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**Report Highlights:**

Singapore does not have any domestic commercial production of plant biotechnology. The Singapore Food Agency (SFA) website lists 108 genetically engineered (GE) crops approved for use as food for direct consumption, ingredients, and further processing into ingredients for other food in the country. GE foods sold in Singapore must undergo a rigorous safety assessment by the Genetic Modification Advisory Committee (GMAC) and the Singapore Food Agency (SFA). The assessments are based on Codex principles. SFA's "Regulatory Framework for the use of Genome Edited Crops for Food and Animal Feed" was implemented on August 1, 2024. Prior to the implementation, SFA held public and stakeholder consultations on the proposed regulatory framework.

## EXECUTIVE SUMMARY

Plant biotechnology product development in Singapore is minimal and has been limited to just one project to date. There is no commercial production of GE plants in the country.

Singapore is a large importer of processed food products, many of which may have been derived from GE crops. In 2023, Singapore imported about \$ 11.3 billion in consumer-oriented food and beverage products, with the top suppliers being France, Malaysia, the United Kingdom, China, Indonesia, the United States and Australia. The Singapore Food Agency (SFA) website listed 108 genetically engineered crops that have been approved for use as food for direct consumption, ingredients, and further processing to become ingredients for other food in the country.

GE foods sold in Singapore must undergo rigorous safety assessments by the Genetic Modification Advisory Committee (GMAC) and Singapore Food Agency (SFA). The assessments are based on Codex principles. The SFA is the national body that regulates GE crop market access in Singapore. The multi-agency GMAC was established under the country's Ministry of Trade and Industry in 1999 to provide science-based advice on research, development, production, release, use, and handling of GE products in Singapore. Developers who wish to gain market access for GE products in Singapore must first submit a proposal to GMAC for a safety evaluation. SFA then considers GMAC's recommendations (and may conduct further safety evaluations) before making an official regulatory decision.

GMAC revised its regulations on stacked events in August 2020, adopting the "high covers low" approach, which exempts lower-order combinations of stacked events from assessment if derived from prior GMAC-endorsed higher-order combinations. SFA implemented its "Regulatory Framework for the use of Genome Edited Crops for Food and Animal Feed" on August 1, 2024, following public and stakeholder consultations on the proposed regulatory framework over the past few years

Currently, Singapore does not have any specific guidelines on the labeling of GE products. As a Codex Committee on Food Labeling (CCFL) member, Singapore closely monitors international developments.

Singapore's animal biotechnology development is limited to research activities in fish hatchery technology. There is no commercial animal biotechnology production in the country.

For additional reference on biotech standards and requirements, please reference the [FAIRS Country Report](#), 2024.

## Table of Contents

<b>EXECUTIVE SUMMARY.....</b>	<b>2</b>
<b>CHAPTER 1: PLANT BIOTECHNOLOGY.....</b>	<b>4</b>
<b>PART A: PRODUCTION AND TRADE.....</b>	<b>4</b>
<b>PART B: POLICY.....</b>	<b>4</b>
<b>PART C: MARKETING.....</b>	<b>10</b>
<b>CHAPTER 2: ANIMAL BIOTECHNOLOGY.....</b>	<b>11</b>
<b>PART D: PRODUCTION AND TRADE.....</b>	<b>11</b>
<b>PART E: POLICY.....</b>	<b>12</b>
<b>PART F: MARKETING.....</b>	<b>13</b>
<b>CHAPTER 3: MICROBIAL BIOTECHNOLOGY.....</b>	<b>13</b>
<b>PART G: PRODUCTION AND TRADE.....</b>	<b>13</b>
<b>PART H: POLICY.....</b>	<b>14</b>
<b>PART I: MARKETING.....</b>	<b>15</b>

## **CHAPTER 1: PLANT BIOTECHNOLOGY**

### **PART A: PRODUCTION AND TRADE**

#### **a) RESEARCH AND PRODUCT DEVELOPMENT:**

Plant biotechnology product development in Singapore is minimal and has been limited to just one finished project. In 2015, the Singapore Agri-Food and Veterinary Authority (AVA) approved a local company, JOil (S) Pte. Ltd, to conduct small-scale field trials for GE Jatropha kernels with high oleic acid content for the biofuels industry.

