Singapore's Quest for Food Security – 30 by 30

Introduction

As a small urban island-state, land- and resource-scarce Singapore depends on imports from over 180 countries[1] for 90% of its food needs.[2] To feed its population of 6 million,[3] Singapore's food security strategy centres primarily on ensuring long-term food supply resilience and food safety. Defined as "[a]ccess to safe and nutritious food, for all Singapore citizens and residents, at affordable prices in the short and long term",[4] food security is considered a key component of Singapore's Total Defence Strategy, being "an essential requirement for our national security".[5]

This case study traces the development of food security in Singapore and examines the policies to meet the "30 by 30" goal of locally producing 30% of Singapore's nutritional needs by 2030. It discusses the challenges that have arisen in Singapore's quest and suggests possible policy options to address these challenges.

Background

Evolution of the Agricultural Industry

In Singapore's early years after independence, agriculture was a key sector that supplied food, jobs and income for Singaporeans. 25% of Singapore's total land area was devoted to agriculture.[6] The establishment of the Primary Production Department under the Ministry of National Development on 25 June 1959 was a step towards a coordinated approach in the advancement and management of the farming and fishing industry.[7] During the 1960s, there were approximately 20,000 vegetable, fruit, livestock and fish farms spread over

[1] "Diversify Import Sources," Singapore Food Agency, accessed December 17, 2024, https://www.sfa.gov.sg/singaporefoodstory/diversification-of-import-sources.
[2] Singapore Food Agency, *Singapore Food Statistics 2023,* https://www.sfa.gov.sg/docs/default-source/publication/sg-food-statistics/singapore-food-statistics-2023.pdf?sfvrsn=cac6f594_1.
[3] "Population and Population Structure," Department of Statistics Singapore, accessed December 3, 2024, https://www.singstat.gov.sg/find-data/search-by-theme/population/population-and-population-structure/latest-data.
[4] Poh Hong Tan, "Food Security Strategies for Singapore: Why Does It Matter?" (Speech, AVA Food Industry Convention, Orchard Hotel, October 10, 2013) https://www.sfa.gov.sg/docs/default-source/press-releases/2013/indconvceospeech_10oct2013.pdf?sfvrsn=7ffa2b94_2.
[5] Parliament of Singapore, "Committee of Supply – Head J (Ministry of Defence)," Vol. 94, February 28, 2019, https://sprs.parl.gov.sg/search/#/sprs3topic?reportid=budget-1114##.
[6] Centre for Liveable Cities, "Food and the City: Overcoming Challenges for Food Security," (Centre for Liveable Cities Singapore, 2018), https://www.clc.gov.sg/docs/default-source/urban-systems-studies/food-and-the-city-overcoming-challenges-for-food-security.pdf.
[7] "Primary Production Department (PPD)," National Archives of Singapore, accessed August 1, 2024, https://www.nas.gov.sg/archivesonline/government_records/agency-details/100.

