

Study on the Supply Chain of Alternative Proteins in Japan

Final Report

For National Bureau of Agricultural Commodity and Food Standards,
Ministry of Agriculture and Cooperatives, Thailand,
and Office of Agricultural Affairs, Royal Thai Embassy, Tokyo

August 31, 2023



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Table of Contents

1. Introduction	3
2. Regulations for Alternative Proteins in Japan	4
2.1. Overview	4
2.2. Food Sanitation Act	5
2.3. Food Labeling Act and Act against Unjustifiable Premiums and Misleading Representations	6
2.4. Key Points for Importing Alternative Proteins to Japan	10
3. The Alternative Protein Market in Japan	13
3.1. Overview	13
3.2. Plant-Based Food	14
3.3. Insect-Based Food	27
3.4. Cultured Meat	38
3.5. Mycoprotein-Based Food	41
3.6. Microalgae-Based Food	41
4. The Alternative Protein Market in Thailand	49
4.1. Overview	49
4.2. Plant-Based Food	51
4.3. Insect-Based Food	56
4.4. Cultured Meat	57
4.5. Mycoprotein-Based Food	58
4.6. Microalgae-Based Food	58
5. Market Potential of Thai Alternative Proteins in Japan (TOWS Analysis)	60
5.1. Overview	60
5.2. Plant-Based Food	61
5.3. Insect-Based Food	64
5.4. Cultured Meat	66
5.5. Mycoprotein-Based Food	67
5.6. Microalgae-Based Food	68
6. Recommendations	71

6.1.	Recommendations for the Government	71
6.2.	Recommendations for the Private Sector	73
7.	Appendix	76

1. Introduction

This is a report prepared by Meros Consulting for the Embassy of Thailand in Japan and the National Bureau of Agricultural Commodity and Food Standards (ACFS), Ministry of Agriculture and Cooperatives in Thailand.

ACFS initiated this study with the aim of exploring the possibilities for Thai alternative proteins in the Japanese market. ACFS believes that Thai alternative protein products have potential in Japan and seeks to gain a comprehensive understanding of the Japanese alternative protein market. The primary objectives of this study are to identify potential opportunities within the market and to determine which specific Thai products could tap into these opportunities. By conducting this study, ACFS aims to make informed decisions about the viability and potential strategies for introducing Thai alternative protein products to the Japanese market.

In this report, the term “alternative proteins” refers to the following five categories of food products: (1) plant-based food, (2) insect-based food, (3) cultured meat, (4) mycoprotein-based food, and (5) microalgae-based food. Each category is defined as shown in the table below.

Term	Definition
Plant-Based Food	Plant-based alternatives to conventional meat or dairy
Insect-Based Food	Food that is made from insects
Cultured Meat	Meat that is produced by cultivating animal cells
Mycoprotein-Based Food	Food that is made from mycoprotein, a protein produced by fungi
Microalgae-Based Food	Food that is made from protein-rich microalgae such as chlorella and spirulina

First, this report explains Japan’s legislation, regulations, and standards for foods including alternative proteins. Secondly, it discusses market trends and supply chains of the above-mentioned five categories of alternative proteins in Japan. Thirdly, it describes the situation of the alternative protein market in Thailand. Finally, it discusses the potential of Thai products in Japan and recommendations for the Thai government and Thai companies.

Information in this report has been collected through desktop research and industry interviews. Please see the appendix for the list of interviewees. This research was conducted between February and August 2023.

Disclaimer

This report was created for general information purposes only. While every effort has been taken to ensure accurate information at the time of publication, regulations that pertain to alternative proteins can change quickly.

Professional advice should be sought for any specific matters of concern and all information in this report should be re-confirmed with importers or competent authorities.

2. Regulations for Alternative Proteins in Japan

2.1. Overview

In Japan, all foods, including those in the alternative protein category, are mainly regulated by three laws: the Food Sanitation Act, the Food Labelling Act, and the Act Against Unjustifiable Premiums and Misleading Representations. The Food Sanitation Act is a law related to food safety. The Food Labelling Act and the Act against Unjustifiable Premiums and Misleading Representations are laws related to food labeling.

Key Regulations Applicable to Alternative Proteins

Laws	Regulatory Authorities	Purpose of the Laws
Food Sanitation Act	Ministry of Health, Labour, and Welfare (MHLW), Consumer Affairs Agency (CAA)	Stipulates rules about food sanitation to ensure consumers can safely consume food.
Food Labelling Act	CAA	Establishes rules for food safety and functionality labeling for clarity that enables consumers to choose safe food.
Act against Unjustifiable Premiums and Misleading Representations	CAA	Regulates the misrepresentation of products' quality, content, price, etc. so consumers can select better products.

In the EU, there are specific regulations for “novel food,” which is defined as food that has not been consumed significantly in the past. Alternative proteins such as insect-based food and cultured meat are considered to be “novel food” under EU definitions and must be approved by the European Commission to be sold in the EU. However, there is no such regulation in Japan. Therefore, “novel food” can be sold in Japan without special permission from authorities.

On the other hand, one likely exception to this may be cultivated meat, for which regulations may be established in Japan soon. Currently, the cultivated meat industry is not selling any cultivated meat products commercially in Japan as the industry and government work out a clear regulatory framework. It was reported on 20 June 2022 that the Ministry of Health, Labour, and Welfare (MHLW) has set up a study group of experts to consider developing regulations on cultured meat.¹ It is still unclear what rules may be established, but authorities may require approval to sell cultured meat in Japan in the future.

¹ *Yomiuri Newspaper Online*, “The Ministry of Health, Labour and Welfare will establish a study group within this fiscal year to confirm safety of cultured meat and prepare for future industrialization” (translation of original Japanese title), 2022 June 20, <https://www.yomiuri.co.jp/science/20220619-OYT1T50231/>

2.2. Food Sanitation Act

Most consumer products marketed as alternative proteins contain food additives. In Japan, food additives are regulated by the Food Sanitation Act, which is under the purview of the MHLW and Consumer Affairs Agency (CAA). The Act also regulates genetically modified (GM) and genome-edited ingredients (such as plant-based meat made from GM soy) as well as food additives derived from GM or genome-edited microorganisms.

2.2.1. Food Additives

Japan allows four types of food additives: “Designated Additives,” “Existing Food Additives,” “Natural Flavoring Agents,” and “Substances Which Are Generally Provided for Eating or Drinking as Foods and Which Are Used as Food Additives” (hereinafter referred to as “General Food and Beverage Additives”).

“Designated Additives” are additives approved for use by the Minister of Health, Labor, and Welfare, and “Existing Food Additives” are additives with a long history of human consumption. “Natural Flavoring Agents” are natural products that are obtained from animals and plants and used for flavoring food (e.g., vanilla flavoring and crab flavoring). “General Food and Beverage Additives” are substances that are generally provided for eating or drinking as food and which are used as food additives (e.g., fruit juice). In total, more than 1,500 food additives can be used in Japan.

Food products containing food additives other than those approved cannot be sold in Japan. It is also important to note that there are “standards for use” established for some food additives, and any consumer products marketed as alternative proteins which contain food additives that do not meet these “standards for use” cannot be sold.²

Food Additives Allowed to be Used

Food Additives Allowed to be Used	About the Additives	Links to the Lists of Approved Additives
Designated Additives	Food additives approved for use by the Minister of Health, Labour, and Welfare	https://www.ffcr.or.jp/en/tenka/list-of-designated-additives/list-of-designated-additives.html
Existing Food Additives	Food additives that have a long history of consumption by humans	https://www.ffcr.or.jp/en/tenka/list-of-existing-food-additives/list-of-existing-food-additives.html
Natural Flavoring Agents	Natural substances obtained from plants and animals and used for flavoring food	https://www.ffcr.or.jp/en/tenka/list-of-plant/list-of-plant-or-animal-sources-of-natural-flavorings.html
General Food and Beverage Additives	Food additives generally provided	https://www.ffcr.or.jp/en/tenka/list-of-general-food-and-beverage-additives/list-of-general-food-and-beverage-additives.html

² More details on the “standards for use” can be found here: <https://www.ffcr.or.jp/en/tenka/standards-for-use/standards-for-use-of-food-additives.html>

Beverage Additives	for eating or drinking as food	substances/list-of-substances-which-are-generally-provided-for-eating-or-drinking-as-foods-and-which-are-used-a.html
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2.2.2. Food Products Derived from Agricultural Biotechnology

The MHLW regulates food products derived from agricultural biotechnology using two definitions: genetically modified (GM) products and genome-edited products. For the MHLW's definitions of these technologies, refer to the following links.

Genetically modified:

https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/kenkou_iryou/shokuhin/identshi/index_00002.html

Genome-edited:

<https://www.mhlw.go.jp/content/000550824.pdf>

The MHLW must grant approval for GM foods as well as food products that include GM ingredients or food additives derived from GM microorganisms. As of 24 March 2023, 333 varieties of nine foods (potato, soy, sugar beet, corn, rapeseed, cotton, alfalfa, papaya, and mustard) and 76 food additives have undergone safety assessments and can be used in alternative protein products. Here is the link to the list of these foods and food additives: <https://www.mhlw.go.jp/content/11130500/001117139.xlsx>

The MHLW requires prior consultations by developers and importers for genome-edited foods as well as food products that include genome-edited ingredients or food additives derived from genome-edited microorganisms. The MHLW may require notifications or safety reviews depending on its judgments about products. It is not necessary to provide notification concerning food manufactured and processed using ingredients derived from genome editing technology that have already undergone the notification process in Japan. As of 16 April 2023, the prior notification process has been completed for four foods (tomato, waxy corn, and two fish (red seabream and tiger puffer)).

2.3. Food Labeling Act and Act against Unjustifiable Premiums and Misleading Representations

Consumers may be confused by alternative proteins such as plant-based meat and dairy, cultured meat, and mycoprotein-based meat because they can often look like real meat or dairy. Therefore, food labeling for these products should be created so that consumers can clearly understand what the ingredients are and that the products are not real meat or dairy. In Japan, food labeling is regulated by the Food Labeling Act and the Act against Unjustifiable Premiums and Misleading Representations, which are under the purview of the CAA. The CAA

has created and published a document with a 13-question Q&A³ on its website that provides guidance on food labeling of plant-based meat, plant-based dairy, and insect-based food. The following is a translation of the Q&A created for this report.

Q&A Related to Food Labeling and Restaurant Menu Labeling of Plant-Based Food and Insect-Based Food

Q1: Is it a problem under the Act against Unjustifiable Premiums and Misleading Representations to label plant-based food (hereinafter referred to as “alternative meat”) as, for example, “soy meat” or “not meat”?

A1: Alternative meat is not meat.

Therefore, as long as the labeling does not lead the average consumer to mistake the product for meat, it is not a problem under the Act against Unjustifiable Premiums and Misleading Representations. Labeling might include indications such as “made using soybeans,” “contains soy as an ingredient,” “does not contain meat,” or “meat-free,” in addition to the product name.

*The term “plant-based food” as used in this Q&A refers to products made from mainly plant-derived raw materials (which do not include livestock or marine products) that resemble livestock products, such as meat, or marine products, such as fish. Even if the product contains animal-derived additives, if the main ingredients are plant-derived, the food product shall be included in “plant-based food.”

Q2: Under the Act against Unjustifiable Premiums and Misleading Representations, would it be a problem to label a hamburger made from soy-based alternative meat as “hamburger made from soy”?

A2: Some consumers who see the label “hamburger made from soy” may assume it is 100% from soy. Therefore, if soy comprises less than 100% of the product, it is important to clarify the percentage of soy used, such as indicating it separately from the product name. As long as labeling for products not entirely made from soy does not lead the average consumer to mistake them for 100% soy products, it is not a problem under the Act against Unjustifiable Premiums and Misleading Representations.

Q3: If a product made from soybeans as alternative meat is labeled “soy meat” and accompanied by the phrase “100% plant-based,” would it violate the Act against Unjustifiable Premiums and Misleading Representations? Note that food additives such as flavorings are not plant-derived.

A3: Some consumers who see “soy meat” and “100% plant-based” may assume that all ingredients, including flavorings, are plant-based. Therefore, it is important to clarify that the ingredients are plant-based except for the flavorings, such as by indicating this separately from the product name. As long as the labeling does not lead the

³ Consumer Affairs Agency, “Plant-based food related information” (translation of Japanese webpage title), https://www.caa.go.jp/notice/other/plant_based/#q1

average consumer to mistake it for a product made entirely from plant-based ingredients, including flavorings, it is not a problem under the Act against Unjustifiable Premiums and Misleading Representations.

Q4: Would it be a problem under the Act against Unjustifiable Premiums and Misleading Representations to use “oat milk” or “rice milk” in the product name of a plant-based beverage product (hereinafter referred to as “alternative dairy beverage”)?

A4: Alternative dairy beverages are not milk or dairy beverages (hereinafter referred to as “milk, etc.”).

Therefore, for example, labeling “made with oats” or “not milk or milk beverage” separately from the product name is not a problem under the Act against Unjustifiable Premiums and Misleading Representations, unless the labeling misleads consumers into believing that the product is milk, etc. when it is not.

Q5: Is it a problem under the Act against Unjustifiable Premiums and Misleading Representations to use the term “Next Cheese” for cheese which is a plant-based food made from soy milk, etc. (hereinafter referred to as “alternative cheese”), or the term “Neo Butter” for butter which is a plant-based food made from soy milk, etc. (hereinafter referred to as “alternative butter”)?

A5: Alternative cheese and butter made from plant-based sources are not dairy products.

Therefore, as long as it is clear to the general consumer that these products are not dairy products, such as by indicating separately from the product name that they are made from soy milk and are not dairy products, there is no problem under the Act against Unjustifiable Premiums and Misleading Representations.

Q6: Is it a problem under the Act against Unjustifiable Premiums and Misleading Representations to label plant-based food products made from soy, vegetables, etc. as “fish” (hereinafter referred to as “alternative fish”), and to label them as “substitute fish,” “vegetable tuna,” or “alternative tuna”?

A6: Alternative fish is not fish.

Therefore, as long as the general consumer is not misled into thinking that a product is fish when it is not fish, such as by indicating separately from the product name that it is made from vegetables, that vegetables are used as ingredients, that fish is not used, or that it is fish-free, there is not a problem under the Act against Unjustifiable Premiums and Misleading Representations.

Q7: Is it a problem under the Act against Unjustifiable Premiums and Misleading Representations to label a food product made from ingredients different from honey, but with equivalent nutritional content (hereinafter referred to as “alternative honey”) as “Bee Free Honey”?

A7: Alternative honey is not honey.

Therefore, as long as the label includes a statement such as “made from [name of ingredient],” or “not honey,” there is no risk of consumers being misled into thinking that the product is honey when it is not, and there is not a problem under the Act against Unjustifiable Premiums and Misleading Representations.

Q8: If you were to import alternative dairy drinks or alternative butter with packaging that have the English phrases “〇〇 Milk” or “〇〇 Butter” respectively in the product names, would it be a problem under the Act against Unjustifiable Premiums and Misleading Representations?

A8: Some general consumers who come into contact with the labels “milk” and “butter” may believe that the products are milk, etc., or dairy products, respectively.

Therefore, as long as there is labeling besides the product name such as “not milk or dairy beverage” or “not dairy product,” and there is not overall labeling that misleads consumers to think products are milk, etc. or dairy products when they are not, then there is not a problem under the Act against Unjustifiable Premiums and Misleading Representations.

Q9: When offering food prepared with soy-based meat substitutes (such as soy burgers and soy patties) at a restaurant, what should be considered regarding menu names, etc.?

A9: Phrasing on menus, displays, and descriptions within restaurants and on outside displays also fall under the Act on Preventive Measures against Unjustifiable Premiums and Misleading Representations and are subject to regulation.

Q10: How should the ingredients of plant-based food be listed on a menu, and is it possible to use terms like “alternative meat” or “liquid egg”?

A10: According to food labeling standards, ingredients should be listed using “the most common name” for the ingredient. For plant-based food, such as those made from soybeans, the ingredient name should be listed as “soybean” or “soybean processed products,” for example.

Currently, terms like “alternative meat” or “liquid egg” are not considered common names for plant-based food ingredients.

Q11: If a plant-based food is produced in a meat processing plant, is it necessary to have labeling indicating contamination (unintended mixing) with specified ingredients for food allergy labeling?

A11: When producing plant-based food on the same manufacturing line as meat-based processed food that contains specified ingredients for food allergy labeling, it is important to take measures to prevent contamination, such as thoroughly cleaning the production line and using dedicated equipment as much as possible. If it is not possible to eliminate the possibility of contamination, it is desirable to provide a warning label outside the

standardized labeling box, such as “This product is manufactured in a facility that also processes products containing beef.”

Q12: Do plant-based egg substitutes that use ingredients similar to eggs require food allergy labeling?

A12: The scope of “eggs” that are subject to food allergy labeling under the Food Labeling Standards includes not only chicken eggs but also other edible bird eggs such as duck and quail eggs that are commonly used. If the ingredients used in the plant-based food do not fall within this range, food allergy labeling as “eggs” is unnecessary. However, if the main ingredients used in the plant-based food include any specific allergens that are required to be labeled under other food labeling standards or recommended to be labeled under notifications, those ingredients are subject to food allergy labeling.

Businesses can provide warning labels (based on scientific proof) outside the standardized labeling box, such as “This product contains ○○, which contains ingredients similar to eggs. Please refrain from consuming this product if you have an egg allergy.”

Q13: Is food allergy labeling required for insect-based food?

A13: As of August 2021, “insects” do not fall under the specific raw materials subject to food allergy labeling, so food allergy labeling is not required.

However, businesses may choose to include warning statements (based on scientific proof) outside the standardized labeling box, such as “This product contains ○○ (the name of insect-derived ingredients) and may contain components similar to crustaceans. Please refrain from consuming if you have allergies to shrimp or crab.”

2.4. Key Points for Importing Alternative Proteins to Japan

There are no import procedures specific to alternative protein products. Although some details of the procedures vary depending on the type and form of product,⁴ generally the following procedures for importing food products must be followed:

1. Prepare an Ingredient List and a Manufacturing Process Flowchart

Products such as plant-based meat are categorized as processed food. The exporter of processed food must provide a list of all ingredients and a manufacturing process flowchart. Generally, the importer will request this information early when researching new products to confirm whether the product can be imported into Japan. This information

⁴ The Manufactured Imports and Investment Promotion Organization (MIPRO), an organization supporting trade under the jurisdiction of the Ministry of Economy, Trade and Industry in Japan, publishes a [food import guide](#) (in English), which is helpful for further information. This guidebook has been prepared for those who intend to import food for the first time and outlines the import procedures and regulations imposed upon the import and sale of food.

will later be submitted to the quarantine station as a mandatory step in the import clearance process. There are no standardized forms for an ingredient list and manufacturing process flowchart, so these documents should be prepared in consultation with the importer.

2. Confirm Legal Compliance with the Food Sanitation Act

In order to import alternative protein products into Japan, the exporter or importer must confirm the legal compliance of the product with the Food Sanitation Act. The exporter or importer especially needs to be careful about the regulations related to food additives and agricultural biotechnology. It is important to check whether the food product contains any food additives, GM ingredients, or food additives derived from GM microorganisms that are not allowed to be used in Japan. The Food Sanitation Act also regulates agrochemical residue (e.g., pesticides, feed additives) and harmful substances (e.g., mycotoxins, cyanide), and it is recommended to consult with [quarantine stations](#) (in Japanese) about what regulations would apply before exporting new food products in the alternative protein category.

3. Confirm Legal Compliance with Other Regulations Related to Food Imports

The exporter or importer also must confirm legal compliance with other food import-related laws such as the Plant Protection Act. Food products in the alternative protein category are often manufactured using a variety of ingredients, and thus the applicable laws are extensive. For example, when a plant is used in an alternative protein product, phytosanitary procedures may be required depending on the degree of plant processing, the type of plant, and the parts of the plant used. Therefore, again, it is recommended to consult with [quarantine stations](#) (in Japanese) about what laws would apply before importing alternative protein products.

Dried or frozen insects can be imported following the same procedures as other food products. With regard to cultured meat, which is currently not imported into Japan, it should be noted that new regulations may be established in Japan soon. What rules may be set is still unclear, but authorities may require approval to sell cultured meat in Japan in the future.