#### **b) COMMERCIAL PRODUCTION:**

There is no commercial production of GE plants in Singapore.

#### **c) EXPORTS:**

Singapore does not export any GE crops.

#### **d) IMPORTS:**

Singapore's imports of GE agricultural products in bulk form are negligible, as the local livestock industry is insignificant. However, the country is a large importer of processed food products, many of which may have been derived from GE crops. Data on the exact percentage of imports derived from GE plant products is unavailable. In 2023, Singapore imported over \$11.3 billion in consumer-oriented food and beverage products, with the top suppliers being France, Malaysia, the United Kingdom, China, Indonesia, the United States and Australia.

#### **e) FOOD AID:**

Singapore provides humanitarian aid to countries, including food products. In July 2024, Singapore provided humanitarian aid to Gaza, including 300 metric tons of canned sardines and 1,000 metric tons of rice.

#### **f) TRADE BARRIERS:**

There are no specific barriers for the import of GE plant products into Singapore, providing the products are already approved for commercial use by official regulators in the country of origin and by SFA in Singapore. SFA's evaluation of food products is based on Codex's ["Guideline for the Conduct of Food Safety Assessment of Foods Derived from Recombinant-DNA Plants."](#) There are currently no mandatory guidelines on labeling foods, seeds, fibers, oils, or feeds derived from biotech crops.

### **PART B: POLICY**

#### **a) REGULATORY FRAMEWORK:**

SFA has replaced AVA as Singapore's national body that officially regulates GE crop market access. This occurred in April 2019, when AVA was restructured into two separate agencies: SFA, which now exclusively manages food security and food safety matters, and the Animal & Veterinary Service (AVS), which manages all non-food plant and animal matters.

Following SFA’s consultations with the public and stakeholders over the past few years, SFA finally implemented its’ [“Regulatory Framework for the use of Genome Edited Crops for Food and Animal Feed”](#) on August 1, 2024. SFA’s main consideration in establishing the regulatory framework is to ensure the safety of food innovation, and therefore, SFA has developed a science-based and risk proportionate regulatory framework for genome edited (GE) crops used in food and/or animal feed.

The application of the regulatory process as it relates to GE crops for their usage as food and animal feed is contingent on SFA’s classification of GE crops. They are essentially categorized into two groups: GE crops without foreign DNA and GE crops with foreign DNA. According to SFA, GE crops without foreign DNA are “GE crops that could have been generated via conventional breeding”; and GE crops with foreign DNA are “GE crops that could not have been generated via conventional breeding”.

Under SFAs regulatory framework, GE crops that are equivalent to conventionally bred crops –are not required to undergo a premarket safety assessment. While it is not compulsory, crop developers are encouraged to inform SFA prior to the sale of such crops by submitting an information check list. SFA will then verify that the developer has performed the necessary steps and checks to confirm that the crop is equivalent to conventionally bred crops. Please refer to the [Guidance on regulatory framework for genome edited crops of use as food and feed](#) for information on the notification process. When SFA has verified that the GE crop does not contain foreign DNA, the completed notification will be [listed](#).

GE crops that could not have been generated via conventional breeding and equivalent to “genetically modified (GM) crops” must undergo a premarket assessment and approval process before the GE crops can be used in food and/or feed. For more details, please refer to SFA’s [“Conditions related to use of genetically modified crops in food”](#).