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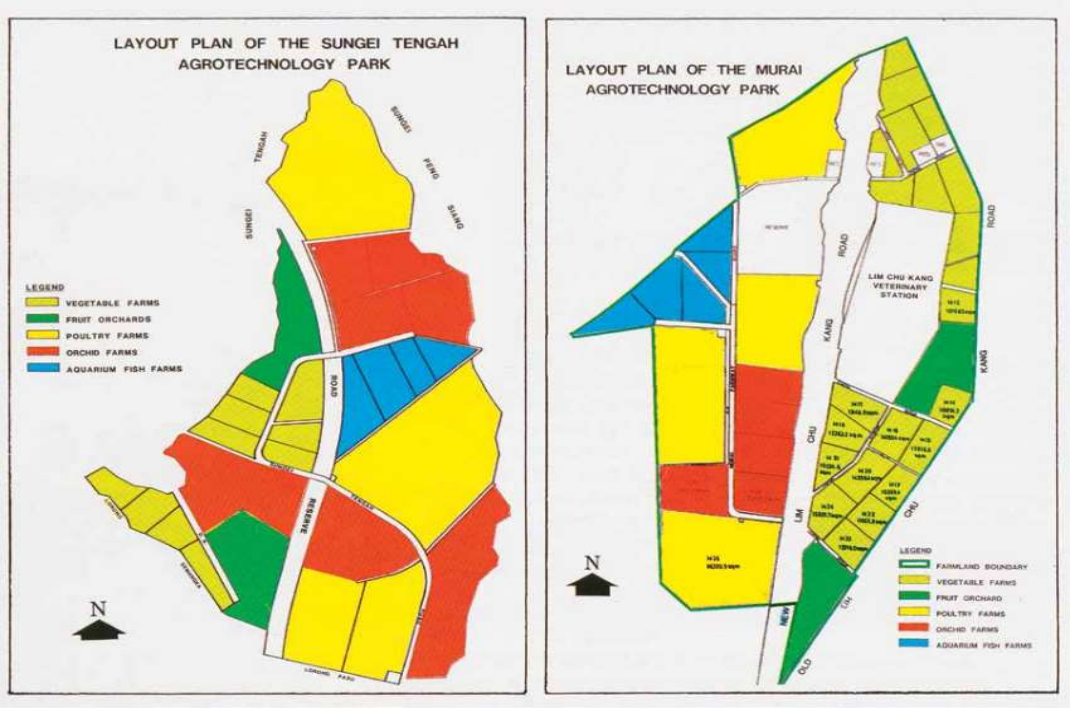
14,000 hectares of land in Singapore.[8] In fact, an estimated 9% of Singapore's total population or 175,400 people were involved in or "indirectly dependent upon agriculture and fishing"[9] as a source of livelihood in 1970. Nevertheless, with rapid urbanisation and industrialisation, agricultural land dropped to 8,400 hectares in the 1970s.[10] As expressed by Mr Ho Cheng Choon, Parliamentary Secretary to the Minister for Law and Development, in 1968:

> *[B]ecause of the growth in our population, we have to industrialise at a quick pace in order to create employment for our people. We should not be under the wrong impression that Singapore's economy is dependent on agriculture. Our discussions should not be based on that and we should not view Government's measures from the point of view of agriculture alone. Unfortunately, Singapore has only 224 square miles of land. She needs more and more land for industrialisation which is more important than any other project. Therefore, the land that can be allotted for agricultural purposes is limited.*[11]

With competing needs for land, the Primary Production Department further streamlined farms into agrotechnology parks which occupied just 1,500 hectares of land in the 1980s–1990s.[12] Aimed at boosting food production through less land and manpower use, these agrotechnology parks were built in more remote areas such as Lim Chu Kang, Mandai, Murai, Sungei Tengah (Figure 1), Nee Soon and Loyang.[13] Pig farming was entirely phased out by 1989, thus rendering Singapore completely dependent on pork imports.[14]

[8] "Celebrating AVA's Excellence through the Years," Singapore Food Agency, accessed August 1, 2024, https://www.sfa.gov.sg/docs/default-source/publication/ava-vision/ava-15years.pdf.
[9] Centre for Liveable Cities, "Food and the City: Overcoming Challenges for Food Security."
[10] Ruizhi Choo, "Of Change & Challenges: Reminders from Singapore's Past Agricultural Transformations," *Food for Thought*, October 12, 2022, https://www.sfa.gov.sg/food-for-thought/article/detail/of-change-challenges-reminders-from-singapore-s-past-agricultural-transformations.
[11] Parliament of Singapore, "Budget, National Development Division," Vol.28, December 19, 1968. https://sprs.parl.gov.sg/search/#/topic?reportid=011_19681219_S0003_T0009#.
[12] Singapore Food Agency, "Celebrating AVA's Excellence through the Years."
[13] Jean Lim and Shereen Tay, "Farmlands in Lim Chu Kang," *Singapore Infopedia,* November 2023, https://www.nlb.gov.sg/main/article-detail?cmsuuid=41ae78eb-a853-49bd-b9f8-807b8b368b1f.
[14] Ruizhi Choo, "Journeys of Transformation: Singapore's Pig Farmers after Pig Farming," *Food for Thought*, September 8, 2022, https://www.sfa.gov.sg/food-for-thought/article/detail/journeys-of-transformation-singapore's-pig-farmers-after-pig-farming.