4. Create a Product Label

The exporter or importer must prepare a product label in Japanese in accordance with Japanese regulations. Generally, the product label is prepared by the importer with information from the exporter (or manufacturer). [Advice](#) (in Japanese) can be obtained from the CAA on the creation of labels.

5. Confirm the Tariff Rate

The exporter or importer should check the alternative proteins' tariff classification in the most recent [Japanese Tariff Schedule](#) (in English) and confirm the tariff rates applied. If the tariff classification is unclear, [quarantine stations](#) (in Japanese) can help identify the correct classification.

6. Consult with Relevant Organizations

As alternative proteins include a wide variety of food products, the regulations that apply are also diverse. It is

therefore important to consult the relevant authorities and seek advice before exporting alternative protein products. The Manufactured Imports and Investment Promotion Organization (MIPRO)⁵ can provide [free phone consultations](#) in English and Japanese related to import business overall. In addition, [13 quarantine stations](#) located at major ports/airports in Japan offer free consultation services related to food import. Note that the quarantine stations can provide support to both exporters and importers, but only in Japanese.

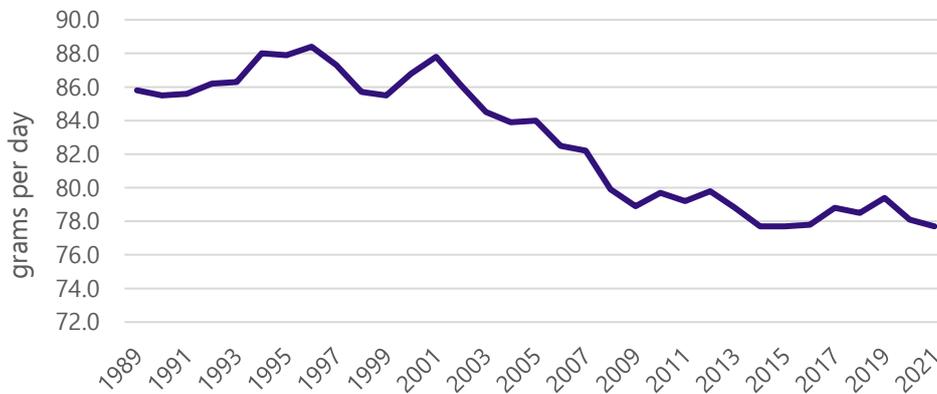
⁵ MIPRO was established in 1978 as a nonprofit organization through the joint efforts of the Ministry of Economy, Trade and Industry and the private sector. MIPRO collects, analyzes, and disseminates a wide range of information on investment in Japan to develop related businesses and thereby contribute to the expansion of international trade.

3. The Alternative Protein Market in Japan

3.1. Overview

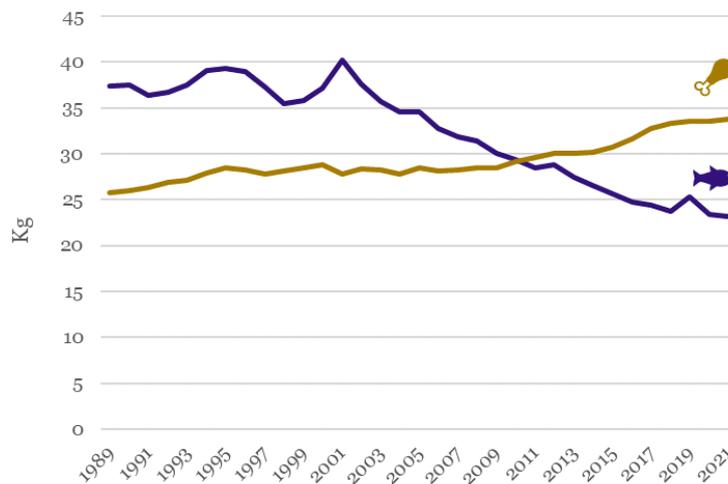
Japan has been experiencing a decrease in protein consumption, mainly due to a significant decline in seafood intake over the past few decades. This trend has resulted in talks about a “protein crisis” in the country. Although there has been a notable increase in meat and dairy consumption, this still does not entirely compensate for the lost protein from seafood. As a result, the Japanese government is encouraging its aging population to incorporate more protein in daily diets to address nutritional deficiencies. Consequently, high-protein supplements and foods are being marketed to consumers of all age groups.

Daily Protein Consumption per Capita in Japan (1989-2021)



Source: Ministry of Agriculture, Forestry and Fisheries (MAFF) Food Supply and Demand Survey 2021

Per Capita Consumption of Meat and Seafood (1989-2019)



Source: MAFF Food Supply and Demand Survey 2021

This chapter outlines Japanese alternative protein market trends according to the five categories defined in the overview (1. plant-based food, 2. insect-based food, 3. cultured meat, 4. mycoprotein-based food, and 5. microalgae-based food).

3.2. Plant-Based Food

3.2.1. Plant-Based Meat

Japanese cuisine has long included plant-based meat substitutes made from soy and gluten. This tradition of plant-based protein is rooted in *shojin ryori*, a vegetarian cuisine associated with Buddhist temple food culture, as well as periods in Japanese history when meat was prohibited. Soy-based food has been used extensively in Japanese cuisine as a source of protein in various forms and processes.

In recent years, Japan has experienced a new surge in plant-based meat substitutes in both retail and food service. This trend was particularly noticeable in 2020, when many of Japan's major meat and soy producers introduced various soy-based burgers within a few months. Japanese fast food and café chains also started to offer menu items featuring soy-based alternative meat. These products had been in development for some time, with major domestic Japanese food processors keeping an eye on global trends in plant-based meat and sustainable protein sourcing, while recognizing the growing demand for protein and the positive perception of plant-based products among Japanese consumers. 2020 was a crucial year for the fruition of this R&D to bring plant-based meat substitutes to the Japanese market. From 2021, plant-based egg products also started to appear in the market.

Industry Trends

Most plant-based meat products in Japan are made from soy, with major soybean processors and manufacturers serving as the lead product developers in the country. The prevalence of soy as the primary ingredient in most plant-based meat products can be attributed to Japanese consumers' familiarity with soy, their trust in its health benefits, and the cost-effectiveness of soy compared to other alternatives like pea protein. In addition to soy, some plant-based meat and seafood products in Japan are made using lesser-known ingredients such as *konnnyaku*, a high-fiber root vegetable, and rice protein.

While soy-based products like dried soy crumble and soy patties have been available in Japan for decades, since around 2020, the market has seen a surge in ready-to-cook plant-based meat products that imitate hamburger patties, meatballs, and meat slices used in popular Japanese dishes like beef-on-rice bowls and barbeque, as well as plant-based ham and sausages. This was driven in part by the food service industry's interest over the past decade in better catering to the varied food requirements of the increasing numbers of tourists visiting Japan. With the 2020 Olympics and other tourist events on the horizon pre-pandemic, the food service industry took the opportunity to develop halal-certified and vegetarian options for visitors, which are not typically available on Japanese menus. Leading food manufacturers are also aware of global trends and opportunities in plant-based protein.

Although it is challenging to estimate the size of the new plant-based meat substitutes market in Japan due to the existing prevalence of traditional soy "meat," recent market research projects substantial growth. The market for plant-based substitutes in Japan is expected to increase from 265 billion yen (71 billion baht) to 730 billion yen (195 billion baht) by 2025, a nearly three-fold growth.⁶

Unlike products from the leading players in the US and EU, the initial wave of new plant-based meat products in Japan did not prioritize emulating the flavor or texture of real meat. By contrast, US companies focused on creating products that they hoped consumers would find to be nearly indistinguishable from conventional meat.

Furthermore, rather than ethical or environmental concerns, the desire for healthy and delicious food alternatives is what attracts Japanese consumers to plant-based products. The number of individuals following a vegan or vegetarian lifestyle in Japan is exceptionally small. The increase in new products in 2020 coincided with the COVID-19 pandemic when consumers preferred shelf-stable food that required fewer trips to the supermarket, and also reflected their growing interest in health. Surveys carried out by food manufacturers have revealed that Japanese consumers perceive plant-based meat as a healthier substitute for traditional meat, citing lower cholesterol and calorie content, as well as higher fiber.

The major challenge for Japanese manufacturers is to produce more diverse and tastier plant-based meat products than the current offerings. Compared to the US and EU, the variety of products available in Japan is still relatively limited, and the perception of tastiness is also lacking. To achieve success, plant-based meat products in Japan will need to go beyond relying solely on soy, which can be limited by its distinct flavor and crumbly texture. Instead, manufacturers must create a more varied selection of meat-like products that appeal to the unique preferences of Japanese consumers.

Major Players and Key Startups

The plant-based meat market in Japan was initially dominated by traditional soybean companies, which leveraged their expertise and experience in soybean processing and the supply chain. One of the major players in this space is Fuji Oil, which reportedly holds around 50% of the market share for soy-based protein products in Japan. The company's forte lies in developing ingredients and isolates for soy meat manufacturing. Another early entrant into the market was Marukome, a miso and soy sauce manufacturer, which introduced new soy-based meat products for the retail market in 2015.



| Dried soy meat (mince type), 337 yen (90 baht)/180 g at Amazon, Marukome

⁶ Website of KAGOME CO., Ltd., which references 2021 data by TPC Marketing Research (<https://www.kagome.co.jp/products/brand/plantbased/>). This estimate includes all plant-based substitutes, such as meat, seafood, dairy, and eggs.

Other food manufacturers in Japan soon followed and started experimenting with plant-based meat products. This included major meat processors like Itoham, Prima Meat, and Nippon Ham Foods, which recognized the importance of having a diverse protein portfolio. Even confectionery and snack producers like Koikeya and Morinaga began manufacturing plant-based snacks. Additionally, all three major convenience store chains in Japan have launched plant-based products.

Start-ups have also emerged in the plant-based meat industry. In 2022, there were approximately 26 plant-based meat start-ups. Two of them, Daiz and Next Meats, have especially attracted domestic and international attention for their innovative and sustainable products. They have received substantial investment and established foreign partnerships, with Next Meat already introducing its vegan short ribs in the US market.

Most major Japanese food manufacturers have entered the plant-based meat market with a meat substitute that typically relies on soy as its base ingredient. Many of these companies are also expanding their product lines and introducing novel options. For example, in 2022, Otsuka's Zero Meat became Japan's first certified organic soy-based meat product.



| Zero Meat demiglace sauce hamburger, 269 yen (72 baht)/140 g at Amazon, Otsuka

Some of the domestic food manufacturers are also expanding their reach globally as they expand their product lines. Kagome, a food manufacturer, has collaborated with Japanese plant-based food brand 2Foods to expand beyond Japan, and introduced plant-based eggs and chicken nuggets in the US in April 2023. Plant-based eggs are still a new product in Japan. Apart from Kagome, Kewpie also sells a plant-based egg product.

Several international players, such as Ikea, Beyond Meat, Naturali, and OmniMeat have entered the Japanese market, which domestic players otherwise dominate. Unlike the local manufacturers, these foreign brands primarily use pea protein as the main ingredient instead of soy. Strategic partnerships with trading companies have facilitated the entry to the Japanese market by these foreign players. For example, Naturali and OmniMeat were introduced through Alishan, a vegetarian and organic food company. Sojitz, a general trading company, invested in Chinese start-up X-meats and intends to import its products to Japan.



| Next calbi, 576 yen (154 baht)/80 g at Amazon, Next Meats



| HUVUDROLL plant balls, 799 yen (214 baht)/500 g at Ikea stores, Ikea



| Beyond Beef plant-based ground, 1,598 yen (427 baht)/453 g at Karuna E-commerce, Beyond Beef

Thai plant-based products are also available in Japan. In 2021, plant-based meat products under the brand “Let’s plant meat” manufactured by the Thai company Nithi Foods began to be marketed in Japan. Nithi Foods’ products are introduced by the food importer Japan Food Science. The “Let’s plant meat” products are unique in that they are made using spices and herbs to bring out the flavors of Thai food.



| Let’s plant meat plant-based minced meat, 348 yen (93 baht)/150 g at Karuna E-commerce, Nithi Foods

Plant-based meat offerings at restaurants have also been on the rise in Japan. Specifically, in 2020, there was a surge in plant-based burgers and other menu items at Burger King, Doutor, MOS Burger, Freshness Burger, Denny’s, and Coco Ichibanya Curry. While some menu items were limited-time experiments, several chains have made plant-based meat a regular part of their menu.

Supply Chain

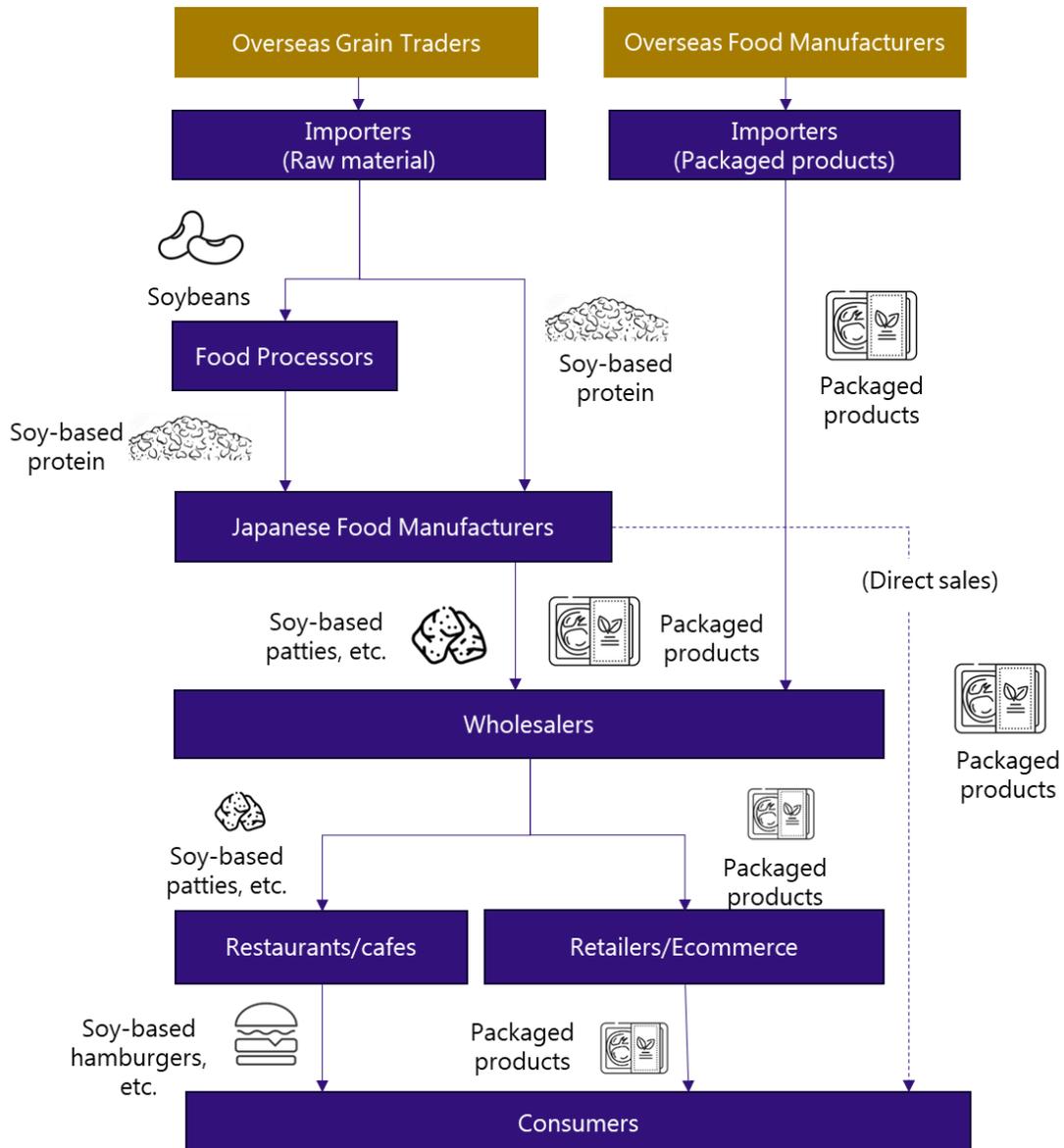
Currently, most plant-based meat products in Japan are soy-based products, meaning the supply chain heavily relies on soybean procurement. Japanese companies typically rely on imported soybeans or soy protein⁷ as their primary raw materials for producing plant-based meat products. On the other hand, imported plant-based meat products, which are predominantly non-soy-based, usually arrive as packaged goods ready for retail sale. Below is an overview of the typical supply chain for plant-based meat products.



| Example of soy protein

⁷ Soy protein is made from soybeans that undergo processing to become powder, paste, granular, or fibrous, with protein content exceeding 50%.

Supply Chain of Plant-Based Meat Products



Source: Meros Consulting based on desktop research and industry interviews

① Importers

- Importers import soybeans/soy protein as well as ready-to-sell products from overseas.
- Soybeans are imported from countries such as the US, Brazil, and Canada, while soy protein is imported from countries such as China and the US. Soy protein is used for various food products including plant-based meat products, and imports have been on the rise.
- Importers also import plant-based meat products that utilize non-soy ingredients, such as those made from pea protein and other raw materials. These imported non-soy, plant-based meat products typically arrive as packaged items to be sold through retail shops.

② **Food Processers (Companies That Mainly Produce Ingredients for Final Food Products)**

- Food processors purchase soybeans and produce soy protein. Certain food processors also produce soy-based meat products utilizing their in-house soy protein.
- Fuji Oil is the largest producer of soy protein in Japan; with more than a 50% share of the soy protein market. Fuji Oil supplies soy protein to major food manufacturers (companies that mainly produce final food products) manufacturing plant-based meat products. The number of food processors that produce soy protein is limited.
- Since imported soybeans tend to be cheaper than domestic soybeans, imported soybeans are mainly used to make soy protein. On the other hand, some food processors use domestically produced soybeans to differentiate from products made from imported soybean, although the percentage is still small.

③ **Food Manufacturers (Companies That Mainly Produce Final Food Products)**

- Food manufacturers purchase soy protein and produce soy-based meat products. Some food manufacturers sell their products directly to consumers through their e-commerce sites.
- Food manufacturers produce a variety of products, including packaged retail items and soy-based meat products that cater to both the retail and the food service sectors. The number of food manufacturers that produce soy-based meat products is limited.



| Example of a retail soy-based meat product



| Example of a business-use soy-based meat product

④ **Wholesalers, Restaurants, and Retailers**

- Wholesalers distribute soy-based meat products to retailers and restaurants, which sell/serve the products to consumers.
- There are also cases where retailers directly import foreign plant-based meat products to sell them at their outlets. For example, United Super Market Holdings Inc. which owns Japanese major supermarket chains such as Maruetsu, obtained exclusive sales rights for Beyond Meat products in Japan.



| Example of retail soy-based meat products sold at a supermarket



| Example of soy-based meat dishes offered at a restaurant

3.2.2. Plant-Based Dairy

Alternative dairy products are experiencing a surge in demand in Japan and are a strong area of growth within the Japanese food market. This is largely due to a growing awareness of the importance of increasing overall protein intake in the Japanese diet. In line with this rise in dairy product demand, demand for plant-based milk and cheese products is also increasing among consumers, driven by the interest in high-protein food and the perceived health benefits of plant-based alternatives. The growth in plant-based dairy products is further bolstered by the increase in imports of foreign plant-based dairy brands, in addition to efforts by major domestic Japanese manufacturers to develop their plant-based dairy lines. Some industry players are investing in domestic and foreign start-ups, while others prioritize R&D of new ingredients and technologies.

Industry Trends

Meros estimates that the plant-based dairy market is approximately 75-90 billion yen (20-24 billion baht) based on market research data from Fuji-Keizai, Intage, and TPC Marketing, as well as press releases and articles from major plant-based dairy manufacturers, including Marusan-ai and Kagome. Soy milk has the largest share of the market, which is estimated to be in the 50-70 billion yen (13-19 billion baht) range. It is followed by almond milk in the 8-9 billion yen (2.1-2.4 billion baht) range, soy-based yogurt in the 5 billion yen range, oat milk and other plant-based milks in the five billion yen range, and plant-based cheese, cream, and other dairy products in the 5-6 billion (1.3-1.6 billion baht) yen range.