## **GMAC**

The multi-agency GMAC was established under the country’s Ministry of Trade and Industry in 1999 to provide science-based advice on the research, development, production, release, use, and handling of GE products in Singapore. GMAC’s objective is to ‘ensure public safety while maintaining an environment that is conducive for commercial exploitation of “GMOs” and “GMO-derived” products.’ As an advisory committee, GMAC works closely with other national bodies and regulatory agencies, particularly SFA, Ministry of Manpower (MOM), and the Ministry of Health (MOH). GMAC published [“Guidelines on the Release of Agriculture-Related “Genetically Modified Organisms \(GMOs\)”](#) and [“Biosafety Guidelines for Research on “Genetically Modified Organisms \(GMOS\)”](#) (last revised May 2021). GMAC also endorsed as a separate Annex on their website a document titled [Risk Assessment of Stacked Events](#) (revised in August 2020; please see Stacked or Pyramided Event Approvals Section below).

GMAC’s *Guidelines on the Release of Agriculture-Related “GMOs”* provide a common framework to assess risks of agriculture-related GE products to human health and the environment, and approval mechanisms for their release in Singapore. Under the guidelines, a proposal has to be submitted to GMAC and its subcommittees (please see details below). Collectively, they will review the application, including examining the GE product’s origin, the experimental procedures used in its development, and the methods used to prove it is safe for consumption. For issues related to food safety, GMAC adopts the concept of “substantial equivalence,” which means that if a new food/food component is found to be substantially equivalent to an existing food/food component, it can be treated as safe as the conventional

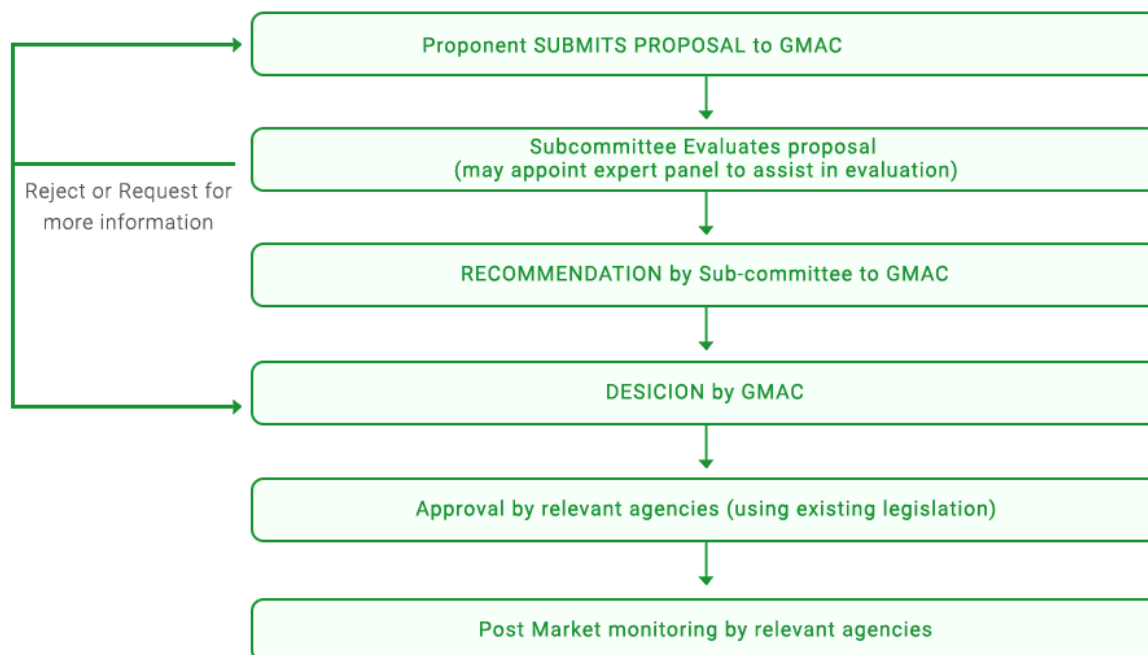
food/food component. GMAC decides whether to endorse the application after the review process. GMAC’s recommendations are then forwarded to SFA and relevant agencies, which determine final regulatory approval.

GMAC’s members are from local regulatory agencies and academic institutions, and they serve on a voluntary basis. Dr. HongYan currently chairs the GMAC Main Committee from the Nanyang Technological University (NTU). The other members come from 12 agencies/institutions, including SFA, MOH, the National Parks Board, the National Institute of Education International, and the Nanyang Technological University.