Figure 1: Layout plans for Sungei Tengah and Murai Agrotechnology Park



Source: Singapore Food Agency, "Celebrating AVA's Excellence through the Years."[15]

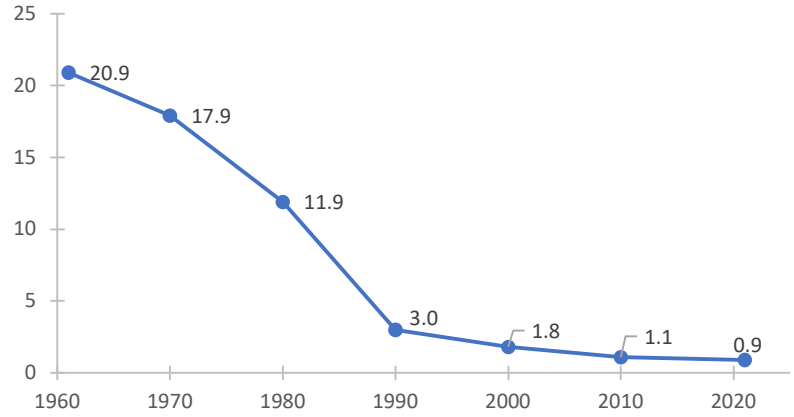
To continue meeting Singapore's needs for "food safety, animal, plant and public health", the Primary Production Department became the Agri-Food and Veterinary Authority on 1 April 2000.[16] By then, Singapore's agricultural landscape was centred on "(i)nnovation, technology, and automation…adopted by farmers to increase yields" in land-scarce Singapore, "where more than 90 percent of the food we eat is imported".[17] The Agri-Food and Veterinary Authority was succeeded by the Singapore Food Agency (SFA) on 1 April 2019, signalling a shift towards greater "regulatory oversight over all food related matters from farm to fork…[to] further strengthen food safety regime."[18]

There has been a rapid decline in land usage for agriculture through the years (Figure 2). In 2023, agriculture contributed only 0.03%[19] of Singapore's GDP through 254 farms.[20] This is in stark contrast to the approximately 20,000 farms in the 1960s.

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[15] Singapore Food Agency, "Celebrating AVA's Excellence through the Years."
[16] Singapore Food Agency, "Celebrating AVA's Excellence through the Years."
[17] Agri-Food and Veterinary Authority of Singapore, "SG50 Special: Singapore's Food Farms – A Story of Then and Now," *Food for Thought,* March 13, 2015, https://www.sfa.gov.sg/food-for-thought/article/detail/sg50-special-singapore's-food-farms---a-story-of-then-and-now#:~:text=By%201970%2C%20about%20175%2C400%20people,harvesting%20were%20inefficient%20and%20laborious.
[18] "New Singapore Food Agency to Oversee Food Safety and Security," Ministry of the Environment and Water Resources and Ministry of National Development Media Release, July 26, 2018, https://www.sfa.gov.sg/docs/default-source/newsroom/before-april-2019/sfa-and-avs-media-release-final.pdf.
[19] "Agriculture, Forestry, and Fishing, Value Added (% of GDP) – Singapore," World Bank, accessed August 1, 2024, https://data.worldbank.org/indicator/NV.AGR.TOTL.ZS?locations=SG&most_recent_value_desc=true.
[20] Singapore Food Agency, *Singapore Food Statistics 2023.*

Figure 2: Agricultural land (% of land area) – Singapore



Source: World Bank, Agricultural Land (% of Land Area) – Singapore, accessed August 1, 2024.[21]