Estimated Market Volume of Dairy Milk and Plant-Based Milk

	2021 (000 kl)	YoY change
Dairy milk	4,050	-1%
Soy milk	410	0.2%
Almond milk	30	37%
Oat milk	4-5	700%

Sources: Meros Consulting, based on Japan Soymilk Association (2022), "The Research on Soymilk;" Almond Milk Laboratory, "Almond Milk Market;" Japan Dairy Association, (2022) Dairy Data; shokuhin.net, 23 Nov 2022, "Oat milk ALPRO brand expanding rapidly and doubling in sales" (translated title)

Alternative Milk: Around 10% of the drinking milk market now consists of plant-based products, as shown in the figure on the right. Most sales of alternative milk are at retail outlets, although there is some usage in the food service industry, such as at coffee shops and cafes.

Soy milk has led the alternative dairy market for the last two decades. Japanese consumers have a strong and positive image of soybeans, backed by their long historical use in Japanese cuisine. Japanese consumers believe in the health benefits of soy milk, including its potential to reduce cholesterol, regulate the digestive system, relieve menopause symptoms, and even enhance beauty. The top three local manufacturers, Kikkoman, Marusan-ai, and the Sujahta Meiraku Group, have a 90% share of the soy milk market, and they mainly rely on imported soybeans as their raw material.

Almond milk is the second largest category after soy milk. Ezaki Glico, a leading confectionary and granola manufacturer, launched almond milk under the brand Almond Koka (*koka* means benefit in Japanese) in 2013 and expanded products nationwide in 2014. The company now has the largest share of the almond milk market. Simultaneously, US-based Blue Diamond Growers, which started to export its Almond Breeze brand in 2013, granted a license in 2017 to the Sapporo Group, a leading Japanese beer and soft drink manufacturer, for the local production and sale of Almond Breeze in Japan.⁸ In 2020, Shoei Foods Corporation, a major importer of nuts and dried fruit, also established a nut processing factory to produce almond milk under the brand name Koi Almond Milk (*koi* means rich in taste).

Subsequently, oat milk has also entered the Japanese non-dairy milk market, with major companies such as Danone introducing imported oat milk brand Alpro in 2020, Coca-Cola introducing domestic oat milk Tasty Oat Milk by Go: GOOD in 2021, and the Sujahta Meiraku Group introducing its oat milk in 2022.

Other plant-based milk products now available in Japan include rice milk, walnut milk, hemp milk, and pea sprout milk. This also includes imported Thai plant-based milk. Haruna, an importer specializing in distinctive and unique beverages, has been importing the 137 Degrees brand of various nut milks from Simple Food of Thailand since 2017. These milks are available at premium supermarkets, imported food stores, and online stores. The Thai oat milk brand Goodmate is also imported by Haruna. V-fit brand rice milk from Thailand was sold at retailers like Kaldi, Oisix, and Amazon from around 2017 to 2019, but is no longer on the market.

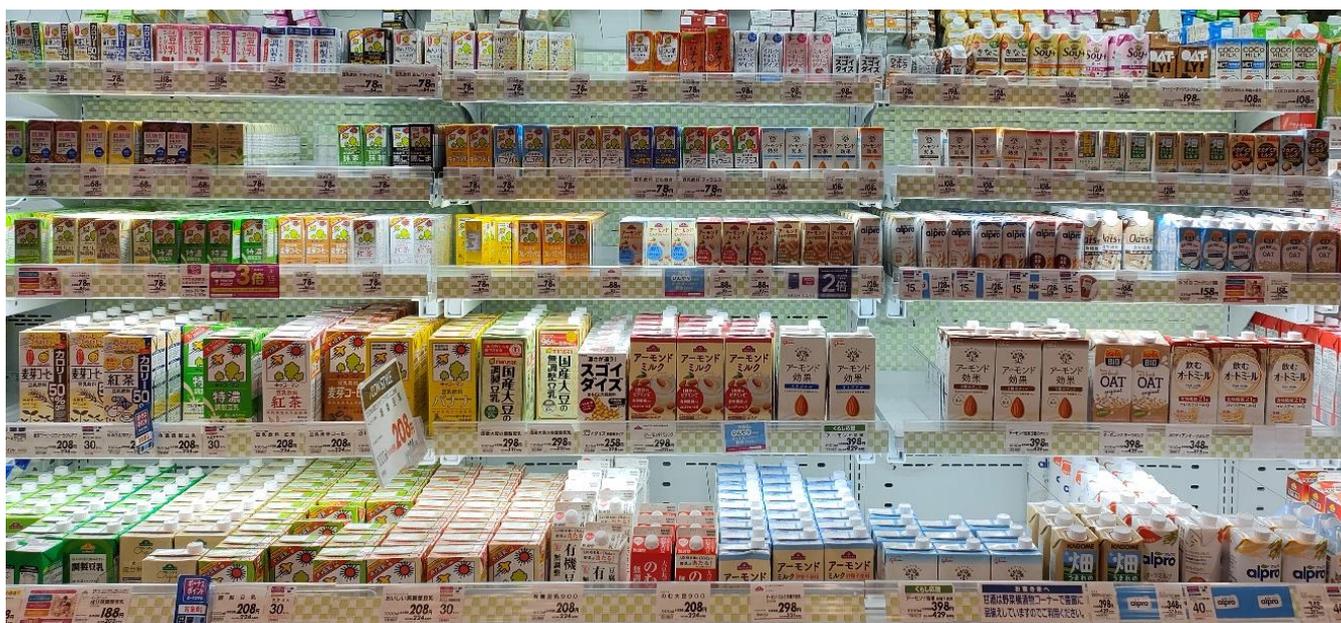


| 137 Degrees almond milk and pistachio milk made in Thailand, 224 yen (60 baht)/180 ml at Kinokuniya (a premium supermarket)

The milder taste of these plant-based milks compared to soy milk and the health benefits ascribed to nuts, oats, and other plant ingredients drive the growth of these products.

⁸ Almond Milk Research Lab, "Almond Milk Market" (translation of Japanese webpage title), <https://www.almondm-labo.jp/jp-market.php>
Sapporo Holdings, "94th Shareholder Communication Report, 2017 Jan 1 – Dec 31," 2018, https://www.sapporoholdings.jp/ir/library/communication/items/information_H29_12.pdf

Alternative Yogurt: Plant-based yogurt, made from either soy milk or almond milk, is also growing in retail, although it still represents only 1-2% of the market. These plant-based yogurt products particularly emphasize their health functionality. For example, Pokka Sapporo's soy-based yogurt has acquired FOSHU certification (Food for Specified Health Uses) for its cholesterol-reducing effects, and its sales are growing. FOSHU is a certification granted by the Japanese government to food that has been officially approved as containing ingredients with proven functional benefits for health.



| Alternative plant-based milk section at an Aeon supermarket

Plant-Based Cheese: Plant-based cheese appeared in the market in the late 2000s, and was firstly used in the food service industry. This use of plant-based cheese in food service was primarily driven by the competitive price of the products rather than consumer demand for healthier or plant-based products. 80% of the dairy cheese in the Japanese market is imported, and the high tariff of about 30% on most dairy cheese imports makes plant-based cheese prices very attractive. The demand for dairy cheese substitutes in food service has further grown in the past year due to the price of dairy cheese increasing even further since 2022. Plant-based cheese for food service is generally made of vegetable oil and protein and is considered to have virtually no flavor. It is often used as a bulking agent and is mixed with natural cheese to add flavor.

Plant-based cheese only began to be seen in the consumer retail market in the past two years, but already there are a variety of domestically manufactured products as well as imported products from Italy, Germany, Denmark, and the US. The main selling points for plant-based cheese in the Japanese retail market are that it is tasty, healthy, allergen-free, and affordable. While in some cases it is marketed as “vegan cheese,” this does not necessarily reflect growth in consumers following a vegan diet, but rather an interest in tasty and healthy products due to the healthy connotations of the word “vegan.”

Plant-Based Butter, Fat, and Other Dairy Products: Plant-based butter and fats have become an area of particular interest over the past year. The food industry is increasingly recognizing that the texture and flavor of the fats and oils used in plant-based meat and dairy alternatives are the key to ensuring delicious taste, and the development of plant-based butter and fats with richer, more aromatic flavor has recently seen renewed efforts.

In addition to plant-based milk, yogurt, cheese, and butter, the Japanese plant-based dairy market is also beginning to see more plant-based ice cream, chilled desserts, and lactic acid beverages.

Major Players and Key Start-ups

Major food manufacturers are more prominent than start-ups in new product development in the Japanese plant-based dairy sector. These major food manufacturers include Kikkoman, Marusan-ai, the Sujahta Meiraku Group, and Kagome for soy-based products, Ezaki Glico and Pokka Sapporo for almond milk, Danone for oat milk, Pokka Sapporo for soy-based yogurt, and Marin Foods for plant-based cheese. In addition to these companies, vegetable oil processors, including Fuji Oil, J-Oil Mills, ADEKA, and Miyoshi Oils have very recently become especially active in this area, since this is seen as a new area for utilization of their technology related to vegetable oil and fats.

- **Marin Foods** (<https://www.marinefoods.co.jp>)

Plant-based cheese development has been led by Marin Foods, a prominent cheese and margarine processor that currently holds the largest market share in the plant-based cheese category. In 2007, the company developed a mock cheese called Styrino made from rennet casein, cheese powder, water, and palm oil. The company expanded its Styrino business in the food service market, mainly on the strength of its low prices. Marin Foods also launched a retail product in 2016 called My Vegan Plant-based Shred, a fully plant-based cheese that does not contain any animal ingredients or common allergens. Last year, Marin Foods also introduced vegan butter to the retail market.

- **Fuji Oil** (<https://www.fujioil.co.jp>)

Fuji Oil, a leading specialty fat and soy-based products manufacturer, jumped into the plant-based cheese market in 2015 by targeting food service companies. The company's products imitate the rich taste of cheese by using the same fermentation process as cheese production, rather than adding flavoring. Soy milk is fermented to create a mozzarella-style block of soy cheese as well as mascarpone-style fresh soy cheese. Fuji Oil also has a solid business in the specialty fat category in Europe. The company opened its Global Innovation Center Europe in the Netherlands and is actively looking for collaboration opportunities for innovation in plant-based food.

- **ADEKA** (<https://adeka.co.jp>)

ADEKA is a leading manufacturer of specialty oils and chemical products. It has launched a new brand of plant-based food for the food processing and food service sectors under the name Deli-PLANTS. The series includes highly-concentrated oat milk, cheese cream, block cheese, whipped cream, butter, and fat, focused on providing a "rich delicious taste."

- **Miyoshi Oil** (<https://miyoshi-yushi.co.jp>)

Miyoshi Oil has developed three different types of vegetable butter and fats under the Botanova brand. These products use only plant-based ingredients to create a taste with the characteristics of animal oil and fats. The company is now working to expand its business not only in Japan but also internationally.

- **J-Oil Mills** (<https://www.j-oil.com>)

Japan's second largest vegetable oil processor, J-Oil Mills imports Violife products made by the Greek company Arivia, which was acquired by the Upfield Group. Violife has now become the largest mock cheese brand in the Japanese retail market. Violife's production is based in Greece.

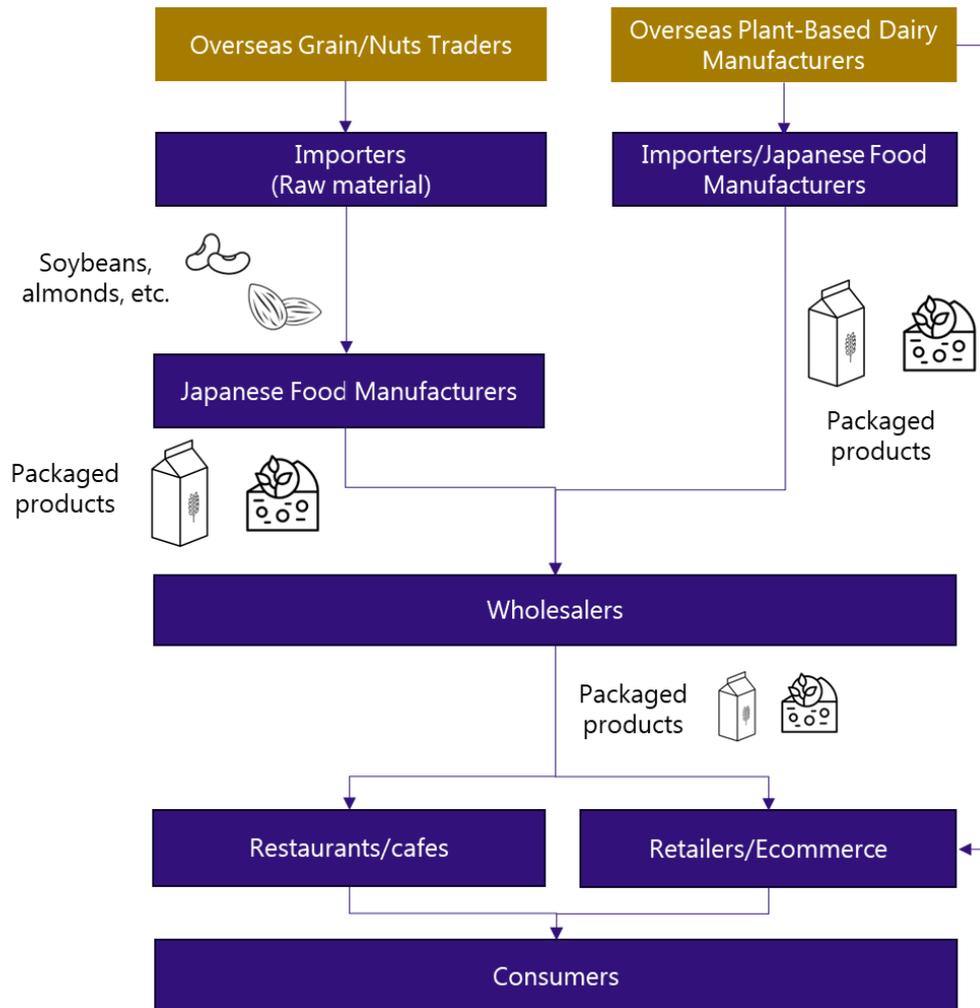


| Violife mozzarella-type slices made in Greece, about 538 yen (144 baht)/140 g. Major ingredients include coconut oil, starch, salt, olive extract/processed starch, flavor, carotene color, and vitamin B12.

Supply Chain

Plant-based dairy in Japan revolves mainly around soy milk products. Soy milk production is mostly vertically integrated and is primarily handled by several major players. Similar to plant-based meat, the ingredients used in soy milk production are predominantly imported. Additionally, the majority of imported products in the plant-based dairy market are non-soy-based packaged goods intended for retail sale. Below is an overview of the typical supply chain for plant-based dairy products.

Supply Chain of Plant-Based Dairy Products



Source: Meros Consulting based on desktop research and industry interviews

① Importers

- Importers import raw material such as soybeans and almonds as well as packed products for retail.

② Food Manufacturers

- Food manufacturers purchase soybeans or other ingredients through importers to manufacture their products. Sometimes, food manufacturers also import packed products from overseas by themselves.
- In Japan, the size of the soy milk market is significantly larger than the markets for other plant-based dairy products. Soy milk production is characterized by vertical integration, with a single player handling all aspects, from sourcing the ingredients to manufacturing the final products. The top three soy milk manufacturers are Kikkoman, Marusan-ai, and the Sujahta Meiraku Group, which have a 90% total share of the soy milk market. These manufacturers mainly rely on imported soybeans.
- The second major category of domestically produced plant-based dairy in Japan is almond milk. Ezaki

Glico, a leading confectionary and granola manufacturer, holds an over 90% share of the market. Almonds are imported through designated importers and then processed domestically to create almond milk.

- Plant-based cheese products, which are mostly made from vegetable oils and protein, are also manufactured using ingredients imported from abroad through importers.

③ Wholesalers, Restaurants, and Retailers

- Wholesalers distribute plant-based dairy products to retailers and restaurants, which sell/serve the products to consumers.
- There are cases where retailers import plant-based dairy products by themselves to sell the products at their outlets. For example, Gyomu Super, a supermarket chain that has more than 1,000 stores all over Japan, directly imports plant-based milk products from overseas.
- The majority of plant-based dairy product sales occur at the retail level, although there is some usage in the food service industry, such as at cafes. On the other hand, there has been robust demand for dairy cheese substitutes within the food service sector. These substitutes are now becoming more widely distributed and available in retail markets as well.
- There has been an emergence of imported plant-based cheese products from countries such as Italy, Germany, Denmark, and the US entering the Japanese market. These products are imported by importers and distributed by wholesalers, or imported directly by food manufacturers, such as J-Oil Mills importing Violife from Greece and repacking the items from bulk to retail packs.
- The soy milk market is primarily dominated by Japanese products. However, imported products have a more significant presence in other plant-based milk markets, such as oat milk.



| A large variety of domestic soy milk products sold at a supermarket

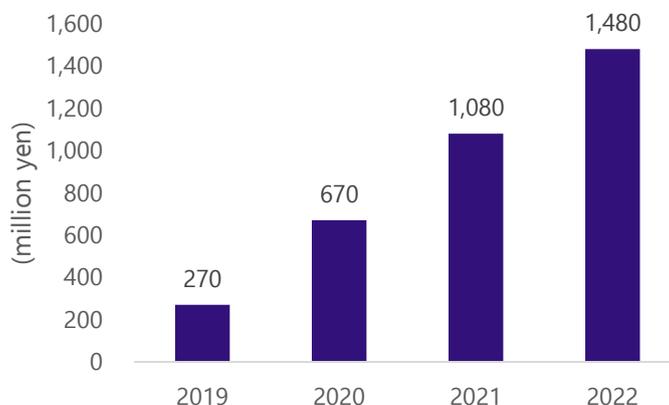
3.3. Insect-Based Food

Japan has an extensive history of consuming insects like locusts and bee larvae. However, following World War II, insects began to vanish from daily diets as the Japanese economy surged and incomes increased. Consequently, until very recently, consumption of insects has been restricted to specific areas where they have been traditionally eaten as local delicacies. However, with the rising global interest in insect-based foods as an eco-friendly protein source, insects are gradually making a comeback in the Japanese market.

Industry Trends

The size of the insect-based food market in Japan is growing quickly, led largely by products using cricket powder sold at retail stores. According to data released by TPC Marketing Research, the size of the insect-based food market stood at 270 million yen (72 million baht) in 2019, but rose to 1.48 billion yen (400 million baht) in 2022. The number of insect-based food companies began to grow in Japan after 2015, the year the Sustainable Development Goals (SDGs) were adopted by the UN. In May 2020, major retailer Ryohin Keikaku, which sells a wide variety of household and consumer goods as well as food at its Mujirushi (Muji) brand stores, started to sell cricket-based crackers and a chocolate bar with cricket powder. The launch of insect-based products at such a high-profile retailer has had a huge impact on the industry and accelerated the growth of the market of insect-based food in Japan.

Growth of the Insect-Based Food Market in Japan (2019-2022)



Source: TPC Marketing Research, https://release.nikkei.co.jp/attach/647948/01_202301231115.pdf

In early 2023, criticism of these cricket-based food products began to spread within certain social media communities and through online articles. Manufacturers of cricket-based food products have received an increasing number of calls and emails criticizing the use of insects. This backlash is considered to have slowed the growth of the industry to a certain extent. Nevertheless, it is believed that the overall market is continuing its gradual expansion with more Japanese companies interested in handling insect-based products.

Currently, the Japanese insect-based food market is dominated by cricket-based products. The most common product at physical retail stores are cricket powder-based crackers. Many of the first products released by Japanese companies have used insect powder due to the companies' concerns that consumers will dislike seeing insects in their original form.

Insect-based foods have more presence at retail stores compared to food service. It is not difficult to find cricket-based food products at physical retail stores these days because they are stocked by major retailers such as Ryohin Keikaku (with about 500 Muji stores in Japan) and Maruetsu (a supermarket chain with about 300 stores in Japan) as well as other well-known retailers such as Daiso, Don Quijote, and drug store chain Welcia. However, it is important to note that the variety of cricket-based items is very limited. For example, Muji sells the aforementioned two items and Maruetsu has only one. Furthermore, after the current stock is sold out, Maruetsu plans to discontinue the sale of cricket-based food products.

Unfortunately, few products have been able to maintain a true presence on the supermarket shelves in Japan. The lack of strong product appeal, such as taste, pricing, or other factors, represents a major challenge, especially because the Japanese market is highly competitive with constant entrance of new products. Currently, few supermarkets sell insect-based products on a regular basis. The general retail chain Don Quijote does usually offer some insect-based food items, but this is an unusual case. In addition, current sales of insect-based products are largely concentrated in large metropolitan areas such as Tokyo, where there are more consumers interested in trying out novel products.