In addition to the Main Committee, GMAC has three Subcommittees. For details on the Subcommittees and a list of Subcommittee members, please refer to the following:

- [Subcommittee for Release of “GMOs” and “GMO” Related Products](#)
- [Subcommittee for Research on “GMOs”](#)
- [Subcommittee for Public Awareness](#)

### Endorsement Process for GE Products in Singapore



Source: GMAC

\*Please note, after endorsement SFA determines final approval.

<b>Legal term (in official language)</b>	<b>Legal Term (in English)</b>	<b>Laws and Regulations where term is used</b>	<b>Legal Definition (in English)</b>
Genome Edited (GE, GEd)	Genome edited	Regulations pertaining to biotechnology: SFA and GMAC guidelines, including SFA’s Regulatory Framework for the use of genome edited crops in food and/or animal feed.	Genome Edited techniques (e.g., Site-directed nucleases, Base-editing) that change the genome of a crop by inserting, deleting, or altering the genetic material at specified targeted locations in the genome, with or without the introduction of foreign DNA to the genome. (Source: SFA)
Genetic Modification (GM)	Genetic Modification (GM)	Regulations pertaining to biotechnology: SFA and GMAC guidelines, including SFA’s Regulatory Framework for the use of genome edited crops in food and/or animal feed.	Genetic Modification is a form of technology that involves direct alteration of DNA of an organism. It involves the identification, isolation and introduction of specific gene(s) from donor to recipient organisms. Genetic Modification also permits the transfer of genes between totally different organisms. Genetic modification is being applied to develop new benefits, such as creating crops with new traits (Source: GMAC)
Genetically Modified Organism (GMO)	Genetically Modified Organism (GMO)	Regulations pertaining to biotechnology: SFA and GMAC guidelines, including SFA’s Regulatory Framework for the use of genome edited crops in food and/or animal feed.	An organism which has its DNA altered by molecular techniques is termed a genetically modified organism (GMO). DNA (Deoxyribonucleic acid) itself is the molecule within a cell nucleus that contains genetic instructions which are

			required for a cell to function. (Source: GMAC)
Agri-Tech (Agriculture Technology)	Agri-Tech	Grants, 30 by 30 Initiative	Use of technology to aid efforts in farming, which enable Singapore to find ingenious and highly efficient ways to grow produce. These range from high-tech indoor farms which can produce up to 10 times the crops of conventional farm to multi story fish farms that rely on automation to improve/increase yield. (Source: SFA)

b) APPROVALS/AUTHORIZATIONS:

A total of 108 GE plant products have been approved for use as food for direct consumption, food ingredients, and further processing to become ingredients for other food in Singapore. The [list of approved products](#) was updated on September 13, 2024.

c) STACKED OR PYRAMIDED EVENT APPROVALS/AUTHORIZATIONS:

In July 2016, GMAC endorsed a document on stacked events that was prepared by the Subcommittee for Release of Agriculture-related “GMOs.” The document, “[Risk Assessment for Stacked Events, Annex A](#)”, was revised in 2020 to adopt a "high covers low" approach which exempts lower order combinations of stacked events from assessment if they are derived from prior GMAC-endorsed higher order combinations.

d) FIELD TESTING:

AVA (SFA’s predecessor) granted approval in 2015 for a local company, JOil (S) Pte Ltd, to conduct small scale field trials on Semakau Island for Jatropha kernels with high oleic acid content for the biofuels industry. JOil has completed its trials, and it has been reported that GMAC is reviewing the company’s findings. No further information is available on the trial.

e) INNOVATIVE BIOTECHNOLOGIES:

Singapore has been deliberating on regulatory issues arising from innovative biotechnologies and has recently implemented a harmonized regulatory framework on genome editing. For more details, please refer to Part B: Policy, a) Regulatory Framework.

f) COEXISTENCE:



There are no rules on coexistence, as there are no GE crops approved for domestic commercial cultivation at this time.