The Context Today

Food imports make up a large proportion of Singapore's food supply, making it vulnerable to the volatile changes in global food prices and to foreign government policies. Geopolitical factors (eg the 2022 Russian invasion of Ukraine) can disrupt food supply chains and affect food prices. Climate change has further affected the availability of arable land, threatening global food production. The COVID-19 pandemic was a wake-up call for Singapore as global supply chains came to a standstill. Between 2019 and 2023, Singapore fell from the top position on the Global Food Security Index to number 28.[22] Minister for Sustainability and the Environment Grace Fu stated that:

> *We currently import more than 90% of our food needs. We have ample supply and we have access to a rich variety of foods from all over the world. However, if we look beyond the immediate term, we see the mega trends of climate change and extreme weather events, geopolitical tensions and disease outbreaks that will cause volatility to food production and place increasing pressure on our food sources.*[23]

With countries increasingly prioritising domestic food security over food exports, Singapore is susceptible to food supply disruption. Recent examples include the ban of poultry exports by Malaysia, the limitation of

[21] "Agricultural Land (% of Land Area) – Singapore," World Bank, accessed August 1, 2024, https://data.worldbank.org/indicator/AG.LND.AGRI.ZS?end=2021&locations=SG&name_desc=true&skipRedirection=true&start=1961&view=chart.

[22] Singapore's fall in the Global Food Security Index comes about with the inclusion of its score for areas such as natural resources and resilience. Shenggen Fan, Paul Teng, Ping Chew, Geoffry Smith and Les Copeland, "Food System Resilience and COVID-19 – Lessons from the Asian Experience," *Global Food Security* 28 (2021): 100501, https://doi.org/10.1016/j.gfs.2021.100501.

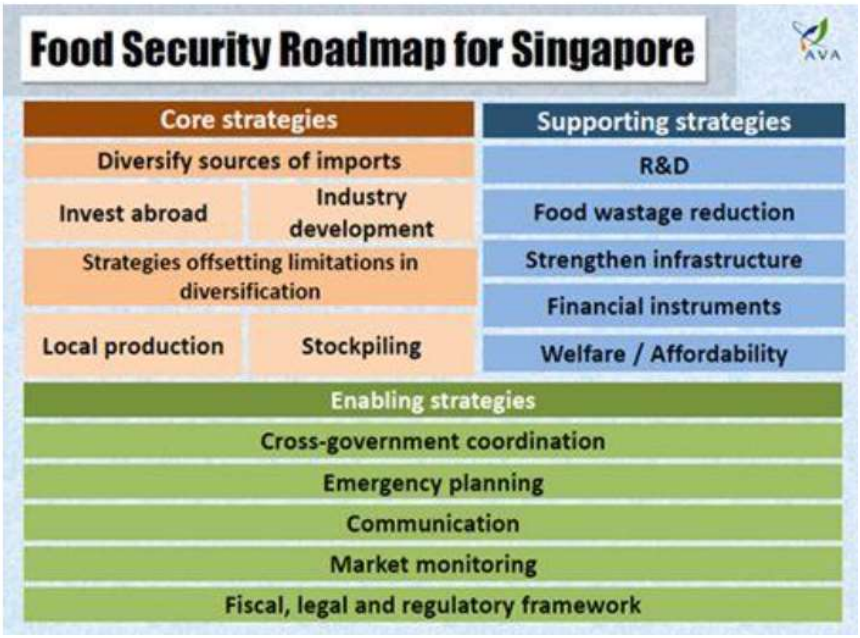
[23] Parliament of Singapore, "Debate on President's Address," Vol. 95, April 20, 2023, https://sprs.parl.gov.sg/search/#/sprs3topic?reportid=president-address-2168##.

wheat and sugar exports by India, and the embargo on edible oil exports by Kazakhstan, Egypt and Turkey[24] in 2022.

Singapore's Food Strategy Today

Singapore's food strategies today are similar to the core strategies of the Food Security Roadmap for Singapore (Figure 3) that was introduced on 10 October 2013.