That being said, there have been examples of introductions of insect-based foods in local municipalities. For example, in 2022, a cricket-based pumpkin croquette was offered for the school lunch at a high school in Tokushima Prefecture as part of a SDGs project.⁹ The pumpkin croquettes mixed pumpkin and cricket powder as an alternative protein source to minced meat in the recipe. The idea of introducing cricket powder into school meals came about when a teacher saw students playing a game that involved eating dried edible crickets. The teacher was surprised by the good taste and hoped that incorporating cricket powder into school lunches would be a good way to increase students' awareness of environmental issues.

In addition to crickets, a limited number of products using insects such as locusts, silkworms, bee larvae, and cicadas are sold at retail stores. Some of these products are domestically produced and have a history of local consumption. For example, Nagano Prefecture is an area of Japan with a long tradition of eating insects. Even now, some local supermarkets sell locusts, silkworms, and bee larvae cooked in the *tsukudani* style by simmering in soy sauce and *mirin* rice wine. In addition, packs of dried insects or flavored dried insects are sold at physical stores and especially online stores specializing in insect-based foods as well as stores owned by insect-based food manufacturers. These products tend to be made using imported insect ingredients. According to a Japanese player dealing with various

⁹ Nikkei, "Edible cricket powder used in school lunches in Tokushima for the first time in Japan" (translation of Japanese article title), 2022 November 28, <https://www.nikkei.com/article/DGXZQOCC24BFE0U2A121C2000000/>

insect-based products, its mixed dried insect products are recently gaining popularity among consumers who want to try out insect-based foods.

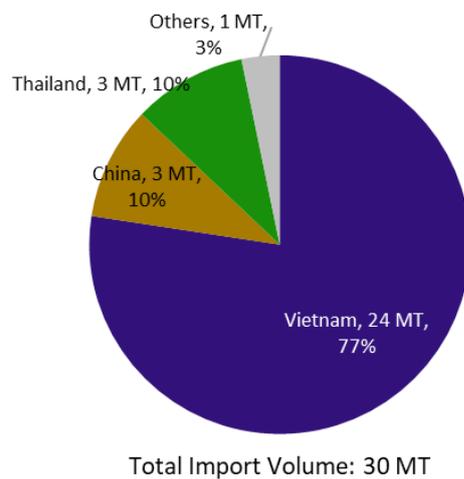
The number of restaurants that offer insect-based dishes is still extremely limited. These few restaurants serve food such as ramen using crickets in the broth, pasta with dried crickets, and diverse dried insects like crickets and worms. These restaurants still tend to serve insects as a novelty item, and none of the major restaurant chains offer an insect-based product on the menu.

While there is some domestic productions of cricket powder in Japan, the majority of the supply comes from imports. According to trade data, Vietnam is by far the largest exporter of insect-based food to Japan, accounting for 24 megatons of insect-based food products in 2022. It is not clear from the trade data what insect-based foods these are, but it is assumed that Vietnam is mainly exporting cricket powder. For example, Cricket One, a Vietnamese company that produces food using crickets, exports its cricket powder to Japan.¹⁰ Following Vietnam, the next largest exporters of insect-based products to Japan are China and Thailand, which each exported three megatons to Japan in 2022. Japan also receives cricket powder imports from Canada.

Thailand is recognized largely as a major cricket-powder supplier, but is also known to supply various dried insect-based snacks. One of the largest Japanese insect-based food manufacturers, Takeo, sells many products using insects imported from Thailand. The largest online shop specializing in insect-based food, Bugs Farm, sells products from Thai insect-based food manufacturers such as JR Unique Foods and Global Bugs.

There is no particular standard for powder particle size required by the Japanese industry. Some importers require a course texture, while others require a fine texture.

According to the industry, in terms of the quality of cricket powder, the differences between manufacturers are more significant than the differences between countries. Regarding pricing, Southeast Asian countries, particularly Vietnam and Thailand, are known for offering competitive and reasonable prices compared to Canada and Europe. In addition, Thailand’s cricket production is well-regarded for its high level of management and efficiency, even



Japan’s Import Volume of Insect-Based Food (2022)

Source: ITC (International Trade Centre), HS code 041010 (Insects, fit for human consumption)

¹⁰ Japan External Trade Organization (JETRO), “Local Vietnamese start-ups bringing edible crickets to the world” (translation of Japanese tile), 2020 October 9, <https://www.jetro.go.jp/biznews/2020/10/727467dff682f97a.html>

when compared to Japan. Moreover, the ability of Thai companies to offer a variety of insects is seen as a major strength. On the other hand, there have been some instances involving issues with cricket powder quality from Thailand. For example, pesticide residue has been detected in some shipments at customs, and there have been cases where bacteria counts exceeded the permitted limits. Additionally, some packaging has lacked proper vacuum sealing, resulting in an oxidized smell.

As mentioned earlier, with the expansion of the insect-based food industry, criticism of insect-based food is also increasing. For example, major Japanese bread manufacturer Pasco Shikishima's official Twitter account received many critical comments after the company launched a bread product using cricket powder. A group of consumers even started a boycott of all Pasco Shikishima bread. The Tokushima high school that offered cricket-based croquettes as part of its school lunch also received significant criticism.

The reasons for the criticism of this cricket-based food are varied and seem to come from a very small niche group of consumers. A common criticism is that crickets are disgusting, and there are also concerns that students might be forced to eat insects. According to the industry, this consumer backlash has slowed industry growth to some extent, especially with Japanese companies' tendency to be very risk averse and desire to avoid any controversy.

Nevertheless, it is believed that the market has experienced some growth due to the general tendency for Japanese companies to look for more "sustainable" sources of protein. According to the industry, while the current demand for insect-based protein is relatively limited, many companies are preparing for the future expansion of the market. Currently, the primary focus of Japanese companies is cricket powder. Additionally, there is a growing interest in dried insect products, as they offer a visually interesting and novel option for consumers. Besides cricket powder, Japanese companies are also showing interest in exploring other types of insect-based powders, such as mealworm, silkworm, and sago worm powder. This diversification indicates a willingness to experiment with different insect sources to provide consumers with a broader range of options.

One significant obstacle highlighted by the industry for the further expansion of the insect-based product market is the lack of evidence for the health benefits of these products. While some curious consumers may be willing to try insect-based products once or twice, there is a lack of incentive for them to continue consuming the products regularly. Industry experts believe that consumption could be boosted via research that supports claims about the strong health functionality of these products, especially for cricket powder. However, at present, such research is non-existent, hindering the ability to make compelling health claims. If research can provide substantial evidence of the health benefits and functionality of insect-based products, there is a possibility that these products will gain wider acceptance among mainstream consumers.

Another major obstacle for expanding the product range in Japan is the scarcity of companies capable of providing original equipment manufacturing (OEM) for insect-based products. OEM companies traditionally focus on eradicating insect contamination, and as a result, many of them feel hesitant to deal with insect-based products due to concerns about potential negative effects on their reputation and other non-insect-related products they manufacture.

Furthermore, prices of insect-based products are generally considered too high to expand the market. Because the demand for insects is still limited in Japan, the freight cost for importing insect-based products tends to be expensive, as they are often shipped by air. If the demand becomes high enough to bring these products by container, the price can be lowered considerably.

The market for insect-based protein in Japan is currently in its early stages, but the rising interest from Japanese companies indicates a promising future for this innovative food sector. It is essential to recognize that the size of the market is likely to remain relatively small, especially when compared to other types of alternative protein sources. Despite its niche status, the insect-based protein market can continue to grow and offer opportunities for various companies, especially if factors such as lack of R&D activities or lack of OEM production capacities are addressed, together with increasing consumer acceptance of insect-based products.

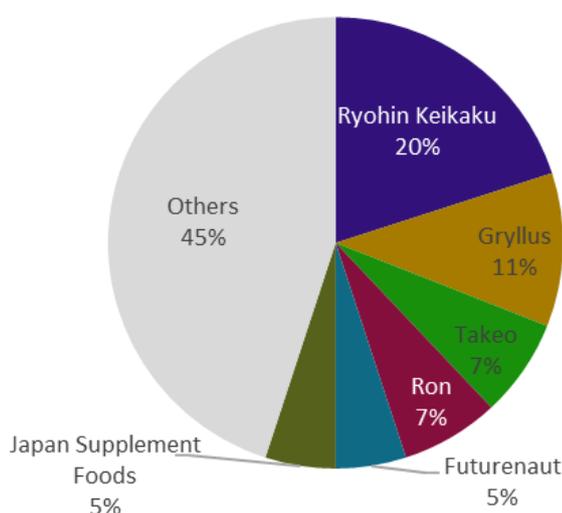
Major Players and Key Start-ups

In Japan, six companies hold a combined 55% share of the insect-based food market. The remaining 45% is held by many small-sized companies.¹¹ The six major companies are Ryohin Keikaku (Muji), Gryllus, Takeo, Ron, Futurenaut, and Japan Supplement Foods.

- **Ryohin Keikaku** (<https://www.ryohin-keikaku.jp/>)

Ryohin Keikaku is the largest player in the industry, with a 20% share of the insect-based food market. The company sells a wide variety of household and consumer goods as well as food products through its

Muji brand stores. Because Ryohin Keikaku is one of Japan's largest retailers with about 500 retail stores, its launch of cricket-based products in 2020 had a huge impact on the industry. The company says that it developed these products to encourage people to consider issues such as food security and environmental impact. Currently, Ryohin Keikaku sells two insect-based products: cricket-based crackers and a cricket-based chocolate bar. Ryohin Keikaku developed those products through collaboration with the start-up Gryllus, which originated from Tokushima University. The crackers and chocolate are sold at physical Muji retail stores as well as the Muji online store.



Market Size in 2021: 1.08 billion JPY

Market Share of Insect-Based Food in Japan by Company (2021)

Source: TPC Marketing Research, https://release.nikkei.co.jp/attach/647948/01_202301231115.pdf

¹¹ Konchushoku no Semitama, "Entomophagy-related companies and industries guide (chaos map) 2022! What stores sell insect-based foods?" (translation of Japanese title), 2022 February 16 (updated 2023 April 3), <https://semitama.jp/column/3287/>



| Cricket cracker, 220 yen (59 baht)/pack (55 g)



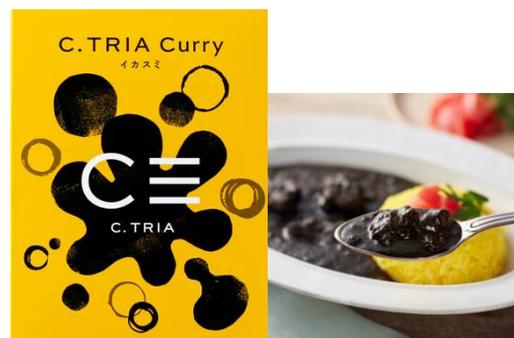
| Chocolate bar with cricket powder, 220 yen (59 baht)/bar (38 g)

- **Gryllus** (<https://gryllus.jp/>)

Gryllus is the second largest player in the industry, with an 11% share of the insect-based food market. It is a start-up that originated at Tokushima University, which has a 30-year history of cricket research. Gryllus has turned two former school buildings in Tokushima Prefecture into production and research bases and is involved in all aspects of the production of crickets, from breeding research for improved varieties to the development and sale of cricket powder and food products containing cricket powder. Gryllus sells its own C. Tria brand products in its online store as well as some outlets of the major convenience store chain Family Mart. Gryllus raised approximately 290 million yen (78 million baht) in funding last year, for a cumulative total of about 520 million yen (139 million baht), the highest among domestic insect-based food start-ups. The company aims to produce about 60 tons of cricket powder annually by December 2023. It just announced that it will work together with NTT (Nippon Telegraph and Telephone East Corporation), a major Japanese telecommunications operator, to conduct a pilot program to experiment with more efficient breeding of crickets through utilization of NTT's ICT/IoT knowledge.¹²



| Cricket chocolate bar, 240 yen (64 baht)/bar (37 g)



| Pre-packaged curry including cricket powder, 870 yen (233 baht)/pack (180 g)

- **Takeo** (<https://about.takeo.tokyo/>)

¹² Gryllus press release (in Japanese), 2023 January 19, <https://gryllus.jp/news/release/ntt/>

Takeo is a company specializing in insect-based food that was established in 2014. Takeo cultivates insects domestically and also imports insects to develop and sell insect-based food. The company's most well-known product is called Tagame Cider, a carbonated beverage that includes an extract from giant water bugs from Thailand. The beverage won a well-known design award sponsored by the Japan Institute of Design Promotion, marking the first time that an insect-based product won the contest. Recently, Takeo has been working on developing and marketing a series of products using insects from various prefectures in Japan. For example, Takeo developed a cricket-based product that uses crickets produced in Kyoto Prefecture with packaging emphasizing the words "Kyoto Crickets." Takeo also owns a restaurant and retail store where people can try its insect-based food. Last year, Takeo received an undisclosed amount of investment from Nichirei, a major food manufacturer in Japan that pioneered frozen food in the country. Takeo aims to develop frozen insect-based food products with support from Nichirei.



| Soda pop with extract of giant water bugs, 480 yen (128 baht)/bottle (200 ml)



| Crickets produced in Kyoto Prefecture, 620 yen (166 baht)/pack (3 g)

- **Ron** (<https://ron.co.jp/index.html>)

Ron is involved in diverse businesses, including selling products for the darts, sports, and pet industries through its online stores as well as running media sites and a recruitment site. In 2013, Ron became involved in insect-based products as well. Ron is a wholesaler and retailer of insects and insect-based food, and also develops its own branded insect-based food. Ron owns Bugs Farm, the largest online store specializing in insect-based food in Japan (<https://bugsfarm.jp/>), which sells its own branded products and other companies' products. Ron is also the Japanese distributor for several Thai insect-based food companies such as JR Unique Foods and Global Bugs. Two of these Thai products can be seen below.



| Weaver ant eggs (JR Unique Foods), 4,320 yen (1,155 baht)/can (200 g)



| Cricket powder (GLOBAL BUGS), 2,484 yen (664 baht)/pack (100 g)



- **Futurenaut** (<https://futurenaut.co.jp>/<https://bugsfarm.jp/>)

Futurenaut is a company that originated at Takasaki City University. It imports and sells cricket powder from Thailand, and also develops cricket-based products such as chips and chocolates containing cricket powder. In 2019, Futurenaut formed a business partnership with a Thai company called Cpoint Corp., Ltd. related to insect procurement. Futurenaut has also been working with the major Japanese bread manufacturer Pasco Shikishima to develop cricket-based bread. Recently, Futurenaut has started conducting research with a company called Nakari, which manufactures and sells rice, for the production of crickets raised on rice bran as feed with the aim of selling these crickets as a branded cricket product in the future.¹³



| Cricket powder, 1,480 yen (396 baht)/pack (100 g)



| Cricket chips, 390 yen (104 baht)/pack (20 g)

- **Japan Supplement Foods** (<https://www.j-sf.co.jp>/<https://bugsfarm.jp/>)

Japan Supplement Foods is a company that develops and sells healthy food. In 2019, the company started an insect-based food business. It imports insects from Thailand and uses them as ingredients for various insect-based foods

¹³ Futurenaut press release (in Japanese), 2022 December 23, <https://prtimes.jp/main/html/rd/p/000000015.000060156.html>

under its brand Bugoom. The products are sold through the company's two physical retail stores in Fukuoka Prefecture as well as an online store. Last year, Japan Supplement Foods developed a product with the YouTuber Orochinyu, who is well-known for making videos of himself cooking insects he has caught.¹⁴ Orochinyu was involved in the development by selecting his favorite insects for the product (dried crickets, bamboo worms, and sago worms, and the product packaging features his name. Recently, Japan Supplement Foods launched a noodle product containing cricket powder, the first in the industry.



| Instant cricket noodles, 810 yen (217 baht)/cup (120 g)



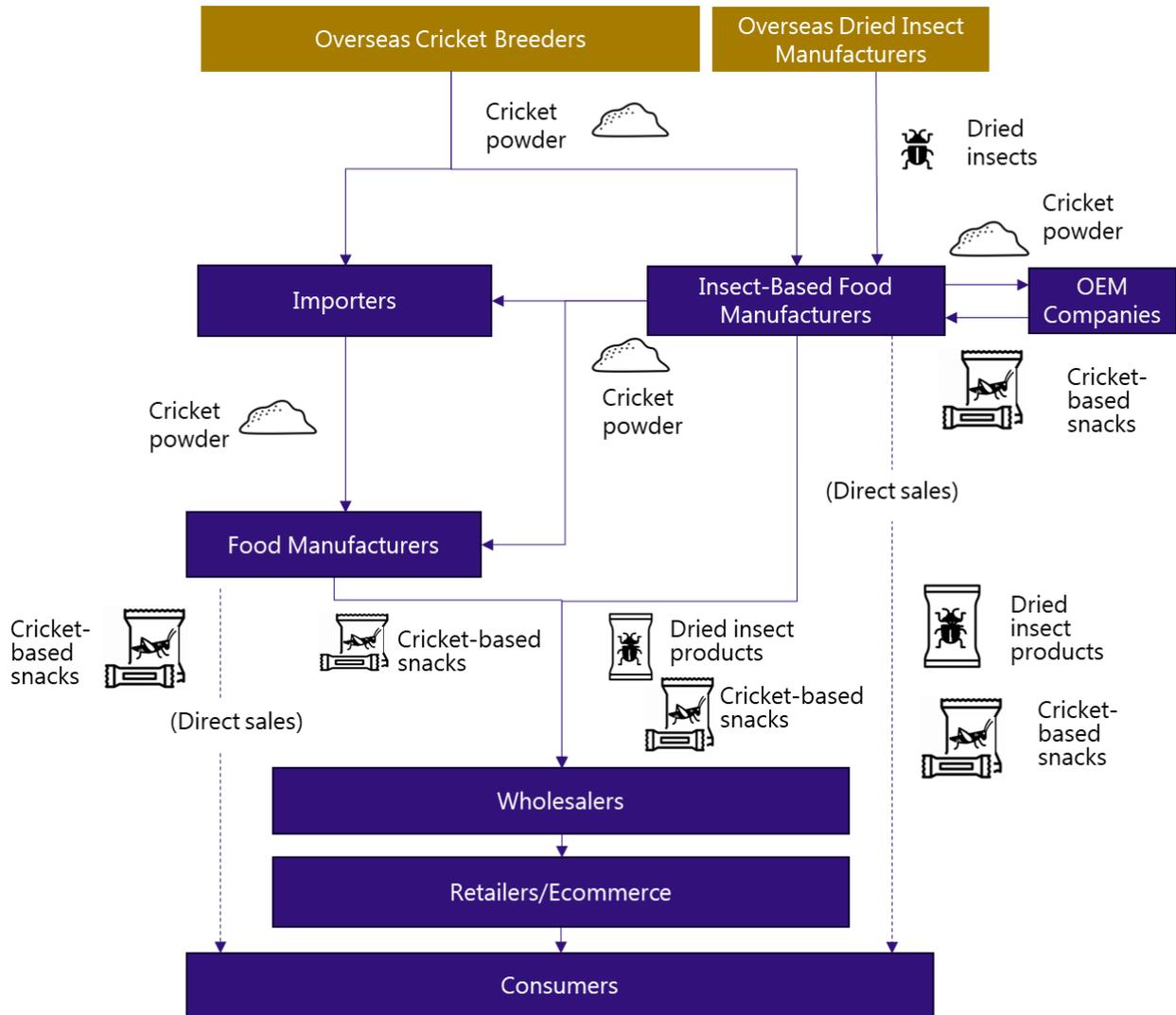
| Dried tarantula, 2,560 yen (684 baht)/pack (8 g)

Supply Chain

Insect-based products in Japan primarily contain cricket powder. Few insect-based products are sold at physical retail stores, and most are products that are produced domestically using either imported or domestically produced cricket-powder. Manufacturing of these products relies on OEM production in Japan. Imports, including dried insect snacks, are typically handled by companies specializing in insect-based foods and health products. These imported items are primarily sold through online shops, although some are also available in physical retail stores. At present, imported products tend to be particularly in categories such as dried insect snacks, rather than cricket powder-based products. The diagram below shows the typical supply chain for insect-based products.

