- Developing business relationships in Japan usually takes patience, as the decision-making process can take a long time.
- Japanese importers/buyers pay attention to a product's *novelty/uniqueness, price and* the *story behind the brand*.
- *Long-term commitment:* Market entry into Japan requires a long-term commitment as it takes time to build brand awareness, establish relationships, and gain market share.

c. Main Challenges

- *Complex distribution system* that can have several layers between the imported product and the end user.
- *Complicated regulatory framework* that can take time to understand.
- *Strong competition* from domestic brands and non-EU actors.

- *Need to adapt to local tastes*: Japanese consumers have unique preferences and EU manufactures may need to adapt their products to appeal to Japanese tastes.
- *Consumer acceptance*: While Japan is open to technology, there can be resistance when it comes to new food technologies.
- *Technology adoption pace*: EU companies need to assess the market's readiness for their products.

d. Business Opportunities in Foodtech Segment

Expanding into Japan's Foodtech market can be a promising opportunity for EU SMEs. Japan is known for its advanced technology adoption and a growing interest in innovative food solutions. Key opportunities that EU SMEs can explore include:

- *Innovative food products:* EU SMEs can introduce innovative food products, such as plant-based alternatives.
- *Smart agriculture:* Japan is investing in smart agriculture (agritech) and precision farming. EU SMEs specialising in agritech can offer solutions for optimising crop production, reducing use of resources, and improving sustainability.
- *Collaborations and partnerships:* Partnering with Japanese foodtech companies, research institutions, or distributers can provide EU SMEs with local market insights, distribution channels, and access to resources. Joint ventures or technology transfer agreements may also be explored.
- *Food delivery and logistics:* With the rise of online food delivery services, EU SMEs can offer technology solutions for efficient food delivery and logistics operations. This includes last-mile and inventory management systems.
- *Culinary innovation:* EU SMEs specialising in culinary innovation, including food design and flavour development, can tap into Japan's culinary culture. This may involve creating new fusion food products or enhancing traditional Japanese dishes.
- *Food waste reduction:* EU SMEs with expertise in food waste reduction technologies, including biodegradable packaging or food surplus management, may find business chances in Japan.
- *Food safety and quality control:* Japan places a strong emphasis on food safety and quality. EU SMEs can offer expertise in food safety standards, testing, and quality control, helping Japanese companies meet stringent regulatory requirements.

12. Related Organisations and Trade Fairs

a. Related Organisations

i. Cellular Agriculture Institute of the Commons

Cellular Agriculture Institute of the Commons (CAIC) is a non-profit organisation for promoting "Cellular Agriculture", manufacturing based on cells throughout society and increasing the understanding and trust concerning this new manufacturing process [70].

ii. Japan Association for Cellular Agriculture

Japan Association for Cellular Agriculture (JACA) is a non-profit incorporated association registered in 2022. JACA aims to contribute to key issues in Japan, such as food security and sustainability, by collecting information, as well as establishing and executing strategies and measures on how Japan should face the growing cellular agriculture industry [71].

b. Trade Fairs

i. FOODtech Week Tokyo 2024

FOODtech Week Tokyo comprises two specialised shows: FOODtech Japan and SMART RESTAURANT Expo. Products exhibited include cooking robots, IoT/AI solutions and solutions to reduce food loss & waste.

The next FOODtech Week Tokyo 2024 will be held at Makuhari Messe between November 20 (Wed.) – 22 (Fri.), 2024 [72].

ii. J AGRI 2024

J AGRI, formerly called AGRI WEEK TOKYO, is a global exhibition that highlights agricultural and livestock materials and technologies, including agricultural drones, smart farming technologies and agricultural machinery. The next J AGRI exhibition will be held at Makuhari Messi between October 09 (Wed.) – 11 (Fri.) 2024 [73].

iii. International Food & Beverage Exhibition (FOODEX) JAPAN 2025

FOODEX JAPAN, which is held in Tokyo in March every year, attracts many visitors, including food service representatives, manufacturers, wholesalers, retailers, and importers as well as many overseas visitors.

FOODEX JAPAN 2025 (50th International Food and Beverage Exhibition) will be held at Tokyo Big Sight between March 11 (Tue.) – 14 (Fri.), 2025 [74].

FOODEX JAPAN is also held annually in Osaka in July. The date for the 2025 trade show has not yet been communicated.

iv. Supermarket Trade Show (SMTS) 2025

The Supermarket Trade Show (SMTS) offers the latest information on the food distribution industry with focus on supermarkets. SMTS presents opportunities to meet the leaders from the retail, wholesale, and food service industry. It is also possible to take part in business matching to explore new business opportunities.

The next SMTS will be held at Makuhari Messe between February 12 (Wed.) – 14 (Fri.), 2025 [75].

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