Figure 3: Food Security Roadmap for Singapore



Source: Centre for Liveable Cities, "Food and the City: Overcoming Challenges for Food Security."[25]

One of Singapore's key strategies to ensure food security has been building buffer stocks. The government "works closely with industry partners to maintain adequate stockpiles of essential food items"[26] such as rice,[27] hen shell eggs, wheat, flour and infant milk powder,[28] to serve as a buffer during supply disruptions. As expressed by Minister Chan Chun Sing on 16 March 2020:

[24] Selena Ling, "Commentary: Chicken and Other Export Bans Create a Lose-Lose Scenario for Everyone," *CNA*, June 14, 2022, https://www.channelnewsasia.com/commentary/malaysia-chicken-export-ban-singapore-supply-demand-shortage-2720371.

[25] Centre for Liveable Cities, "Food and the City: Overcoming Challenges for Food Security."

[26] "Our Food Policy," Ministry of Sustainability and the Environment, accessed August 2, 2024, https://www.mse.gov.sg/policies/food/#:~:text=Stockpiling%20%2D%20The%20Government%20works%20closely,food%20supply%20disruption%20or%20emergency.

[27] Under the rice stockpile scheme, importers of rice are required to have at least 2 months stockpile of their average monthly import quantity. Ministry of Trade and Industry, "Written Reply to Parliamentary Question on Stockpiling of Key Food Items," July 4, 2022, https://www.mti.gov.sg/Newsroom/Parliamentary-Replies/2022/07/Written-reply-to-PQ-on-stockpiling-of-key-food-items.

[28] "Key Points on Ensuring Food Security in Singapore," SG101, June 14, 2022, https://www.sg101.gov.sg/resources/current-topics/ensuringfoodsecurityinsingapore/.

> *For carbohydrates, like rice and noodles, we have more than three months' worth of stockpile at the national level. For proteins like meat, and vegetables, we use a combination of fresh, frozen and canned options to meet our demand and we have more than two months' worth of supplies at normal consumption patterns. As for eggs, we have our local production and we are also activating air freight options to substitute the Malaysian supplies should they be disrupted.*[29]

In addition, Singapore currently pursues three primary strategies for long-term food security:

- diversify import sources;
- grow overseas; and
- grow local.

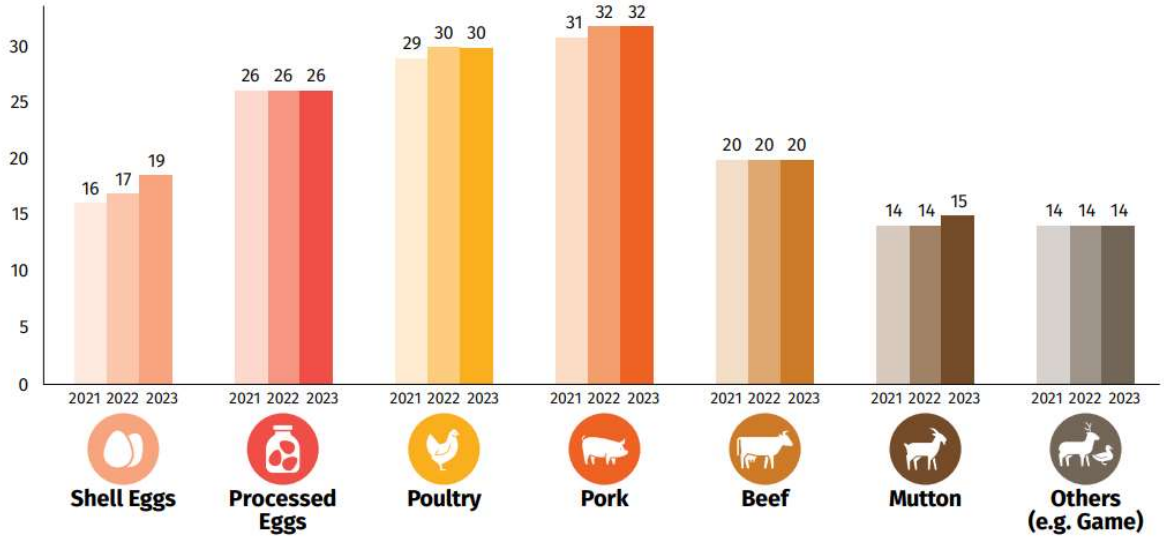
Import Source Diversification

Singapore seeks to diversify the countries from which it imports food to prevent over-reliance on any one source. In 2004, Singapore imported food from over 140 countries and this has since increased to 187 as of 2023.[30] This diversification helps suppliers to swiftly switch to alternative sources during disruptions.[31]