¹⁴ Japan Supplement Foods press release (in Japanese), 2022 March 4, <https://prtimes.jp/main/html/rd/p/000000005.000080566.html>

Supply Chain of Insect-Based Food Products



Source: Meros Consulting based on desktop research and industry interviews

① **Importers**

- Importers import cricket powder from overseas, mainly Southeast Asian countries such as Thailand, Vietnam, Malaysia, and the Philippines. Japan also imports from countries such as Canada and some European countries, although the volume is not large. Cricket powder from Canada and European countries tends to be more expensive than cricket powder from Southeast Asian countries.



| Example of cricket powder

- For manufacturing cricket-based products, imported cricket powder currently has an advantage over domestic cricket powder in terms of volume and price. According to industry interviews, the typical price of imported cricket powder is around 5,000-6,000 yen (1,337-1,604 baht)/kg, but

domestic powder is around 12,000-15,000 yen (3,208-4,010 baht)/kg.

- There are sometimes cases in which importers purchase cricket powder from Japanese insect-based food manufacturers to supplement their imports.

② Insect-Based Food Manufacturers

- Insect-based food manufacturers import cricket powder, dried insects, and insect-based food products from overseas. Some of them breed crickets and produce cricket powder by themselves. They manufacture their own insect-based food products using the powder and dried insects.
- Some insect-based food manufacturers sell products directly to consumers through their e-commerce sites. For example, RON, an insect-based food manufacturer, imports dried insect products from Thailand and sells them through its online store, Bugs Farm.



| Example of cricket powder-based products

- Overall, the number of insect-based food manufacturers in Japan is limited. Because most of the insect-based food manufacturers do not own food factories, they use OEMs to manufacture products.

③ Food Manufacturers (Companies That Produce Not Only Insect-Based Food Products but Also Other Kinds of Food Products)

- Food manufacturers purchase cricket powder to manufacture cricket powder-based products. The cricket powder-based products currently available in the Japanese market are mainly crackers and snack bars.
- Ryohin Keikaku (Muji) is one of the few large players in the Japanese insect-based food market, and produces OEM cricket-based products. The company is also one of the rare companies that use domestic cricket powder.

④ Wholesalers and Retailers

- Wholesalers distribute insect-based products manufactured or imported by insect-based manufacturers and food manufacturers to retailers.
- Imported products have a strong presence in the dried insect products market. The cricket powder-based product market is dominated by Japanese domestic products.
- Retailers sometimes use vending machines to sell imported insect products.



| Imported insect-based products sold from a vending machine

3.4. Cultured Meat

As of August 2023, cultured meat is not yet sold commercially in Japan. Because Japan allows new foods to be sold unless they are specifically banned by the authorities, it would be possible for cultured meat to be sold commercially. However, Japanese cultured meat companies are being careful and working with the government on rule-making for this new type of meat before they start selling commercial products.

Although the number of start-ups and research collaborations in the cultured meat industry in Japan is relatively low, there is growing interest in the global cultured meat sector among Japanese investors, increasing attention paid to Japanese start-ups, and high-profile research collaboration between major corporations and universities. This suggests that Japan is closely following the developments of global cultured meat leaders in Singapore, the US, and Israel, and looking to become a part of this future food sector.

Because cultivated meat products are not yet on the market, consumer awareness of cultured meat is still low. Industry organizations in Japan are preparing for the future by working to establish a supportive regulatory framework for the industry's development. Recent efforts by the Japanese government also indicate that cultured meat is a growing priority for the establishment of a safe and commercially viable market.

Industry Trends

The cultured meat industry in Japan is being primed for commercialization of its products and technologies through global and domestic collaborations by key players in the sector. These key players comprise start-ups, food and research equipment manufacturers, Japanese investors, universities, and organizations supporting the establishment of a regulatory framework and raising public awareness.

Japan boasts four prominent cultured meat industry start-ups: IntegriCulture, NuProtein, Organoid Farm, and Diverse Farm. These start-ups are conducting R&D from various angles of cultured meat technology. IntegriCulture and NuProtein are leading the way in cost-reduction technology, which is attracting global attention. Furthermore, these Japanese start-ups have partnered with two of Singapore's most prominent cultured meat start-ups, with plans to commercialize cultured seafood products in Singapore by the end of 2023.

Major Japanese food manufacturers are collaborating with research partners to create prototypes for cultured meat, such as steak cuts and chicken. Their focus is not only on reducing production costs but also on improving the taste and texture of the products. Additionally, food companies and other Japanese investors, such as major trading companies, research equipment manufacturers, and tech companies outside the food industry, are looking at overseas cultured meat start-ups. They are beginning to invest and partner with leading overseas players in the cultured meat industry.

Although the focus of cultured meat research in Asia has been primarily on seafood, particularly in Singapore, Japan's initial prototypes have concentrated on beef, chicken, and foie gras. However, it is possible that cultured

seafood may also find a market in Japan, as Japanese investors and partners have recently invested in cultured seafood projects.

Japanese consumers have strong concerns about food safety, which is likely to affect their acceptance of cultured meat. A survey conducted in 2020 by the Cellular Agriculture Institute of the Commons (CAIC) showed that 60% of Japanese respondents were not familiar with the concept of cultured meat. Among those who were aware, they expressed significant concerns about the safety, taste, and ingredients used in cultured meat products. Major food manufacturers have conducted similar consumer surveys, which also indicated low public awareness and concerns about food safety and taste.

The long-term consumer acceptance of cultured meat in Japan is expected to depend significantly on consumers' confidence in the safety and quality of early consumer products. This is one of the reasons why the Japanese cultured meat industry is taking a cautious approach to the commercialization of consumer products.

Major Players and Key Start-ups

There are multiple start-ups and major food manufacturers involved in the field of cultured meat. Additionally, research equipment manufacturers such as Able, Takasago Fluidic Systems, Shimadzu, and Futamura Chemicals are supporting the development of the necessary technical infrastructure and ingredients for cultured meat production. The growth of the cultured meat industry is being driven by cutting-edge research conducted by Japan's leading universities and educational institutions.

The network of collaborations within the Japanese cultured meat industry is marked by a number of noteworthy partnerships. Listed below are some of the most notable collaborations presently in effect.

Notable Collaborations in the Japanese Cultured Meat Eco-System

Company Name	Type of Company	Collaboration
NuProtein	Start-up	Technological collaboration with Singapore-based start-up Umami Bioworks (seafood) to bring down production costs
IntegriCulture	Start-up	Technological collaboration with Singapore-based start-up Shiok Meats (seafood and meat) to reduce production costs
Shimadzu	Research equipment manufacturer	Research collaboration with Osaka University
Nissin Food Holdings	Food manufacturer	Research collaboration with the

		University of Tokyo
Maruha Nichiro and Ichimasa Kamaboko	Food manufacturer	Research collaboration with start-up IntegriCulture

Major Japanese investors, including large trading companies and investment branches of major manufacturers, are increasingly showing interest in the global cultured meat industry. This interest is reflected in a growing trend of investments made in overseas cultured meat companies. In line with Japanese investment patterns in new sectors, these investments in the global cultured meat industry often involve late-stage overseas start-ups that have already established themselves. These investments frequently take the form of strategic partnerships, with the aim of introducing these technologies and products to new markets, including Japan. For overseas start-ups, partnering with Japanese players may provide better access to resources that can aid in the development of more cost-effective production of cultured meat, as well as enable access to Asian, US, and EU markets where these Japanese companies have a strong presence and reputation.

Major Investments by Japanese Players Into Overseas Cultured Meat Start-ups

Japanese Company Name	Type of Company	Investment Recipient
Sumitomo Corporation	Trading company	Blue Nalu (US)
Mitsubishi Corporation	Trading company	Mosa Meats (Netherlands) Aleph Farms (Israel)
Ajinomoto	Food manufacturer	Super Meat (Israel)
Food & Life Companies	Sushi chain operator	Blue Nalu (US)
Dainichi Corporation	Metal and alloy manufacturer	Finless Foods (US)
Toyo Seikan	Packaging material company	Shiok Meats (Singapore)
Softbank	Telecom and tech company	Upside Foods (US)

Supply Chain

Cultured meat products are not yet sold in Japan and the supply chain is not established.

3.5. Mycoprotein-Based Food

Industry Trends

Mycoprotein products are not yet sold in Japan. However, there have been several recent movements to develop mycoprotein products in Japan among companies as well as a university, and it is expected that mycoprotein products will be available in Japan soon.

Green Earth Institute (GEI), a company that develops biomass-derived chemical products, and Agro Ludens (AL), a company that produces agricultural robots and biomass products, signed a business cooperation agreement on January 12, 2023¹⁵ to advance the research, development, and commercialization of mycoprotein. In addition, the US start-up company MycoTechnology aims to market its products in Japan with support from the major Japanese food and biotechnology company Ajinomoto.¹⁶ MycoTechnology currently produces a plant-based protein product made by fermenting mushroom mycelia, pea protein, and rice protein together, and has a plan to build a plant to produce 20,000 megatons of mycoprotein per year from tropical fruit.¹⁷ In addition, Yukiguni Maitake, one of the largest Japanese mushroom production and sales companies, has announced the establishment of a new business division aimed at developing mycoprotein products.¹⁸ The company believes that there is potential high demand for fiber-rich mycoprotein in Japan, where health consciousness has increased due to factors such as health concerns during the COVID-19 pandemic and the rapid aging of the population.

The University of Tsukuba is also making mycoprotein-related moves. Associate Professor Daisuke Hagiwara's laboratory at the University is conducting research on developing alternative meat using filamentous fungi called *Aspergillus oryzae*. The fungi is called *koji-kin* in Japanese and is used to make fermented products such as miso and soy sauce.¹⁹ Professor Hagiwara's lab aims to collaborate with food companies to develop mycoprotein meat products in the near future.

Supply Chain

Mycoprotein-based food products are not yet sold in Japan and the supply chain is not established.

3.6. Microalgae-Based Food

Microalgae have emerged as a highly attractive area for Japanese food-tech players due to their high photosynthetic productivity and the wide range of compounds they can produce, ranging from protein and antioxidants to other specific functional substances. Japan has had a health food market utilizing microalgae such as

¹⁵ Green Earth Institute press release (in Japanese), 2023 January 30, https://gei.co.jp/ja/img/newsrelease/news_20230130.pdf

¹⁶ Techblitz website, <https://techblitz.com/myco-technology/>

¹⁷ World Economic Forum website, <https://jp.weforum.org/agenda/2021/09/kinokoga-tampaku-de-ni-tsu/>

¹⁸ *Niigata Keizai Shimbun*, "Special Feature: Success-assuring content for the Niigata Food Industry? Moves to enter the alternative food market" (translation of Japanese title), 2022 July 17, <https://www.niikei.jp/458900/>

¹⁹ https://www.life.tsukuba.ac.jp/laboratory/lab_hagiwara_20220215/

spirulina, chlorella, and donnariella since the 1970s. In fact, Japanese companies were the first to mass-cultivate these microalgae successfully for commercial food use on a global scale at the time. Recently, the Japanese microalgae market has been revitalized, fueled by the increased attention paid to microalgae worldwide. Because mass cultivation of microalgae requires specific temperatures, adequate levels of sunlight, and large areas of land to set up production facilities, many microalgae production bases are located overseas.

Industry Trends

Microalgae have been found to possess an exceptionally high capacity for photosynthetic carbon dioxide fixation and biomass production efficiency, far surpassing that of ordinary plants. Moreover, they can synthesize a wide range of substances directly from photosynthesis, including proteins, oils, carbohydrates, dietary fiber, various pigments and minerals, vitamins, antioxidants, and other health-functional substances.

Although the use of microalgae as a protein substitute for meat and seafood is still in the early stages of development in Japan, many microalgae companies are exploring multiple applications, including health food, feed, biofuels, pigments, functional materials, cosmetic ingredients, and space food. The use of microalgae as an alternative protein ingredient is also being considered.

Because microalgae growth requires specific temperatures and levels of sunlight, production sites are often located overseas. There are no notable facilities constructed by major Japanese players in Thailand for the production of microalgae for alternative proteins. However, IHI, one of the major comprehensive heavy-industry manufacturers in Japan, has established a microalgae production base in Thailand for jet fuel and is conducting pilot testing of this process.

Euglena, chlorella, and spirulina are the major microalgae in the Japanese market. In addition to these three species, microalgae such as aurantiochytrium, nannochloropsis, donnariella, and coccoliths are also of interest.

Euglena: Euglena is a genus of unicellular, freshwater microalgae. In 2005, the Japanese company Euglena Co. became the first in the world to succeed in the outdoor cultivation of euglena. In recent years, the company has played a significant role in expanding the microalgae market in Japan. The euglena market is estimated to have expanded to around 30 billion yen (eight billion baht) by 2022 based on the company's sales. Currently, the company's main products include packaged beverages, powders, supplements, and cosmetics. In addition, Euglena Co. collaborated with Next Meats, a plant-based meat start-up, to launch a soy-based meat substitute containing euglena and chlorella extract under the brand NEXT Euglena Yakiniku EX in 2021. Furthermore, the company is developing food to be used in space travel that can take advantage of the high protein content of microalgae. With the rapid expansion of the euglena market and growing consumer awareness, other suppliers have also jumped into the Japanese euglena market, such as Kobelco Kankyo Solution, a subsidiary of Kobe Steel Group, and several Taiwanese producers.

Chlorella: Chlorella is a single-celled freshwater microalgae species of the division Chlorophyta. It is the longest-used microalgae for health food products in Japan and is estimated to have a market size of 10 to 20 billion yen (2.7-5.3

billion baht).²⁰ Chlorella contains about 60% protein. It is generally made into powder and used as a raw material for a green drink commonly called *aojiru* as well as tablets, after separation from the culture medium, removal of the cell wall, and drying. Major players in the chlorella market include Chlorella Kogyo, which succeeded in the commercial cultivation of chlorella in 1964, and Nikken Sohonsha, which succeeded in the commercial cultivation of chlorella and *donnariella* in the 1970s. Chlorella Kogyo has its production site in Japan, while Nikken Sohonsha has its production sites in Israel and Taiwan. However, these players have been relatively slow in the development of alternative protein products using chlorella. The only existing alternative protein product that contains chlorella is NEXT Euglena Yakiniku EX, as mentioned in the previous section.

Spirulina: Spirulina is a cultured species of cyanobacterial algae (or blue-green algae) of the order Cyanophyceae *Euremales*. It is estimated to have a multi-billion yen market in Japan. Spirulina contains 50-70% protein and is often dried for use in tablets, powders, extracts, and pigments (phycocyanin, a blue pigment). It is sold for feed and other products as well. DIC Lifetech, a subsidiary of the DIC Group (formerly Dainippon Ink & Chemicals), is the largest handler of spirulina in Japan. The company was the first in the world to succeed in the controlled cultivation of spirulina in the 1970s, and has its production sites in California in the US and on Hainan Island in China. The company's main businesses are spirulina health food (powder and tablets) and phycocyanin. In recent years, the company has been taking advantage of spirulina's high protein content to develop a market for the use of the product after pigment extraction in aquaculture feed and as an additive to alternative meat products. The company is also exploring the potential to create a new market for spirulina, focusing on the prevention of frailty in the elderly by taking advantage of spirulina's high nutritional value. In addition to DIC Lifetech, the emerging biotech group Chitose Bio has been exploring opportunities in the microalgae business since 2007. The company now sells raw, quick-frozen spirulina as a highly nutritious food through its subsidiary Tabérumo and plans to enter the alternative meat market with spirulina-based products around 2023.²¹

Major Players and Key Start-ups

Some key players in the industry, such as Chlorella Industries and Euglena Co., have adopted an integrated business model in which they develop their microalgae cultivation technology, grow microalgae in their factories in Japan and overseas, process the microalgae into finished products, and sell these products directly to consumers. On the other hand, some companies such as Mitsubishi Kakoki focus on developing microalgae bioreactors, while others function as importers of microalgae produced overseas, selling the microalgae as material to domestic companies or processing them into various finished products.

²⁰ Shigeyuki Kono, "Seven-Color Chlorella and Rare Carotenoids for Healthy Food" (translation of Japanese title), Future Center Initiative, The University of Tokyo, 2017, https://shingi.jst.go.jp/pdf/2017/2017_kisoken3_2.pdf

²¹ Tomomi Owari, "Research and Development of Raw Spirulina and Challenges of Tabérumo Business" (translation of Japanese title), *Journal of the Society for Biotechnology, Japan*, Vol. 95, No. 2., 2018, https://www.sbj.or.jp/wp-content/uploads/file/sbj/9502/9502_project_bio.pdf

Moreover, major players in the microalgae industry, such as Chitose Bio and Euglena Co., are collaborating with a range of other companies to foster deeper cooperation and create opportunities for joint development, thereby invigorating the industry as a whole.

The following are some of the significant players in the microalgae industry that have been active recently in developing microalgae-based proteins.

- **Euglena Co.** (<https://www.euglena.jp/>)

Euglena Co. first succeeded in the outdoor cultivation of euglena in 2005. The company's main products include packaged beverages, powders, supplements, and cosmetics, and it is now exploring opportunities in biofuel. The company has a production base in Okinawa, Japan, with a production capacity of 140 tons of chlorella and 160 tons of euglena per year. The company is also collaborating with many other companies in R&D and market development. For example, in collaboration with Itochu Corporation, Euglena Co. has been conducting pilot projects in Indonesia and Colombia as part of an overseas cultivation demonstration project on euglena for feed and biofuel, and completed the construction of a large-scale plant in Indonesia in 2022. The company is also one of the leading players in an initiative to make food for use in space travel called Space Foodsphere, a consortium of more than 40 companies. Euglena Co. is also supplying OEM products to around 50 companies, including Takeda Pharmaceutical Company Limited. The company has its corporate venture capital and is active in investing in start-ups both in Japan and overseas.²²



| Euglena Co.'s signature product, Karada ni Euglena ("Euglena for your body"), sold at supermarkets and other main retail stores. 149 yen (40 baht)/125 ml



| Euglena Co. and the plant-based meat start-up Next Meats teamed up to create Next Euglena Yakiniku EX

- **Chitose Bio** (<https://chitose-bio.com>) and **Taberumo** (<https://www.taberumo.jp/>)

The Chitose Group is a group of biotech companies operating mainly in Southeast Asia and Japan. Its mission is to contribute to global prosperity by utilizing technologies for culturing and growing living organisms (mainly microorganisms, algae, and animal cells).

²² Euglena Co. website, <https://www.euglena.jp>

Next Meat press release in February 2021, "'Next Euglena Yakiniku EX' jointly developed by Next Meats and Euglena Co., an alternative meat containing euglena with less environmental impact, will be available online from Meat Day (February 9)" (translation of Japanese press release title), <https://prtimes.jp/main/html/rd/p/000000013.000062184.html>

The company established Tabérumo in 2014 to develop cultivation technologies for its commercial production and new applications of Spirulina as well as marketing. Tabérumo raised 1.7 billion yen (500 million baht) from the major Japanese trading firm Mitsubishi Corporation and others to build a large spirulina plant in Brunei in 2019. The companies currently sell frozen spirulina under the brand name Tabérumo. Freezing the spirulina is said to preserve its rich nutritional benefits and offer an odorless fresh taste. The companies plan to enter the alternative meat market with spirulina-based products soon.