g) LABELING AND TRACEABILITY:

Currently, Singapore does not have any specific guidelines on the labeling of GE products. However, generally, SFA's policy is that food products for sale in Singapore can be voluntarily labeled as "GM" or "non-GM", as long as it is factual and not misleading. GE foods, like all other food products, must meet existing food labeling requirements on product information as well as details to facilitate product tracing and recall (e.g., ingredient listing, details of manufacturer or importer). The current Singapore's position on labeling of GE products is in line with Codex principles: i.e. GE food and food that contains GE ingredients are not required to be specifically labeled as "GM" or non-"GM". However, according to industry observers, GE labeling is receiving increased public attention.

Additionally, as a member of the Codex Committee on Food Labeling (CCFL), Singapore is closely monitoring international developments on acceptable GE food labeling guidelines. The CCFL is studying the various facets of the labeling issue, including threshold levels and methods of implementation.

h) MONITORING AND TESTING:

SFA monitors for the presence of GE products in the market. As GE foods are controlled items in the country, they are subject to special declaration, review, inspection, and testing procedures implemented by SFA's Food Control Division. This includes taking samples and testing in SFA laboratories. GE product detection methods and reference materials are required by SFA as part of the market access approval process.

i) LOW LEVEL PRESENCE (LLP) POLICY:

Singapore does not have a threshold established or specific policy on LLP. However, the country has demonstrated sensitivity to instances of inadvertent release of unapproved products. Additionally, LLP is connected to Singapore's policy on labeling, and SFA is actively monitoring developments on the labeling of GE products internationally.

j) ADDITIONAL REGULATORY REQUIREMENTS:

None at this time.

k) INTELLECTUAL PROPERTY RIGHTS (IPR):

While Singapore does not have any commercial production of GE crops, the country does have intellectual property legislation covering patents.

Singapore has a very advanced IP regime and the Intellectual Property Office of Singapore (IPOS), a statutory board under the country's Ministry of Law, administers IP laws, promotes IP awareness, and facilitates the development of IP in Singapore.

l) CARTAGENA PROTOCOL RATIFICATION:

Singapore is not a party to the Cartagena Protocol on Biosafety.

m) INTERNATIONAL TREATIES and FORUMS:

Singapore is an active member of the Asia-Pacific Economic Cooperation (APEC) forum and Codex Alimentarius. The country is also one of the 15 signatories of the Regional Comprehensive Economic Partnership (RCEP), and one of the signatories of the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP). Singapore is a member of the International Union for the Protection of New Varieties of Plants (UPOV), and the International Plant Protection Convention (IPPC). It is also a member of the Association of Southeast Asian Nations (ASEAN) and the ASEAN “GM” Food Testing Network (AGMFTN) sub-group that caters to regulatory and scientific exchanges on issues related to GE food analysis.

n) RELATED ISSUES:

Singapore has a multi-pronged strategy to promote food security, with research and development using modern agriculture technologies playing a key role. For example, the Singapore government in February 2021 announced they allocated a budget of \$45.2 million for the creation of the Agri-Food Cluster Transformation (ACT) Fund to “support the transformation of the agri-food sector into one that is highly productive, climate-resilient and resource efficient”. The ACT Fund was designed to better support local food producing farms to achieve the country’s “30 by 30 goal”– i.e. the plan to produce 30 percent of Singapore’s nutritional needs by 2030. In 2019, the Singapore government announced the development of an 18-hectare Agri-Food Innovation Park that would bring together hi-tech farming and research and development activities, and it would be progressively developed over the next 20 to 25 years. The country’s sovereign wealth fund, Temasek Holdings, has invested close to \$5 billion in the agri-food sector nurturing a portfolio of more than 40 agri-food companies with a focus on agricultural biotechnology, alternative proteins, vertical farming, and commodities. Temasek also signed an agreement with Singapore’s Agency for Science, Technology and Research (A\*Star) to establish the Food Tech innovation Centre, a “facility to accelerate the commercialization of food technologies”.