The government consistently opens new sources and accredits new suppliers for imports. For instance, with the Malaysian ban on poultry exports in 2022, SFA responded quickly and added Indonesia to the list of approved export countries for poultry.[32] Singapore also began receiving imports of hen shell eggs, vegetables and fish from Poland in June and July 2020 – a sign of Singapore and Poland's mutual "commitment to strengthen bilateral economic cooperation amidst COVID-19".[33] As of 2023, Singapore can import meat, eggs and livestock from 41 countries and regions. As Figure 4 shows, the number of approved countries that may export hen shell eggs, poultry, pork and mutton to Singapore has increased between 2021 to 2023. As part of licensing requirements, the government also mandates that local importers of key food items establish business continuity plans which will be deployed during supply disruptions.

[29] Chan Chun Sing, Facebook, March 16, 2020, https://www.facebook.com/ChanChunSing.SG/posts/3042850885766874?ref=embed_post.
[30] Singapore Food Agency, *Singapore Food Statistics 2023*.
[31] For instance, in addition to a local supply of eggs, Singapore's supply is supplemented by regional sources such as Malaysia, Thailand and Indonesia, as well as those further afield in Australia, New Zealand, Japan and Europe such as Ukraine, Spain, Poland and Turkey. Singapore Food Agency, *Singapore Food Statistics 2023*.
[32] Nivell Rayda, "First Shipment of Chicken Products from Indonesia to Singapore to Depart on Wednesday: Agriculture Ministry," *CNA*, July 12, 2022, https://www.channelnewsasia.com/asia/indonesia-first-chicken-shipment-singapore-wednesday-agriculture-ministry-2803771.
[33] "First Imports of Eggs from Poland in Singapore," Website of the Government of the Republic of Poland, accessed August 2, 2024, https://www.gov.pl/web/singapore/first-imports-of-eggs-from-poland-in-singapore.

Figure 4: Number of approved countries/regions by food type



Note: *(1) Poultry refers to chicken, duck, turkey, goose, pigeon, quail and wild guinea fowl, including livestock.*
(2) Shell eggs refer to fresh hen and quail shell eggs.

Source: Singapore Food Agency, Singapore Food Statistics 2023.[34]

Grow Overseas

The government further works with local businesses to expand their operations overseas and export locally established agri-tech solutions. These companies have expanded to locations in Australia, Brunei,[35] China, Hong Kong and Thailand where they have access to more land and labour as well as new, larger markets. This allows for economies of scale which will contribute to lower costs of food exports back to Singapore.[36]

Grow Local

To boost Singapore's food security and resilience in the long term, Minister for the Environment and Water Resources Masagos Zulkifli announced in 2019 that Singapore was aiming to produce 30% of its nutritional needs locally by the year 2030, up from less than 10%:

> *SFA has set the target of achieving "30 by 30" – that is, to locally produce 30 per cent of Singapore's nutritional needs by 2030. This is an ambitious multi-fold increase to our current production. Remember, we import over 90 percent of our food. To get to the "30 by 30" vision, will require our agri-food industry to adopt new solutions to raise productivity, apply R&D, strengthen climate*