In addition to its subsidiary Tabérumo, Chitose Bio also leads an industry-wide initiative called MATSURI (MicroAlgae Towards Sustainable and Resilient Industry),²³ which is a joint venture project that aims to develop a “society based on algae.” The goal of this project is to create an algae-based industry, from supply to consumers. 43 companies and three local governments in Japan have joined the MATSURI project so far. Several projects under this initiative are aiming to create algae-based alternative protein products, such as algae-based cheese and protein bars. They also aim to collaborate with foreign companies, especially in countries that have a suitable environment for large-scale algae cultivation such as Malaysia and Saudi Arabia.



| The companies and local governments that are involved in Project MATSURI as of January 2023

²³ Matsuri means a festival celebrated by people with similar beliefs and values. MATSURI project website: <https://matsuri.chitose-bio.com/>

- **Algal Bio** (<https://algalbio.co.jp/>)

Algal Bio is a start-up from the University of Tokyo that develops and licenses functional ingredients that can be derived from algae. It has a library of more than 3,000 algae strains. Last December, the company announced a business alliance with Taiyo Nippon Sanso, a major industrial gas company. The companies intend to utilize carbon dioxide emitted from the gas combustion process to produce alternative proteins and other products.²⁴

- **Opbio** (<https://opbio.com/>)

Opbio is a biotech start-up launched in 2006 for marine exploration and collection of marine biological resources such as microalgae, bacteria, and microorganisms. The company is committed to implementing these resources in various fields such as food, cosmetics, pharmaceuticals, chemicals, and the environment. The company's "Biological Resource Library" contains more than 20,000 samples, including approximately 1,000 species of microalgae. R&D through alliances with major corporations is the primary focus, including protein research using microalgae. The company is also the Japanese distributor of Varicon Aqua Solutions, a UK-based leader in microalgae photobioreactors. In addition, the company has developed its own microalgae products and is selling supplements and food utilizing microalgae, including the first-in-the-world successful mass cultivation of the microalgae *pavlova*.²⁵

Supply Chain

Currently, microalgae-based products in Japan are mainly supplements (such as pills, capsules, tablets, powder, and liquids). Below is the typical supply chain of microalgae-based products.

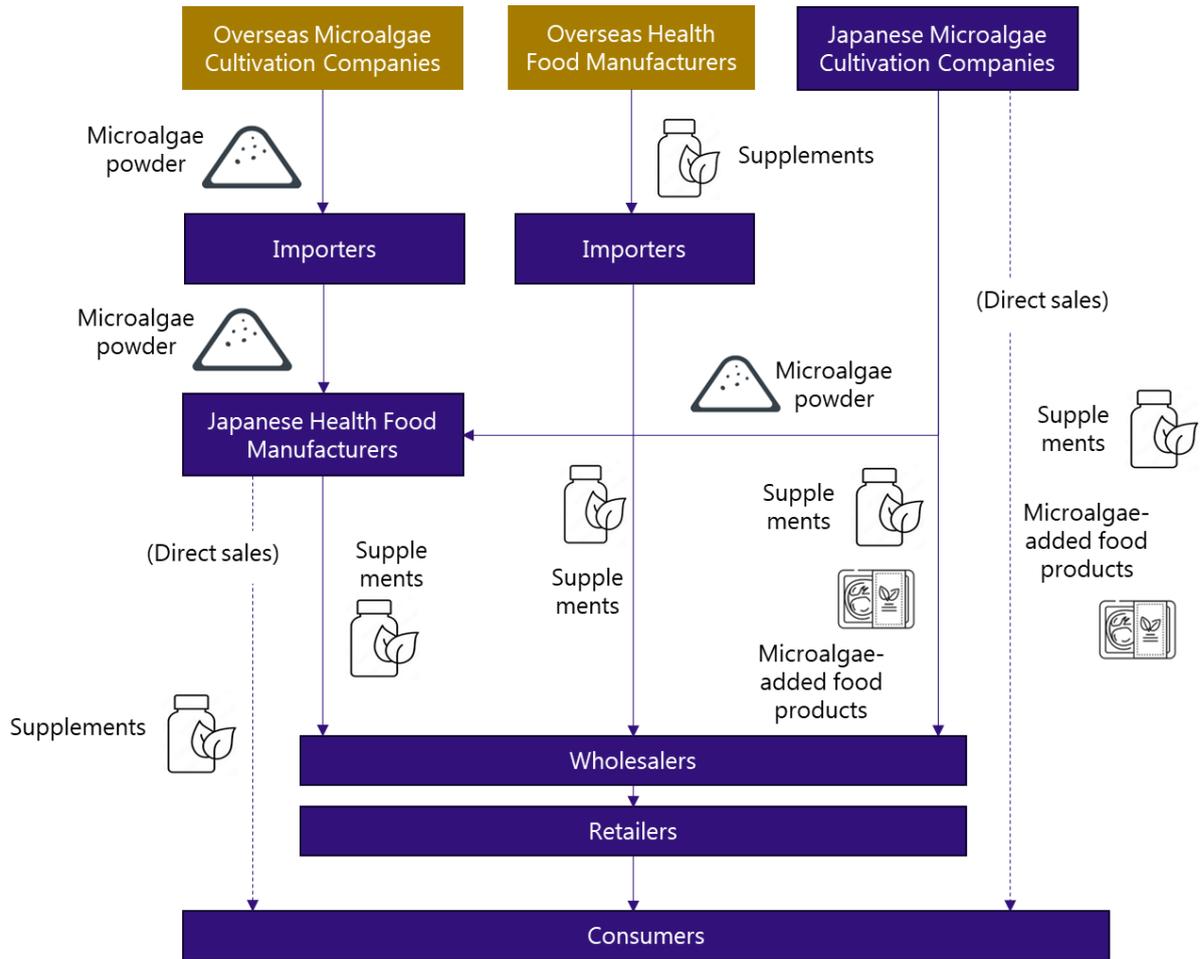
²⁴ Algal Bio website, <https://algalbio.co.jp>

News Release of the Gas Professionals, "Announcement of investment in and alliance with microalgae venture Algal Bio" (translation of Japanese title), 2022 December 28, <https://www.tn-sanso.co.jp/LinkClick.aspx?fileticket=bx5vaubh%2BJg%3D&tabid=206&mid=951>

²⁵ Opbio website, <https://opbio.com>

Health Business Online, "Contributing to the SDGs through the utilization of marine resources/Op-Bio Factory" (translation of Japanese title), 2023 April 19, <https://www.healthbusiness-online.com/3992/>

Supply Chain of Microalgae-Based Products in Japan



Source: Meros Consulting based on desktop research

① Importers

- Importers import microalgae powder as well as supplements from overseas. Japan imports microalgae powder from countries such as Taiwan, China, India, and the US.



| Example of microalgae powder

② Japanese Microalgae Cultivation Companies

- Apart from importers, major Japanese microalgae cultivation companies play an important role as importer, manufacturer and retailer. These companies are vertically integrated and are involved in every step of the supply chain from cultivation of microalgae to production of packaged products for retail and direct sales to consumers through their online stores.



| Example of a microalgae-based supplement product

- These companies cultivate microalgae in both Japan and overseas and process them into powder. They have long been producing supplements using the microalgae powder. Moreover, in recent years, some of them have started manufacturing other food products such as microalgae-based pasta and beverages.

③ Japanese Health Food Manufacturers

- Health food manufacturers purchase microalgae powder and produce supplements. The three largest health food manufacturers in Japan are DHC, Fancl, and Suntory Wellness.

④ Wholesalers and Retailers

- Wholesalers distribute microalgae-based products to retailers. In Japan, supplements are often sold through online stores, drug stores, and door-to-door sales. The majority of microalgae-based supplements available on the market are domestic products. However, some specialized health food stores offer imported products as well.
- In recent years, foreign online stores specialized in health foods such as iHerb have been gaining popularity in Japan. iHerb sells numerous foreign microalgae-based supplements, which are directly shipped to Japanese consumers from overseas.

4. The Alternative Protein Market in Thailand

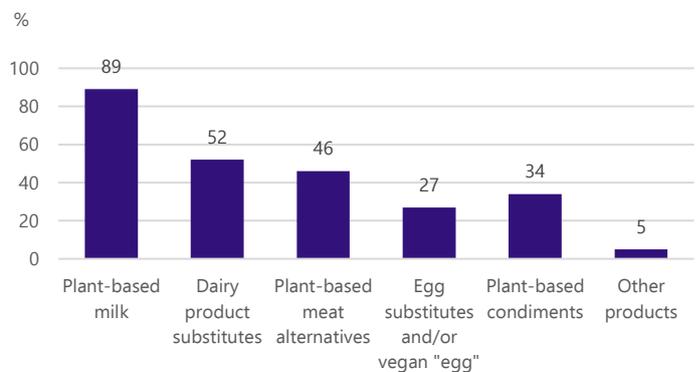
4.1. Overview

Thailand is one of the leading countries in the Asian alternative protein market, possessing a vibrant domestic market and strong export capacity. The country is home to some of the world's largest and most innovative agribusiness and food companies, such as Charoen Pokphand Foods PCL (CP Foods), Thai Union Group PCL (Thai Union), and Betagro PCL (Betagro), which are investing in research and development to create sustainable alternative protein products. Many Thai start-ups are also emerging in the industry.

According to a study published by KasiKorn Research Center in July 2022, the value of Thailand's alternative protein market was estimated to reach 4.1 billion baht by the end of 2022, with a growth rate of 5.1% compared to the previous year.²⁶ Had there been no high inflation and higher cost of living triggered by recent global political and economic disruptions, the market had been predicted to grow by 7%. The growth is supported not only by domestically produced products but also by various imported products which are popular among Thai consumers.

Currently, plant-based dairy represents the largest single category in the plant-based protein market. A consumer survey conducted by Rakuten Insights in 2021 showed that the most widely consumed alternative protein products in Thailand are plant-based milk products, accounting for 89% of the respondents. This was followed by dairy product substitutes such as soy yogurt and vegan cheese (52%) and plant-based meat alternatives (46%).²⁷ According to the USDA, sales of alternative dairy products in Thailand in 2020 were 22.9 million baht, while sales of plant-based meat products were 0.6 million baht.²⁸

Plant-Based Alternatives Thai Consumers Have Tried



Source: Rakuten Insight, "Plant-based food alternatives-Future or Present?", 2021

On the other hand, insect-based protein is emerging as a strong export item amid the increasing industrialization of Thailand's traditional insect-farming practices. The mycoprotein industry is still small with a limited number of players, but R&D is continuing to find more local microbes for mycoprotein production. The microalgae-based

²⁶ Asian Agribiz, "Slower growth for Thai alternative protein market," 2022 August 4, <https://www.asian-agribiz.com/2022/08/04/slower-growth-for-thai-alternative-protein-market/>

²⁷ Rakuten Insight, "Plant-based food alternatives-Future or Present?", 2021

²⁸ United States Department of Agriculture (USDA), "Plant-Based Food and Beverage Market in Thailand," 2021

protein industry is currently dominated by spirulina, which is mostly used for supplements. However, new demand for microalgae-based protein for the emerging alternative meat industry is likely to boost product development. Cultured meat is still in the R&D stage, mostly led by large food manufacturers who foresee future expansion in the global market.

The growth of the alternative protein market in Thailand is underpinned by the large “flexitarian” consumer group which is estimated to account for one quarter of the population,²⁹ as well as increasing health and environmentally conscious consumers. While the recent increase in food prices has slowed down the market expansion to some extent, the alternative protein industry is expected to grow further as Thai consumers seek healthier and greener alternatives and companies seek to capitalize on consumer demand.

Government and private support for R&D have also supported market growth. As a collaborative effort to support R&D and innovation in food tech, Thailand’s first global food-tech start-up incubator and accelerator program SPACE-F was founded in 2019 through a partnership between the National Innovation Agency, Thai Union Group, Mahidol University, Thai Beverage (ThaiBev), and Deloitte Thailand. The program has supported several alternative protein companies including More Foods Innotech Co., Ltd (production of plant-based meat “More Meat” from split gill mushrooms) and Advanced GreenFarm/AdGreen (farming of wolffia for high-quality proteins).

Thailand is a major exporter of alternative proteins. According to a study by the Ministry of Commerce, exports of plant-based food³⁰ have been expanding continuously and reached 81.3 million baht in 2021, making Thailand the 6th largest exporter in the world following the US, Singapore, Germany, the Netherlands, and China.³¹ The ability of Thailand to serve as an overseas production base for alternative protein companies, as well as the country’s strong OEM production capabilities, are also boosting exports. Exports have been particularly strong in plant-based dairy, accounting for almost half of the exports. Insect-based proteins underpinned by Thailand’s traditional insect-eating culture are also a major export category.

The current high cost of end products is viewed as a significant barrier to the industry’s growth. Additionally, Thai producers face the challenge of imported products being more popular among consumers, making it harder for local producers to expand domestically. As a result, many companies are looking to export. To overcome these challenges, the industry is focused on R&D and innovative technology to produce alternative proteins from locally-sourced materials at a lower cost. Effective marketing strategies are also being implemented to reach more consumers domestically and globally, with the goal of expanding Thailand’s alternative protein industry.

²⁹ Mekong Eye, “The rise of alternative meat in Thailand,” 2022 August 29, <https://www.mekongeye.com/2022/08/29/the-rise-of-alternative-meat-in-thailand>

³⁰ The Ministry of Commerce categorized plant-based foods into three groups: processed foods, beverages and protein concentrate (plant-based milk), and textured vegetable protein (plant-based meat and protein powder).

³¹ *Bangkok Post*, “Upbeat outlook for plant-based food exports,” 2022 November 17, <https://www.bangkokpost.com/business/2439775/upbeat-outlook-for-plant-based-food-exports>

4.2. Plant-Based Food

4.2.1. Plant-Based Meat

Although still in its early stage of development, the plant-based meat market is the most active sector within the Thai alternative protein market. The plant-based meat market has seen several new products released in the last few years by both major food manufacturers as well as start-ups, as the food industry accelerates its shift toward more sustainable food. Foreign start-ups are also entering the rapidly emerging market. Exports are still limited, but Thailand is likely to become one of the major suppliers of alternative meat products in Asia.

Major international food manufacturers have been one of the major forces leading the market development. CP Foods released its plant-based meat brand Meat Zero in 2021. The company aims to further develop its product line and to expand significantly into international markets.³² Meat Zero is priced at 35 to 69 baht per package, a level relatively close to the price of real meat.³³ CP All, a convenience store operator under the CP group, also released the ready-to-eat plant-based meal VG for Love in 2021 to be sold in its convenience store network. By utilizing its global distribution network and customer base, the company aims to become the top alternative meat brand in Asia and one of the top three brands in the world.³⁴

Thai Union, another leading food manufacturer, launched its plant-based meat brand OMG meat in the Thai market in 2021. As a major seafood manufacturer, the company also offers various plant-based seafood products including dim sum, crab meat, and fish nuggets.³⁵ In 2021, the company announced a collaboration with the plant-based meat company V Foods (Thailand) Co., Ltd, which produces corn-based products.³⁶

The major agribusiness company Betagro also announced its launch of premium plant-based ready-to-eat meals under the brand Meatly! in 2022. The company aims to expand its consumer base to include flexitarians and health-conscious consumers.³⁷

Strong OEM capacity is one of the key strengths of Thailand's plant-based meat industry. For example, NR Instant Produce (NRF) PCL, a leading food manufacturer and distributor, has been active in the OEM production of plant-

³² Ibid.

³³ *Nikkei*, "Thai food giants such as CP are launching 'plant meat' with lower price and better texture" (translation of Japanese title), 2021 June 21, <https://www.nikkei.com/article/DGXZQOGS139WT0T10C21A5000000/>

³⁴ CPF News Release, "CPF launches 'Meat Zero'" (translation of Thai title), 2021 August 18, <https://www.cpfworldwide.com/th/media-center/corporate-MEAT-ZERO-kick-off>

³⁵ Thai Union News Release, "Thai Union launches plant-based protein OMG Meat to Thai market," 2021 May 19, <https://www.thaiunion.com/en/newsroom/press-release/1313/thai-union-launches-plant-based-protein-omg-meat-to-thai-market>

³⁶ Bangkok Business News, "Thai Union' joins hands with 'V Foods' to expand plant-based alternative food business" (translation of Thai title), 2021 June 29, <https://www.bangkokbiznews.com/news/detail/945902>

³⁷ Betagro News Release, "Betagro launches 'Meatly!' premium plant-based ready-to-eat series Kick off with spicy, delicious, healthy Thai fares Advocate new generation to create sustainable food culture," 2023 March 28, <https://www.betagro.com/en/updates/news-release/180/betagro-launches-meatly-premium-plant-based-ready-to-eat-series-kick-off-with-spicy-delicious-healthy-thai-fares-advocate-new-generation-to-create-sustainable-food-culture>

based meat, manufacturing various plant-based meat products for foreign brands. Thai Union also offers OEM manufacturing services for alternative seafood products.³⁸

Some companies are entering the market from other industries. The state energy company PTT announced in 2021 that it will enter the plant-based protein food business as part of its carbon-neutral strategy, and has partnered with NR Instant Produce PCL. The two companies have formed a joint venture with UK-based Plant and Bean to develop alternative protein products to be sold in Thailand as well as other Asia-Pacific countries.³⁹

Specialized food manufacturers and start-ups have also been very active. Let's Plant Meat, a subsidiary of Nithi Food (a spice manufacturer), launched its plant-based burger products in 2020, offering more affordable alternatives to plant-based meat products imported from the US. The company targets Asian markets as export destinations, including Singapore and Japan. Meat Avatar, a start-up founded in 2018, produces a range of plant-based alternatives including crispy pork and fried egg made from soybeans and peas. The plant-based food company Mantra offers various plant-based seafood alternatives tailored to Thai cuisine. More Foods Innotech, a company founded in 2019, manufactures plant-based meat mince made from split gill mushrooms. There are also many other start-ups and plant-based meat companies such as V Foods (Thailand) Co., Ltd, Never Meat, MJ Plant-Based Food, and First Pride.

Foreign start-ups have also entered the market, aiming to take a share as it grows. In 2020, Malaysia's Phuture Foods began online sales of minced plant meat made from rice, chickpeas, and shiitake mushrooms in Thailand. The following year, Green Monday from Hong Kong launched Omni Meat, a soy and wheat-based alternative meat product, at supermarkets affiliated with Central Group, the largest retailer in Thailand. Both brands are manufactured in Thailand.

Diversification of ingredients used to produce alternative protein products is one of the challenges the industry faces. Currently, about 60% of the alternative meat products produced in Thailand use soybeans as their main ingredient.⁴⁰ The remaining 40% are mainly made with other peas, grains, mushrooms, mycoprotein, jackfruit, etc. Soybean supply in Thailand is highly dependent on imports, and rising international prices have been identified as a major risk for plant-based protein manufacturers. As such, the industry is on a constant lookout to find new ingredients to substitute for soybeans. Split gill mushrooms grown in southern Thailand are attracting attention as a new plant-based protein source, as they can be sourced domestically. In addition to finding alternative ingredients, many companies are focusing their R&D efforts on innovative ways to flavor plant-based meat products as well as on techniques to increase the protein content of their products.

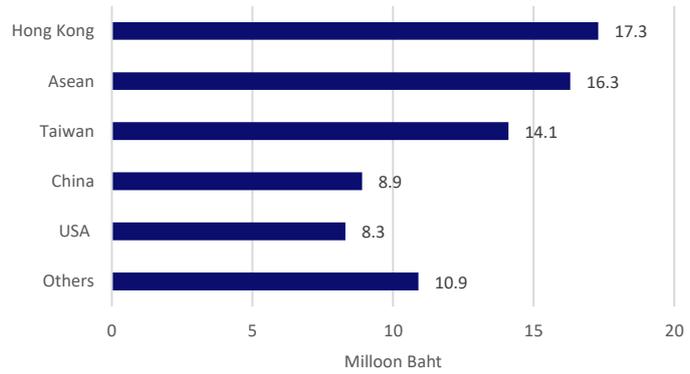
³⁸ Nikkei Asia, "Impossible Tuna: Thai Union dives into plant-based seafood," 2022 January 30, <https://asia.nikkei.com/Business/Food-Beverage/Impossible-Tuna-Thai-Union-dives-into-plant-based-seafood>

³⁹ Bangkok Post, "New venture looks to meat alternatives," 2021 December 23, <https://www.bangkokpost.com/business/2236387/new-venture-looks-to-meat-alternatives>

⁴⁰ Industry interview by Meros Consulting

Exports of plant-based meat products are still relatively limited as the industry is in an early stage of development. The Thai Food Processors Association reported the export value of Thailand’s plant-based protein products to be 76 million baht in 2021.⁴¹ The largest export destination was Hong Kong, followed by ASEAN countries, Taiwan, China, and the US.

Export Values of Thailand’s Plant-Based Protein



Source: Thai Food Processors Association

Leading plant-based meat manufacturers are actively expanding their export capacity. CP Foods’ Meat Zero brand has been introduced in

Singapore and Hong Kong, with plans to expand to other Asian markets, Europe, and North America. The company aims to become one of the top three alternative meat brands around the world by 2026.⁴² Thai Union is also seeking to expand its alternative seafood products overseas by leveraging its existing distribution channels, as 70% of its sales already come from overseas markets. The company has already shipped alternative tuna to Europe, and will soon sell the product in the US using its OEM capacity.⁴³ While exports to Japan remain limited, Nithi Foods has successfully exported its plant-based meat product (Let’s Plant Meat) to Japan through Japan Food Science.