The country is also a member of the Agricultural Innovation Mission for Climate ([AIM4C](#)).

## **PART C: MARKETING**

a) PUBLIC/PRIVATE OPINIONS:

Market analysts report that although cautionary letters and demands for stringent labeling occasionally appear in public forums, overall opposition to GE foods is fairly insignificant in Singapore. However, Singapore may expect a rise in public interest as the popularity of novel food technology grows including GE derived products.

Singapore's position on GE labeling is in tandem with international trends and practices. SFA's fundamental principle is that any labeling must be "practical, scientifically driven and effectively implementable across countries." SFA and GMAC are expected to continue monitoring international developments closely.

**b) MARKET ACCEPTANCE/STUDIES:**

[A 2020 study conducted by Singapore's Nanyang Technological University in collaboration with Harvard University](#), involving 1,000 adults, revealed that Singaporeans tend to have mixed feelings about "GM" products. There is generally an openness to "GM" food products but concerns about health risks and environmental impact persists. Much of the public's acceptance of "GM" foods is contingent on their perceived safety, with Singapore's regulatory frameworks playing a key role in shaping public opinion. The research indicated a "spill-over effect" where negative attitudes towards "GM" food influenced opinions on technologies. This highlights the challenges in promoting acceptance of novel food technologies in the country. Addressing safety concerns GMAC states on its website that its objective is to "ensure public safety while maintaining an environment that is conducive for commercial exploitation of "GMOs" and "GMO" derived products."

**CHAPTER 2: ANIMAL BIOTECHNOLOGY**

**PART D: PRODUCTION AND TRADE**

**a) RESEARCH AND PRODUCT DEVELOPMENT:**

Singapore's animal biotechnology development is limited to research activities at [SFA's Marine Aquaculture Center \(MAC\)](#) located at St. John's Island. Established in 2003, the MAC's objective is to "deepen the country's expertise in the areas of aquaculture genetics, nutrition and health". MAC has undertaken several research and development initiatives, including genetics and brood stock development of Asian seabass in partnership with Temasek Life Sciences Laboratory (TLL). According to SFA, through the Asian seabass selective breeding program, a genetically superior line has been developed, producing fry that can grow about 30% faster. This program utilizes aquaculture genomic tools for more accurate selection of superior breeds without using "genetic modification". Other activities include developing large-scale hatchery production technology to ensure a long-term sustainable supply of marine fish fry, as well as establishing an aquaculture nutrition facility. The facility features a pilot feed mill and tank systems that optimize fish feeds for locally farmed species, promoting health growth with ingredients sourced sustainably.

**b) COMMERCIAL PRODUCTION:**

There is no commercial production of animal biotechnology in Singapore.

**c) EXPORTS:**

None

d) IMPORTS:

None

e) TRADE BARRIERS:

There is no commercial production or trade in animal biotechnology. As a result, there are no applicable trade barriers.

**PART E: POLICY**

a) REGULATORY FRAMEWORK:

The approval process for animal biotechnology is the same as the approval process for plant biotechnology (please refer to the PLANT BIOTECHNOLOGY REGULATORY FRAMEWORK section above).

b) APPROVALS/AUTHORIZATIONS:

There are no approved animal biotechnology products for commercial use in Singapore.

c) INNOVATIVE BIOTECHNOLOGIES:

There is no specific regulatory status for innovative biotechnology in animals.

d) LABELING AND TRACEABILITY:

Currently, Singapore does not have any specific guidelines on the labeling of GE products, nor does it have specific traceability requirements beyond those required for all food products.

e) ADDITIONAL REGULATORY REQUIREMENTS:

There are no specific regulatory requirements for animal biotechnology.

f) INTELLECTUAL PROPERTY RIGHTS (IPR):

There is no current legislation that addresses IPR for animal biotechnologies.

g) INTERNATIONAL TREATIES and FORUMS:

Singapore is a member of the World Organization for Animal Health (WOAH/OIE). Singapore regularly sends officials to Codex forums.

h) RELATED ISSUES:

Singapore aims to be a leader in the alternative protein industry, as well as in innovative/novel foods overall. In 2020, Singapore became the first country to approve the sale of lab-grown meat. Eat Just is the only company that has received approval to market its products in Singapore. However, the company has paused operations in Singapore, impacting its cultivated meat brand, Good Meat, and its plant-based egg substitute, Just Egg. The company is “reevaluating its strategy in Asia, including processing conditions, unit economics, and a larger strategic approach”. Eat Just’s primary facility and a new plant are closed, and it has also canceled plans to build a Just Egg product plant. Overall, the cultivated meat sector gained significant momentum up until 2022. However, in 2023, investor interest in the emerging sector began to wane due to concerns about the lengthy timeline from research to commercialization, high costs, and the technological challenges of scaling up the production of meat cells, such as chicken and fish. This is partly due to contamination issues that arise when transferring cells from vats to larger bioreactors.

Before submission of a new cell-based protein for approval [please refer to “Part H: Policy, a) Regulatory Framework” for more details], companies are required to complete self-assessment checklists, including a [checklist for cell-based companies](#).

## **PART F: MARKETING**

### **a) PUBLIC/PRIVATE OPINIONS:**

Few discussions of GE animals, cloned animals, or products derived from cloned animals take place in Singapore.

### **b) MARKET ACCEPTANCE/STUDIES:**

FAS Singapore is unaware of any studies on animal biotechnology market acceptance.

## **CHAPTER 3: MICROBIAL BIOTECHNOLOGY**

### **PART G: PRODUCTION AND TRADE**

#### **a) COMMERCIAL PRODUCTION:**

Singaporean companies work on a variety of bacteria, yeasts, fungi, and enzymes that may have been derived from microbial biotechnology for application in food and beverage, pharmaceutical, bio-industrial, and veterinary areas. There are several Singapore companies that are developing microbial biotechnology derived ingredients for plant-based protein production, including Life3 Biotech (producing Veego, alternative protein source made of legumes, grains and mushrooms), Next Gen Foods (producing TiNDLE), Growthwell Foods, Urban Tiller, and potentially startups within the Protein Innovation Centre, which is a collaboration between Bühler, and Givaudan focused on plant-based meat innovation.

#### **b) EXPORTS:**

Singapore exports alcoholic beverages, dairy products, and processed products, which may contain microbial biotech-derived food ingredients.

c). IMPORTS:

Singapore imports alcoholic beverages, dairy products, and processed products which may contain microbial-derived food ingredients.

d) TRADE BARRIERS:

There are no known trade restrictions related to microbial biotechnology at this stage.

## **PART H: POLICY**

a) REGULATORY FRAMEWORK:

In 2018, SFA (then the Agri-Food & Veterinary Authority) initiated a series of public consultations for a regulatory framework on novel food and ingredients. In 2019, SFA introduced the [novel food regulatory framework](#), which requires companies to seek pre-market allowance for novel food<sup>1</sup>. Companies are required to conduct and submit safety assessment of their products for SFA's review before they are allowed for sale. SFA will review these safety assessments to ensure that potential food safety issues have been addressed.

In order to ensure that food safety assessments are rigorously conducted, SFA formed a Novel Food Safety Expert Working Group in March 2020 to provide scientific advice. Chaired by the Head of the Center for Regulatory Excellence, Duke-NUS Medical School, the working group seeks to strengthen health product regulatory systems across Asia, and comprises experts in fermentation technology and microbiology, and in food toxicology, bioinformatics, nutrition, epidemiology, public health policy, food science, genetics, carcinogenicity, metabolomics, and pharmacology.

For novel food ingredients that are produced from a GE microbe, information must be provided to SFA that includes safety information of the production strain, allergenicity of the ingredients, and residual impurities (if present). As part of SFA's review process for safety assessments, companies are encouraged to refer to the [Conditions related to Novel Food](#), which outlines the necessary steps for obtaining information from SFA and submitting safety assessments. Companies can contact SFA via their [online feedback form](#).