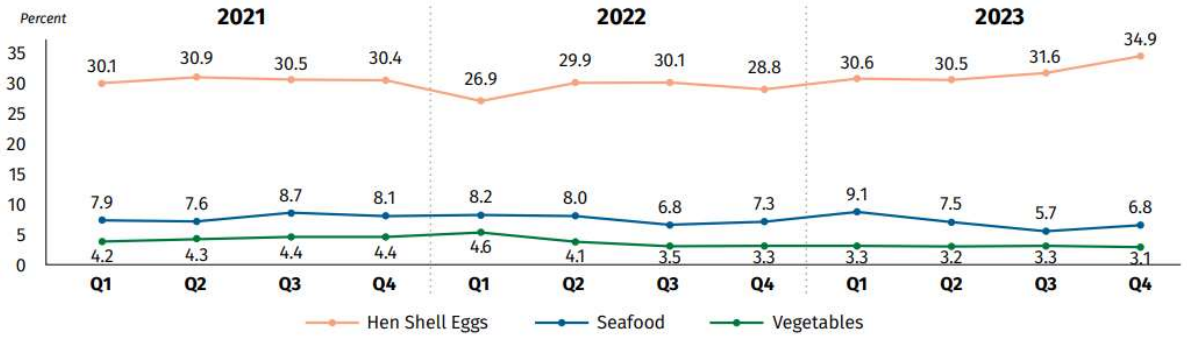
[34] Singapore Food Agency, *Singapore Food Statistics 2023*.
[35] An example of a company that has expanded into Brunei is Barramundi Asia, which is developing a 6600-hectare fish farm aimed at producing approximately 40,000 tonnes of fish to be exported back to Singapore. Parliament of Singapore, "Singapore Food Agency Bill," Vol. 94, February 12, 2019, https://sprs.parl.gov.sg/search/#/sprs3topic?reportid=written-answer-na-5128##.
[36] Parliament of Singapore, "Steps Taken to Secure and Invest in Singapore's Long Term Food Security," Vol. 94, September 2, 2019, https://sprs.parl.gov.sg/search/#/sprs3topic?reportid=written-answer-na-5128##.

> *resilience, and overcome our resource constraints. We need new paradigms in the agri-food industry.*[37]

This will be achieved with less than 1% of Singapore's land by using technology as a "key enabler to grow more with less". The aim is to transform the agri-food industry "into one that is a highly productive, climate resilient and resource efficient".[38]

As of 2023, local eggs formed 35% of total hen shell eggs consumed, the only category of local food production to have met the target of 30%. In contrast, locally produced seafood and vegetables stood at only 7% and 3% of total seafood and vegetable consumption respectively (Figure 5).

Figure 5: Local production as a percentage of total consumption



Source: Singapore Food Agency, Singapore Food Statistics 2023.[39]

The importance of Singapore's "grow local" strategy and the role of local products as a buffer source was highlighted during the COVID-19 pandemic. The vulnerability of Singapore's food supply was evident amidst global disruptions of supply chains and lockdowns imposed by foreign governments to safeguard resources for their own populace. Minister Masagos emphasised that local food production "will reduce our reliance on imports, and buffer the impact of overseas supply disruptions"[40] that cause price fluctuations.

The "30 by 30" Plan

The "30 by 30" Plan is a key component of Singapore's quest for food security. It comprises a suite of government policies to develop the agri-food industry, including provision of financial support, education and training of workers, developing infrastructure, encouraging research and best practices, increasing demand for local produce, and introducing alternative food sources.

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[37] Ministry of Sustainability and the Environment, "Committee of Supply Debate 2019 – Mr Masagos Zulkifli, Minister for the Environment and Water Resources, 7 Mar 2019," March 7, 2019, https://www.mse.gov.sg/resource-room/category/2019-03-07-speech-at-the-committee-of-supply-debate/.

[38] "Our SG Food Story," Singapore Food Agency, accessed December 17, 2024, https://www.sfa.gov.sg/fromsgtosg/our-sg-food-story.

[39] Singapore Food Agency, *Singapore Food Statistics 2023*.

[40] Ministry of Sustainability and the Environment, "Committee of Supply Debate 2019 – Mr Masagos Zulkifli, Minister for the Environment and Water Resources, 7 Mar 2019."

Financial Support

There have been various funding initiatives to support innovation and build capability in local farming.