Over the next five years, the alternative meat market is projected to experience a compound annual growth rate of 6-20%, surpassing the growth rate of the conventional meat market.⁴⁴ The industry in Thailand has significant potential for increasing exports, provided that it can offer price-competitive products and leverage its experience and network as one of the world’s leading food manufacturing countries to establish an export market.

⁴¹ Bangkok Post, “Upbeat outlook”

⁴² CPF News Release, “CP Foods launches ‘Meat Zero’ overseas for the first time, starting in Singapore and Hong Kong,” 2021 November 19, <https://www.cpfworldwide.com/en/media-center/corporate-overseas-for-the-first-time>

⁴³ Nikkei Asia, “Impossible Tuna”

⁴⁴ Food Navigator Asia, “Year Meat Zero: CP Foods new alt protein focus driven by category growth and health consciousness,” 2022 June 20, <https://www.foodnavigator-asia.com/Article/2022/07/20/CP-Foods-new-alt-protein-focus-driven-by-category-growth-and-health-consciousness>

Major Players in the Plant-Based Meat Market

Major Food Manufacturers/Agribusiness Companies



Start-ups



Foreign Brands



Source: Meros Consulting

4.2.2. Plant-Based Dairy

Thailand boasts a thriving plant-based milk industry, with both a large domestic market and a significant global presence as one of the leading exporters of plant-based dairy products. Soy milk, a staple of the traditional Thai diet, is represented by well-established brands such as Lactasoy (by Lactasoy Co., Ltd.) and Vitamilk (by Green Spot Co., Ltd.), which have been in the market for over 30 years. Alongside these popular soy milk products, a range of plant-based milk alternatives such as oat milk and almond milk, as well as dairy substitutes including soy yogurt and vegan cheese, have gained traction among the health-conscious consumer base. The market is supplied by both domestic companies and various imported products, resulting in a diverse selection of alternative products available to consumers.

Soy milk remains the dominant category in Thailand's plant-based beverage sector. Besides Lactasoy and Vitamilk, major soy milk brands are produced by both dairy and soy milk companies, including DNA by Dutch Mill Co., Ltd, HomeSoy by Lam Soon (Thailand) Co., Ltd, and Tofusan by Tofusan Co., Ltd.

Coconut milk is also a significant category in Thailand's plant-based beverage sector, particularly in terms of exports. Thai Coco Coconut Beverage, produced by Thai Coconut Public Company Ltd, is a major brand of finished coconut milk drink products. Additionally, First Canned Food (Thai) Co., Ltd provides OEM production of canned coconut milk drinks.

The development and supply of other types of plant-based dairy, such as almond milk and oat milk, have been primarily led by specialized manufacturers and start-ups in Thailand. Heritage Snacks and Foods Co., Ltd, a Thai-based international food manufacturer, produces almond milk under the brand name Blue Diamond Almond Breeze, and is also licensed to sell Sunkist's nuts and pistachio milk products. Chabaa Bangkok Co., Ltd, a major fruit juice

manufacturer, released its oat milk product Goodmate, which is made from whole grain oats, in 2021. Sesamilk Foods Co., Ltd, a start-up company and one of the cohorts of the first batch of the SPACE-F accelerator program, released Sesamilk made from sesame in 2019. The sesame seeds are sourced from Thai contract farmers, and the product has won numerous awards both domestically and globally. Simple Foods Co., Ltd, founded in 2015, is another start-up famous for its almond milk product 137 Degrees. All three products (Goodmate, Sesamilk, and 137 Degrees) have been exported to Japan.

Both major dairy companies and start-ups have been active in the area of dairy product substitute. KCG Corporation PCL, the largest dairy producer in Thailand, has released a vegan cheese product under its major cheese brand Imperial. Swees Plant-Based Cheese, a dairy cheese start-up founded in 2018, has developed a variety of vegan cheese products made from organic soybeans and cashew nuts. The company recently announced that it will develop Thailand’s first vegan cheese factory, which is expected to be fully operational by 2023, and aims to export to other Asian countries.⁴⁵

Thailand’s plant-based dairy industry leads the country’s alternative protein exports and is the world’s second-largest exporter of plant-based milk, with exports worth 52.5 billion baht.⁴⁶ In particular, coconut milk drinks have been a popular export product in recent years. Thailand’s plant-based milk products are primarily exported to neighboring ASEAN countries and China. With a robust global presence and a growing number of players in the market, Thailand’s plant-based dairy industry is expected to maintain its leadership in the plant-based protein export sector.

Major Players in the Plant-Based Dairy Market



Source: Meros Consulting

⁴⁵ Green Queen, "Thailand Just Got Its First Vegan Cheese Factory," 2022 October 20, <https://www.greenqueen.com.hk/thailand-vegan-cheese-factory/>

⁴⁶ Bangkok Post, "Upbeat outlook"

4.3. Insect-Based Food

Thailand is quickly becoming a major player in the global insect protein market, capitalizing on its rich tradition of entomophagy and long-standing farming system. Eating insects has been part of Thai cuisine for a long time, making insect-based protein a relatively mature industry in the country. The most commonly farmed insect is the cricket, with over 20,000 traditional cricket farms located in the northeastern region. With the growing emphasis on environmentally-friendly and sustainable protein sources, Thailand's insect protein industry has gained significant attention as one of the major suppliers in the global market. Several companies are now producing and marketing a range of edible insect-based food products, including cricket powder, cricket-based pasta, and energy bars, and exporting these products to various overseas markets.

The industrialization of insect farming and processing is currently underway, with numerous industrialized cricket farms and start-ups emerging to meet growing demand and international standards. Companies are focused on modernizing traditional cricket farming methods to mass-produce high-quality insect powder and other insect-based products. In 2022, Thai Ento Food Co., Ltd, a start-up company that is Thailand's top producer of cricket powder, received an investment from Thai Sugar Terminal PCL (TSTE) to establish a production facility capable of producing up to 1,200 tons of cricket protein powder per year. This will make Thai Ento Food Co., Ltd Thailand's first industrial producer of cricket protein powder.⁴⁷ The company sells its products under the SixTein brand and aims to make 70% of its sales from export markets. Other companies and brands for insect-based products targeting the export market include Bugsolutely Ltd, Chutikarn Cricket Farm Part., Ltd., Global Bugs Asia, JR Unique Foods Ltd, Protanica Co., Ltd, and Starbugs Insect Food Product Co., Ltd.

These companies are aiming to make exports a significant source of income and have obtained various internationally recognized certifications, such as Good Agricultural Practices (GAP), Good Manufacturing Process (GMP), and HACCP. In addition, they are investing resources into developing and producing competitive products that can hold their own in the global marketplace, with higher protein content and superior flavor profiles.

OEM production is a significant aspect of Thailand's insect food manufacturers. Some companies not only produce their brands but also offer OEM services to international manufacturers and retailers. Thailand's relatively lower production costs compared to other regions with insect-producing start-ups, such as North America and Europe, provide an advantage for international players seeking to produce their brands at a competitive price. Additionally, Thailand's tropical environment provides ideal conditions for rearing insects.

While crickets are still the major insect processed into insect-based protein products, some companies are exploring new protein sources such as the black soldier fly. In 2021, CP Foods signed an MOU with Chiang Mai University to develop the first smart farm for black soldier flies in Thailand.⁴⁸ Black soldier flies are considered to be a sustainable protein and fat source.

⁴⁷ The Nation Thailand, "TSTE, Thai Ento Food to promote Thailand as global production hub of cricket protein powder," 2022 August 11, <https://www.nationthailand.com/business/corporate/40018781>

⁴⁸ All About Feed, "CP Foods and Thai univ partner to develop insect proteins," 2021 March 22, <https://www.allaboutfeed.net/all->

Exports of insect-based products are mainly driven by cricket powder and dried insect products. According to the International Trade Centre, in 2022, Thailand exported 33 tons of edible insects, mainly to the US, Japan, and Korea.⁴⁹ Japan accounted for 24% (eight tons) of this category. Other major export products include prepared/preserved insect products such as cricket-based and grasshopper-based products, and 5.3 tons of these products were exported to the US, Japan, and elsewhere in 2022.

Thailand's insect protein industry, with its well-established production and processing technologies, is poised for further growth as the global demand for alternative proteins continues to rise. The country's favorable climate for insect rearing, ongoing industrialization of production, and improvements in processing technology are expected to drive growth as an exporter of insect-based products.

Major Players in the Insect Protein Market



Source: Meros Consulting

4.4. Cultured Meat

While cultured meat is still in the early stages of R&D in Thailand, two major food companies have recently made moves to enter this field. In 2021, Thai Union announced that it will invest in Israel-based Aleph Farm through its Corporate Venture Capital (CVC) Fund.⁵⁰ Aleph Farm is one of the leading cultured meat companies growing meat from cells taken from cows. In 2022 the following year, CP Foods announced a partnership with Future Meat Technologies, another Israeli cultured meat company, to develop cultured meat products for the Asian market. Future Meat has developed a technology to produce cultured meat from animal stem cells without the use of animal

[about/new-proteins/cp-foods-and-thai-univ-partner-to-develop-insect-protein](#)

⁴⁹ HS code 041010 (Insects, fit for human consumption)

⁵⁰ Thai Union News Release, "Thai Union invests in cell-cultivated meat producer Aleph Farms," 2021 July 7,

<https://www.thaiunion.com/en/newsroom/press-release/1375/thai-union-invests-in-cell-cultivated-meat-producer-aleph-farms>

serum or genetic modification.⁵¹ By leveraging CP Foods' knowledge of the Asian market and distribution network in the region, the two companies aim to develop cultured meat products specifically for the Asian market.⁵²

R&D in the field of cultured meat is also being carried out at universities and research institutes. In 2021, it was reported that the Veterinary Stem Cell and Bioengineering Innovation Center at Chulalongkorn University successfully developed cultured pork, with plans to make the product available for sale by 2023 or 2024.⁵³

At present, Thailand's domestic market is not seen as a significant market opportunity for cultured meat. This is due in part to Thailand's status as one of the major producers of chicken and pork, as well as the fact that the idea of cultured meat is not yet widely accepted by consumers. However, Thailand-based global food companies like CP Foods and Thai Union are expected to establish their presence in the Asian cultured meat markets by investing in innovation and technology.

4.5. Mycoprotein-Based Food

Although mycoprotein is still in the early stages of development in Thailand, there has been recent commercialization of one product. In 2022, Vudhichai Produce Co. Ltd. launched the country's first mycoprotein burgers through its brand Absolute Plant, in collaboration with Lin Innovation (a subsidiary of Thai Roong Ruang Sugar Group) and the National Science and Technology Development Agency (NSTDA). The mycoprotein is produced domestically using edible microorganisms found in Thailand, with utilization of technology originally developed in 2021 by the National Centre for Genetic Engineering and Biotechnology (BIOTEC) in partnership with Lin Innovation. The company has found a way to utilize its sugar by feeding it to microorganisms to produce mycoprotein. Although still in the early stages, R&D could lead to an increase in the availability of such products over the medium to long term.

4.6. Microalgae-Based Food

Spirulina is the main algae-based protein produced in Thailand. It is mostly sold as a dietary supplement both domestically and for export. However, there is growing interest in using algae-based protein as an ingredient in alternative meat products. While Thailand's climate is suitable for algae growth, the development of the algae-based protein industry has been slow due to the significant investment required to establish algae production facilities. Nevertheless, the increasing demand for alternative protein sources and the potential benefits of algae-based protein may lead to further growth in this sector in the future.

⁵¹ Verdict Media Limited, "Future Meat Technologies' Cultured Meat Production Facility, Rehovot, Israel," <https://www.foodprocessing-technology.com/projects/future-meat-technologies-cultured-meat-production-facility-israel>

⁵² CPF News Release, "CPF joins hands with Future Meat Technologies to develop cell cultured meat products that penetrate the Asian market" (translation of Thai title), 2022 March 24, <https://www.wearecp.com/cpfxfuture-meat-20220325/>

⁵³ Newsbeez, "Researcher, Chulalongkorn University Tissue Culture Pork Production Ready for Sale in Next 2 Years," 2021 December 17, <https://newsbeez.com/thailandeng/researcher-chulalongkorn-university-tissue-culture-pork-production-ready-for-sale-in-next-2-years>

While large food manufacturers have not had a strong presence in the industry, it was announced in 2023 that the Thai Union invested in French algae tech company Algama through its Corporate Venture Capital Fund. Thai Union aims to help accelerate Algama's industrial algae production for the food and beverage industries. This shows a growing interest among Thai food companies in exploring new alternative protein sources and investing in innovative technologies to support their development.

Currently, spirulina is the main focus of commercial algae production in Thailand. One major player in the industry is EnerGaia Co., Ltd, which was founded in 2010 and produces spirulina products under the Spring Spirulina brand in Thailand, Indonesia, India, and other countries. In 2019, the company received a 126 million baht investment in Series A funding to expand spirulina production both in Thailand and internationally, as well as to increase its export capacity.⁵⁴ Other commercial spirulina farms in Thailand include Boonsorn Spirulina Farm in Chiang Mai, which produces spirulina and exports it to Japan for sale as a supplement.

In addition to spirulina, Wolffia, a traditional Thai vegetable which is known as the world's smallest flowering plant, has recently been gaining attention as a nutrient-rich alternative protein source. A start-up called Advanced GreenFarm/AdGreen, which was established in 2019 and supported by the accelerator program SPACE-F, has commercialized some protein products based on wolffia, including fresh and frozen wolffia as well as wolffia powder. The company has also invested in large-scale cultivation facilities for wolffia.

With the increasing interest in plant-based and alternative protein sources, there is potential for the algae industry to grow in Thailand. Investment in R&D, as well as production infrastructure, could help to accelerate the growth of the industry.

⁵⁴ *Bangkok Post*, "Green movement: EnerGaia bets on spirulina," 2019 February 4, <https://www.bangkokpost.com/business/1623214/green-movement-energaia-bets-on-spirulina>
Nutraceutical Business Review, "EnerGaia raises \$3.6 m for expanding Spirulina production in Thailand," 2019 September 2, https://www.nutraceuticalbusinessreview.com/news/article_page/EnerGaia_raises_36m_for_expanding_Spirulina_production_in_Thailand/157697

5. Market Potential of Thai Alternative Proteins in Japan (TOWS Analysis)

5.1. Overview

Based on the current market situations in Japan and Thailand, Thai companies have the **highest** potential in the Japanese **plant-based food market**. This is mainly due to the Thai market's substantial size, significant growth potential, and dynamic nature in which numerous players are actively engaged in developing and exporting new plant-based products. While the plant-based food market is relatively competitive, with many Japanese food manufacturers already offering various products, there are opportunities for Thailand if interesting value-added products for consumers can be offered.

The insect-based food and microalgae-based food markets offer **moderate potential** for Thai companies. The markets are smaller compared to plant-based food, especially for insect-based products. The number of players is still limited for insect-based foods, which offers various opportunities for Thai companies both in terms of being ingredient suppliers (for insect-based powders) and in terms of final products such as dried insects. The microalgae industry in Japan has well-established players especially in the supplement sector, but there is some room for new product development for the food sector that capitalizes on the renewed attention paid to algae-based protein and its nutritional benefits.

The cultured meat and mycoprotein-based food markets are still in a very early stage of development both in Japan and Thailand. Consequently, the primary opportunities for Thai companies in these markets are more long-term in nature and mainly revolve around collaborative R&D activities.

Summary of the Market Potential of Each Alternative Protein Category

	Alternative Protein Category	Market Potential (Total Points)	Japan Market			Thai Industry	
			Market Size	Growth	Competition	No. of Players	Export Track Record
	Plant-Based Food	Higher (13)	Large (3)	High (3)	High (1)	Large (3)	Strong (3)
	Insect-Based Food	Moderate (10)	Small (1)	Medium (2)	Medium (2)	Medium (2)	Strong (3)
	Microalgae-Based Food	Moderate (10)	Medium (2)	Medium (2)	High (1)	Medium (2)	Strong (3)
	Cultured Meat	Longer-term	NA	NA	NA	Small	NA
	Mycoprotein-Based Food	Longer-term	NA	NA	NA	Small	NA

Note: Points are based on how favorable the conditions are for the Thai industry to export to Japan or seek market expansion there. The more points, the more favorable the conditions.

Below, we will discuss in detail the strengths, weaknesses, opportunities, and threats of the Thai industry in each

alternative protein category as related to the Japan market.

5.2. Plant-Based Food

The plant-based food market in Japan presents one of the most promising opportunities for entry by Thai companies. This is due to the market's large size, significant growth, and dynamic nature, where numerous players are actively involved in developing new products. It should be noted that the competition in this segment is relatively high, as many major Japanese food manufacturers have already entered the market. Consequently, introducing new products successfully into the market may pose some challenges. Despite this, the market is still in its early stages of development, and many Japanese companies are still struggling to enhance flavors and promote products to mainstream consumers. Additionally, the availability of non-soy-based products tends to be limited, resulting in narrower product ranges. Therefore, there are favorable opportunities for Thai players to enter the Japanese market with distinctive offerings, such as non-soy-based or flavored products. Expansion by Thai products will also be bolstered by the growing number of tourists in Japan and their varied needs for foods, as well as the popularity of Thai cuisine.

Given Thailand's capacity for OEM production and its proven track record of providing OEM services to other plant-based companies, there is also an opportunity for Thai companies to collaborate with Japanese companies in this aspect.

Provided in the next page is the TOWS analysis for Thai plant-based meat players and their products.

TOWS Analysis of the Thai Plant-Based Meat Industry’s Potential for Japan Market Entry

		Strengths and Weaknesses of the Thai Industry	
		Strengths	Weaknesses
Threats and Opportunities in the Japan Market	Opportunities	<ul style="list-style-type: none"> - Strong growth of the industry. - Both major international food manufacturers and start-ups actively develop new products. - Development of products using distinctive raw materials such as split-gill mushrooms. - Has OEM capacity. 	<ul style="list-style-type: none"> - Still at an early stage of development, with relatively low sales. - High dependence on imported soybeans for manufacturing plant-based meat.
	Threats	<ul style="list-style-type: none"> - Develop and offer various value-added products differentiated from existing products (e.g., products with new/better flavor, products catered to various needs of tourists). - Utilize existing food distribution channels and brands of major international food manufacturers to export products to Japan. - Provide OEM services to Japanese plant-based meat companies. 	<ul style="list-style-type: none"> - Offer products using non-soy-based materials or materials originating from Thailand.

Similar to plant-based meat, the plant-based milk category also holds significant potential for Thai players to establish a presence, as demonstrated by some Thai plant-based milk companies. While Japan has a well-established soy milk market with dominant domestic players, there are other categories within plant-based dairy products that show promise, particularly those based on ingredients such as oats.

While foreign brands have already entered the Japanese market with these alternative dairy products, there is still an opportunity for Thai companies to increase their presence by developing products with distinctive characteristics. For example, Thai companies can differentiate themselves by incorporating new and unique ingredients or by

focusing on high health functionality. By offering innovative plant-based dairy products that stand out in terms of taste, nutritional value, or health benefits, Thai players can carve out a niche within the booming Japanese alternative dairy industry.

Additionally, Thai companies have the potential to establish joint venture partnerships with Japanese companies to expand into the Asian market, as exemplified by the collaboration between Megmilk Snow Brand, a Japanese dairy company, and Agropcorp International, a Singapore-based company, which formed a joint venture to develop alternative dairy products.⁵⁵

Provided below is the TOWS analysis for Thai plant-based dairy players and their products.

TOWS Analysis of the Thai Plant-Based Dairy Industry’s Potential for Japan Market Entry

		Strengths and Weaknesses of the Thai Industry	
		Strengths	Weaknesses
Threats and Opportunities in the Japan Market	Opportunities	<ul style="list-style-type: none"> - A significant global presence as one of the leading exporters of plant-based dairy products. - Various non-soy-based products including almond milk, pistachio milk, sesame-based milk, etc. 	<ul style="list-style-type: none"> - Market centered on soy milk, which competes directly with the Japanese market. - High dependence on imported soybeans for manufacturing plant-based dairy.
	Threats	<ul style="list-style-type: none"> - Develop and offer value-added products differentiated from existing products with distinctive characteristics such as health functionality. 	<ul style="list-style-type: none"> - Offer products using non-soy-based materials or materials originating from Thailand.
		<ul style="list-style-type: none"> - Strong growth and high growth forecast of the industry/growing demand for plant-based products. - Push for more protein intake. 	<ul style="list-style-type: none"> - Target niche markets where Japanese players or foreign brands have not entered, especially in the non-soy-milk category. - Promote plant-based milk products as a source of healthy protein.
		<ul style="list-style-type: none"> - Significant presence of Japanese players, especially in soy milk. - Foreign players already in the market. - Decrease in protein consumption. - General food inflation/stagnation of the market. 	<ul style="list-style-type: none"> - Promote Thai brands against domestic products. - Develop and offer low-priced products.