For guidance on the safety assessment process, companies can refer to SFA's document titled [Requirements for the Safety Assessment of Novel Foods and Novel Food Ingredients](#), to help companies better understand the requirements regarding the safety assessment and application process for novel

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<sup>1</sup> SFA considers novel food to be food and food ingredients that do not have a history of safe use. Novel food may also include compounds that are chemically identical to naturally occurring substances but are produced through applications of technology (e.g. precision fermentation). Examples of novel food include cultured meats and alternative proteins produced with novel compounds.

foods. Before submission, the companies are required to complete self-assessment checklists, including a [checklist](#) for precision/biomass fermentation process.

**b) APPROVALS/AUTHORIZATIONS:**

Novel food products derived from microbial biotechnology for human consumption are subject to SFA's *Requirements for the Safety Assessment of Novel Foods* (please refer to the link in the above REGULATORY FRAMEWORK section). Food additives derived from microbial biotechnology are subject to the SFA [Guidance Information Requirement for Food Additives](#) (revised April 1, 2019).

Singapore has given approval for multiple food ingredient and food additive products derived from microbial biotechnology, including products such as soy leghemoglobin for use in meat analogues and lutein esters for coloring.

**c) LABELING AND TRACEABILITY:**

Currently, Singapore does not have any specific guidelines on the labeling or traceability of GE products and, therefore, of products derived from microbial biotechnology.

**d) MONITORING AND TESTING:**

SFA is the agency in charge of monitoring and testing of all food ingredients derived from microbial biotechnology.

**e) ADDITIONAL REGULATORY REQUIREMENTS:**

None at this time.

**f) INTELLECTUAL PROPERTY RIGHTS (IPR):**

Singapore has a very advanced IP regime and the IPOS, a statutory board under the country's Ministry of Law, administers IP laws, promotes IP awareness, and facilitates the development of IP in Singapore.

**g) RELATED ISSUES:**

None

**PART I: MARKETING**

**a) PUBLIC/PRIVATE OPINIONS:**

Food industry contacts report the public has a positive view of plant-based protein due to growing environmental concerns and sustainability benefits. As a result, multiple local companies utilize microbial biotechnology and are increasingly seeking alternatives to animal/fish fats.

**b) MARKET ACCEPTANCE/STUDIES:**

According to the Good Food Institute (GFI), a think-tank focused on alternative protein, \$398 million in capital was invested globally in fermentation companies in the first half of 2024 alone. While traditional fermentation methods have been around for centuries, new techniques – primarily biomass and precision fermentation – are emerging as more sustainable ways to produce proteins.

Such a focus is present in Singapore, as well. In June 2024, the National Research Foundation (NRF) in Singapore invested approximately \$14.8 million to address key challenges in the precision fermentation production process and enhance its scientific capabilities through the establishment of the Center for Precision Fermentation and Sustainability. Sovereign fund Temasek-backed food tech platform Nurasa officially launched its Food Tech Innovation Hub in April 2024, with a strategic focus on precision fermentation due to its potential as a platform technology for producing proteins and other important nutrients. Australia-based Nourish Ingredients has selected Singapore as its Asia Pacific hub, producing precision fermented fats designed to amplify plant-based and dairy products. The company is working to scale up production and with SFA for regulatory approval in Singapore. Finnish company, Solar Foods, which received regulatory approval in 2022 for its fermented protein ingredient Solein, has launched a range of limited-edition products at various F&B outlets in Singapore. Since its first commercial-scale facility became operational in April this year, Solar Foods has ramped up its production, aiming for a target capacity of 160 tons of the novel protein annually.

Nonetheless, the market size for fermentation companies in Asia Pacific still lags behind that of Europe and the U.S.. Greater consumer education on the benefits of fermentation is needed in the region to close this gap. Some fermentation start-ups that have received regulatory approval from SFA have chosen to prioritize larger overseas markets. Another factor limiting the growth of fermentation companies in the region is the lack of sufficient bioreactor capacity.

**Attachments:**

No Attachments