Here is a summary of the plant-based food products that show the greatest potential for Thai companies.

⁵⁵ Nikkei, "Snow Brand Mega Milk and Agropcorp establish joint venture company in Singapore to manufacture and sell ingredients for plant-based food processing" (translation of Japanese title), 2023 May 15, https://www.nikkei.com/article/DGXZRSP654997_V10C23A5000000/

High-Potential Plant-Based Food Items



Non-Soy Plant-Based Meat Products Using Unique Ingredients: Thai companies have an opportunity to stand out in the Japanese market by introducing plant-based food options that use unique ingredients. With the current market focus primarily on soy-based products, offering alternatives such as non-soy-based proteins could attract a consumer base seeking diversity and unique choices. By utilizing ingredients that are not commonly used, such as jackfruit, manufacturers could offer plant-based meat products that stand out among the competition in Japan. This could attract consumers who are looking for new and distinctive plant-based options.



Flavored Plant-Based Meat Products: Developing and offering plant-based food products with distinctive flavors can be a key strategy for Thai companies. By incorporating Thai culinary expertise and incorporating unique taste profiles, they can offer consumers refreshing and exciting alternatives to existing options in the market, both in the retail and food service sectors.



Non-Soy Plant-Based Dairy Products with Distinctive Characteristics: Thai companies can distinguish themselves by incorporating novel and unique ingredients or by emphasizing high health functionality in their plant-based dairy products.

5.3. Insect-Based Food

The Japanese insect-based food market presents moderate potential for Thai companies. Thailand is among the leading global suppliers of insect-based food, which positions it well in catering to the Japanese market's demand for alternative protein sources. However, the Japanese insect-based food market is still small compared to the plant-based food market, and its future growth potential remains uncertain.

Cricket powder-based products dominate the Japanese market, and most of these products are made from imported cricket powder. Thailand is one of the major suppliers of cricket powder to Japan and has a substantial presence in this market. Nonetheless, increasing competition among countries exporting cricket powder to Japan calls for efforts from Thailand to differentiate its cricket powder from the products offered by these countries.

On the other hand, Thailand has an advantage in providing a wide array of dried insect products, which are increasingly available in the Japanese market. Thailand's capability to supply numerous types of dried insect products could position Thai companies favorably in this area.

Additionally, Thailand's capacity for OEM production of insect-based products opens up possibilities for manufacturing on behalf of Japanese companies upon request. Collaborating with Thai companies could also be a viable option for Japanese entities involved in cricket farming R&D, which might help further their research efforts.

Provided in the next page is the TOWS analysis for Thai insect-based food players and their products.

TOWS Analysis of the Thai Insect-Based Food Industry’s Potential for Japan Market Entry

		Strengths and Weaknesses of the Thai Industry	
		Strengths	Weaknesses
		<ul style="list-style-type: none"> - Has long history of insect-based food production, and production knowledge has been accumulated. - Significant cricket powder supply capacity. - Capable of supplying products based on numerous types of insects. - Industrialization of insect farming and processing is underway. High level of management and efficiency for industrialized production. - More players have obtained various internationally-recognized certifications, such as GAP, GMP, and HACCP. - Thailand’s tropical environment provides ideal conditions for rearing insects. - Has OEM capacity. 	<ul style="list-style-type: none"> - The number of modernized factories capable of producing products in large-scale or at export-quality levels is limited.
Threats and Opportunities in the Japan Market	Opportunities	<ul style="list-style-type: none"> - Market size has been expanding. - Push for more protein intake. - The number of cricket powder-based products is increasing and Thai cricket powder is often used. - Certain restaurants and YouTubers have started to use dry insect products to attract customers/viewers. - Ongoing R&D for breeding crickets. 	<ul style="list-style-type: none"> - Promote cricket powder to Japanese insect-based companies and trading companies. - Promote dried insect products to Japanese insect-based companies. - Provide OEM services to Japanese companies that are interested in developing insect-based products. - Seek R&D collaborations with Japanese cricket breeders.
	Threats	<ul style="list-style-type: none"> - Lack of scientific evidence on the health benefits of insect-based foods, which may hinder market growth. - Unstable quality of imported products in terms of taste and preservation. - Increased competition from other suppliers of insect-based food products. - Uncertainty in the market’s future growth trajectory. 	<ul style="list-style-type: none"> - Invest in industrialization of insect farming.
		<ul style="list-style-type: none"> - Promote the positive aspects (e.g., high protein) of insect-based products. - Brand Thailand’s cricket powder to set it apart from products of other countries. - Develop and offer various value-added products differentiated from existing products (e.g., products with new/better flavor). 	<ul style="list-style-type: none"> - Improve the quality of cricket powder by changing cricket breeding methods, such as the type of feed utilized. - Lower the price of cricket powder by improving efficiency of cricket breeding. - R&D to prove the functionality of insect-based foods.

Here is a summary of the insect-based products that show the greatest potential for Thai companies.

High-Potential Insect-Based Food Items



Cricket Powder: The Japanese market is currently dominated by cricket powder-based products, and the majority of companies opt for imported cricket powder due to its competitive pricing. Given Thailand's position as one of the largest suppliers of cricket powder to Japan and its significant capacity for supplying cricket powder, Thai cricket powder holds great potential in the Japanese market.



Dried Insect Products: There has been a noticeable increase in the availability of dried insect products in the Japanese market. Unlike food products that use cricket powder, dried insect products have a visually impactful appeal. This unique characteristic has caught the attention of certain restaurants and YouTubers in Japan, who are keen to incorporate them into their offerings to attract customers and viewers. Since Thailand has the capacity to export numerous types of dried insect products that most countries cannot offer, Thai dried insect products are perceived to have high potential in the Japanese market.

5.4. Cultured Meat

Currently, both Japan and Thailand are actively engaged in various R&D efforts concerning cultured meat. This creates opportunities for Thai companies to collaborate and participate in joint research activities with Japanese start-ups and other players. One of the high priority areas in this emerging sector is investment and R&D efforts to overcome the main challenge of high production costs. For example, the Japanese cultured meat start-up IntegriCulture collaborates with Singapore-based start-up Shiok Meats to reduce production costs. Thai companies can also pursue collaborative research opportunities in this sector.

Considering the current market situations in both countries, including the lack of a regulatory framework and consumer acceptance for cultured meat products, there are valuable opportunities for collaboration between Japan and Thailand. Specifically, the two sides can work together in the areas of regulatory development and raising consumer awareness regarding cultured meat.

TOWS Analysis of the Thai Cultured Meat Industry's Potential for Japan Market Entry

		Strengths and Weaknesses of the Thai Industry	
		Strengths	Weaknesses
Threats and Opportunities in the Japan Market	Opportunities	<ul style="list-style-type: none"> - Major Thai food companies have invested in developing cultured meat products. - Cultured meat R&D is being carried out at Thai universities and research institutes. 	<ul style="list-style-type: none"> - Still at a very early stage of R&D. - Low acceptance from consumers.
		<ul style="list-style-type: none"> - Conduct collaborative research on cost reduction technologies. - Conduct collaborative research on technologies for product development (seafood and meat), technologies to improve taste, texture, etc. 	<ul style="list-style-type: none"> - Pursue collaborative research/partnership opportunities.
	Threats	<ul style="list-style-type: none"> - Coordinate industry-level information exchange and knowledge sharing on regulatory issues. 	<ul style="list-style-type: none"> - Promote collaborative efforts to increase consumer acceptance.
	<ul style="list-style-type: none"> - Four prominent cultured meat start-ups. - High-profile research collaborations between major corporations and universities. - R&D focused on developing cost-reduction technologies. 		
	<ul style="list-style-type: none"> - Low commercialization of products. - Limited consumer awareness. - Strong concerns about food safety. - No regulatory framework to support the industry growth/possibility of strict regulations being applied. 		

5.5. Mycoprotein-Based Food

Currently, mycoprotein-based food products are not yet available in Japan. On the other hand, there have been notable efforts by various companies and universities to develop such products, indicating that their introduction into the Japanese market is forthcoming. As the industry is still in its early stages of commercialization, the primary focus for Thai companies lies in collaborative R&D activities.

Simultaneously, there are opportunities for Thai companies to export their retail mycoprotein products to Japan. Implementation of active marketing and promotional strategies can effectively raise Japanese consumers' awareness of mycoprotein products and their associated health benefits.

TOWS Analysis of the Thai Mycoprotein-Based Food Meat Potential for Japan Market Entry

		Strengths and Weaknesses of the Thai Industry	
		Strengths	Weaknesses
Threats and Opportunities in the Japan Market	Opportunities - R&D activities being carried out by companies and universities.	- Conduct collaborative research with Japanese companies.	- Pursue collaborative research/partnership opportunities.
	Threats - Very little consumer recognition.	- Introduce mycoprotein products to Japan. - Increase awareness among Japanese consumers about mycoprotein and its health benefits through marketing and promotion.	

5.6. Microalgae-Based Food

The Japanese microalgae-based food market offers moderate opportunities for the Thai industry. The Thai industry has the advantage of having a climate suitable for algae production, and has a track-record of producing and exporting algae-products to Japan and elsewhere. However, there is currently a lack of sufficient investment for algae production facilities, which could hinder the industry’s potential to fully capitalize on opportunities in the Japanese microalgae market.

On the other hand, there have been some recent developments in Thailand toward commercializing new types of algae. These advancements could create exciting opportunities for the Thai industry to expand its presence in the Japanese market and explore novel applications for algae-based products.

The active collaboration among Japanese microalgae players and other companies fosters ongoing research on various microalgae types and drives the development of new food products. These trends create opportunities for collaborative R&D between Japanese and Thai companies in the microalgae-based food sector.

Provided in the next page is the TOWS analysis for Thai microalgae players and their products.

TOWS Analysis of the Thai Microalgae-Based Food Items 's Potential for Japan Market Entry

		Strengths and Weaknesses of the Thai Industry	
		<p>Strengths</p> <ul style="list-style-type: none"> - Has a solid base of spirulina production. - Climate suitable for algae production. - Growing interest among Thai food companies in exploring new alternative protein sources. - Some investments going into strengthening existing production facilities. - Some development for commercializing new types of algae. 	<p>Weaknesses</p> <ul style="list-style-type: none"> - Lack of sufficient investment for algae production facilities.
Threats and Opportunities in the Japan Market	<p>Opportunities</p> <ul style="list-style-type: none"> - The second largest alternative protein market in Japan. - Well-established market for utilizing algae in supplements. - Renewed interest in algae for uses other than supplements, such as addition to plant-based foods. - Active collaboration between companies. - Growing interest in supplements and health food items. 	<ul style="list-style-type: none"> - Continue to offer spirulina products. - Develop and offer other types of algae products with distinctive health benefits. - Conduct collaborative research with Japanese companies for development of new types of algae and algae products. 	<ul style="list-style-type: none"> - Seek investments from Japanese companies on industrializing and improving algae production facilities. - Appeal to Japanese companies to locate their production facilities in Thailand.
	<p>Threats</p> <ul style="list-style-type: none"> - Hosts a relatively well-established industry with prominent players (high competition). 	<ul style="list-style-type: none"> - Target niche markets which Japanese players have not entered with new types of algae or offer new usage methods. - Tie-ups with Japanese start-up companies to develop new products. - Promote image of Thailand as a country suited for algae production. 	

Here is a summary of the microalgae-based products that show potential for Thai companies.

High-Potential Microalgae-Based Food Items



Spirulina-Based Products: With the growing interest in the health benefits and expanding applications of algae, such as adding algae to plant-based meats, Thai companies have the potential to expand their presence in the market. Currently, spirulina serves as the primary algae-based protein produced in Thailand, and is primarily utilized for dietary supplements. Building on this existing market, Thai companies can explore other opportunities to utilize spirulina or explore new types of Japanese companies outside the traditional dietary supplements.



Products Using New Types of Algae: There is renewed interest in algae due to the growing awareness of the health benefits. For Thai companies, developing and offering innovative algae products can be a crucial strategy to tap into the Japanese microalgae-based food market. Another viable approach is to collaborate with Japanese start-ups and companies to co-create and introduce new algae-based products tailored specifically for the Japan market. By leveraging the expertise and market knowledge of Japanese partners, Thai companies can enhance their chances of success and better cater to the preferences and demands of Japanese consumers.

6. Recommendations

6.1. Recommendations for the Government

Here are the six recommendations for the Thai government to help Thai alternative protein companies enter the Japanese market and increase their presence in Japan.

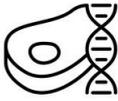
<p>1. Support R&D Activities</p> 	<ul style="list-style-type: none"> As the alternative protein market is still emerging, many Thai companies are currently in the early stages of R&D. This is especially true for cultured meat and mycoprotein-based food, but also applies to other alternative protein products. Providing further support for innovation in this area through R&D funding and start-up incubation is essential for Thai companies to enhance their competitiveness, both domestically and internationally, and to secure a strong market position. With support from government investment in R&D, Thai companies can boost their competitiveness in Japan by creating innovative products that cater to the specific requirements and preferences of the Japanese market. For insect-based food, proving the functionality of products and communicating it to consumers are the key for boosting demand in the Japanese market.
<p>2. Hold Business Matching Events</p> 	<ul style="list-style-type: none"> Finding the right Japanese importer or partner can be challenging for Thai companies operating on their own. This is especially true for the alternative protein market, where there is active participation of numerous start-ups that are often understaffed and struggling to dedicate sufficient resources to market research and understanding the intricacies of specific markets like Japan. Therefore, organization of matching events by the Thai government would greatly assist these companies in entering the Japanese market or expanding their business there. Such events would facilitate valuable connections and collaborations, making the process smoother for all parties involved.
<p>3. Conduct Constant Market Research</p> 	<ul style="list-style-type: none"> Because it is an emerging market, the dynamics of the alternative protein market can change quickly. Continuous market research is vital for Thai companies to ensure a strong sales and marketing strategy in Japan. Provision of such market research by the Thai government would provide the latest insights and information about the Japanese alternative protein market, allowing companies to stay updated and make informed decisions.

<p>4. Support Promotional Activities</p> 	<ul style="list-style-type: none"> • The competition in the Japanese alternative protein market is intensifying, making it necessary to implement promotional activities to distinguish Thai products from others. • In terms of specific activities, the Thai government can consider participating in events as well as operating booths at food-related expos, such as FOODEX, which will help promote Thai alternative protein food products in Japan. • Online promotion is another viable option. For example, Canada recently opened a webpage promoting Canadian food products on Rakuten Ichiba (one of Japan’s largest e-commerce shopping malls). • Setting up opportunities for consumers to sample products would be particularly effective. Because alternative proteins are still relatively new to Japanese consumers, providing them with a chance to try the products firsthand is essential to help them overcome any initial hesitations or misconceptions they may have. It would also provide an opportunity to educate consumers about the benefits of alternative proteins and address any questions or concerns they may have, ultimately contributing to market expansion.
<p>5. Share Knowledge about Food Exports</p> 	<ul style="list-style-type: none"> • Exporting food to Japan can be challenging, especially for Thai companies with no prior experience in this market. • To support these companies, the Thai government can share knowledge about food export to Japan through organizing seminars as well as providing insights, guidance, and practical tips to Thai companies. • Additionally, it would be effective to establish a centralized resource hub on the Thai government website that offers comprehensive information, regulations, and best practices for food export to Japan.
<p>6. Negotiate with the Japanese Government for Tariff Reduction</p> 	<ul style="list-style-type: none"> • Importing certain alternative proteins, such as flavored plant-based meat, from Thailand to Japan comes with a high tariff rate, creating challenges for selling Thai products in the Japanese market. • To address this issue and facilitate better market access for Thai companies, one concrete action that the Thai government can take is to work toward tariff reduction for these products.

6.2. Recommendations for the Private Sector

Here is a summary of recommendations for Thai companies to enter the Japanese market.

<p>Plant-Based Meat Companies</p> 	<p>Product Development</p> <ul style="list-style-type: none"> • Develop and offer various value-added products differentiated from existing products, such as products with new/better flavor. • Develop and offer products using non-soy-based materials or materials originating from Thailand. • Develop and offer low-priced products. <p>Marketing</p> <ul style="list-style-type: none"> • Target niche markets which Japanese players have not entered (e.g., products with Thai cuisine flavors). • Utilize existing food distribution channels and brands of major international food manufacturers to export products to Japan. • Promote Thai brands to differentiate them from domestic products. • Promote plant-based meat products as a source of healthy protein. <p>Other</p> <ul style="list-style-type: none"> • Provide OEM services to Japanese plant-based meat companies.
<p>Plant-Based Dairy Companies</p> 	<p>Product Development</p> <ul style="list-style-type: none"> • Develop and offer value-added products differentiated from existing products with distinctive characteristics such as health functionality. • Develop and offer products using non-soy-based materials or materials originating from Thailand. • Develop and offer low-priced products. <p>Marketing</p> <ul style="list-style-type: none"> • Target niche markets which Japanese players or foreign brands have not entered, especially in the non-soy-milk category. • Promote plant-based milk products as a source of healthy protein. • Promote Thai brands to differentiate them from domestic products.

<p>Insect-Based Food Companies</p> 	<p>Product Development</p> <ul style="list-style-type: none"> • Develop and offer more diverse products differentiated from existing products. • Improve the quality of cricket powder by changing the cricket breeding methods, such as the type of feed. • Lower the price of cricket powder by improving the efficiency of cricket breeding. <p>Marketing</p> <ul style="list-style-type: none"> • Promote cricket powder to Japanese insect-based companies or trading companies. • Promote dried insect products to Japanese insect-based companies. • Brand Thailand's cricket powder to set it apart from products of other countries. • Promote the positive aspects (e.g., high protein) of insect-based products. • Conduct creative marketing with Japanese partners to help Japanese people feel more comfortable and familiar with insect-based foods. <p>Other</p> <ul style="list-style-type: none"> • Provide OEM services to Japanese companies that are interested in developing insect-based products. • Invest in industrialization of insect farming. • Seek R&D collaborations with Japanese cricket breeders. • Conduct R&D to prove the functionality of insect-based foods.
<p>Cultured Meat Companies</p> 	<ul style="list-style-type: none"> • Conduct collaborative research with Japanese companies on technologies for cost reduction, product development (seafood and meat), and improvement of tastes, texture, etc. • Coordinate industry-level information exchange and knowledge sharing on regulatory issues in Japan. • Promote collaborative efforts with Japanese companies to increase acceptance of cultured meat among Japanese consumers.
<p>Mycoprotein-Based Food Companies</p> 	<ul style="list-style-type: none"> • Conduct collaborative research with Japanese companies. • Introduce mycoprotein products to Japan. • Increase awareness among Japanese consumers about mycoprotein and its health benefits through marketing and promotion.

Microalgae-Based Food Companies



Product Development

- Develop and offer non-spirulina products with distinctive health benefits.
- Conduct collaborative research with Japanese companies for development of new types of algae and algae products.

Marketing

- Continue to offer spirulina products.
- Target niche markets which Japanese players have not entered with new types of algae or offer new usage methods.
- Promote the image of Thailand as a country suited for algae production.

Others

- Seek investments from Japanese companies on industrializing and improving algae production facilities.
- Appeal to Japanese companies to locate their production facilities in Thailand.

7. Appendix

List of Interviewees

	Organization/Company	Interviewee	Position/Title
Thailand			
	Thai Future Food Association	Visit Limlurcha	President
	Trade Strengthening Policy Division, Trade Policy and Strategy Office	Pornpunnin Satawatthamrong	Director
Japan			
	Japan Vegetable Protein Food Association	Matsumoto Ryuhei	Managing Director
	Japan Food Science	Shinya Kitazawa	Managing Director
	RON Corporation	Jun Nakamura	President
	Futureonaut	Ren Sakurai	President