- A $60 million Agri-Food Cluster Transformation Fund would support local farmers towards "technology upscaling, innovation and test-bedding, and capability upgrading".[41] The Fund helps local farmers expand their production capacities and competencies. Local farms are also co-funded for adoption of energy-efficient technologies to lower future electricity bills;[42]
- A $30 million "30 by 30 Express" grant was launched in 2020 to provide financial support to the agri-food industry for expediting the local production of eggs, vegetables and fish[43] over the subsequent two years;
- A $55 million Enterprise Development Grant was established to help local farms and aquaculture companies build new capabilities to increase production capacity with less resources; and
- The Singapore Food Story R&D programme commenced in 2019 with $144 million under Singapore's Research, Innovation and Enterprise 2020 plan. An additional $165 million was earmarked for the Singapore Food Story 2.0 R&D Programme in support of Singapore's "30 by 30" vision to promote research and development into four main areas, namely AquaPolis, Sustainable Agriculture, Future Foods and Food Safety.

Education and Training

SFA has also collaborated with universities, polytechnics and the Institute of Technical Education (ITE) to foster a skilled labour force for the growing agri-food industry.

- In partnership with Republic Polytechnic (RP), SFA has launched a Career Conversion Programme for Agri-tech Sector targeted at mid-career professionals. Under this programme, employers will sponsor the course fees for participants attending classroom and on-the-job training, with a minimum starting salary of $2,000 and $2,500 for operators and specialists respectively;
- Furthermore, a work-study diploma programme in Agriculture and Aquaculture Technology for existing employees in the sector and fresh ITE graduates[44] was launched in collaboration with ITE;
- Other work-study programmes include the Specialist Diploma in Agritechnology and Agribusiness by RP and Ngee Ann Polytechnic, and the Diploma in Urban Agricultural Technology by RP; and
- The National University of Singapore (NUS), Singapore Institute of Technology and James Cook University also offer degree courses specialising in the agri-food industry.

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[41] "New $60 Million Fund to Support Transformation and Growth of Local Agri-Food Sector," Media Release, Singapore Food Agency, accessed August 2, 2024, https://www.mse.gov.sg/cos/resources/cos-annex-h.pdf.

[42] Parliament of Singapore. "Committee of Supply – Head L (Ministry of Sustainability and the Environment)," Vol. 95, March 4, 2024, https://sprs.parl.gov.sg/search/#/sprs3topic?reportid=budget-2372#.

[43] Ministry of Sustainability and the Environment, "30x30 Express – Ramping Up Local Production to Enhance Singapore's Food Security," April 8, 2020, https://www.mse.gov.sg/resource-room/category/2020-04-08-press-release-on-30-x-30-express/.

[44] Ministry of Sustainability and the Environment and Singapore Food Agency, "SFA's Manpower Development Initiatives," accessed August 2, 2024, https://www.mse.gov.sg/cos2023/Annex%20J%20COS%202023%20-%20Media%20Factsheet%20on%20Manpower%20Development%20Initiatives.pdf.

In addition, there are short courses and part-time diploma courses that mid-career professionals can attend to gain the necessary skills for a career in the agri-food sector.

An Agrifood Sector Skills Framework[45] has also been developed by SFA and Workforce Singapore in consultation with various agri-food industry stakeholders. This is meant to guide the career pathways and training roadmaps for individuals interested in careers in the agri-food sector.

Infrastructure

The government plans to redevelop the 390-hectare Lim Chu Kang area into a high-tech agri-food zone (Figure 6) to boost local food production:

- Stakeholders were invited to co-create a masterplan for the Lim Chu Kang area. Awards for new plots of land will not be based on the highest bids, but on farm proposals demonstrating the most productivity and efficacy in the use of resources; and.[46]
- Infrastructure within the Lim Chu Kang area would be improved to support the Lim Chu Kang Masterplan. This includes centralised facilities to manage waste and wastewater, and help with logistics and distribution for farms in the area.[47]

Figure 6: Area of Lim Chu Kang to be developed

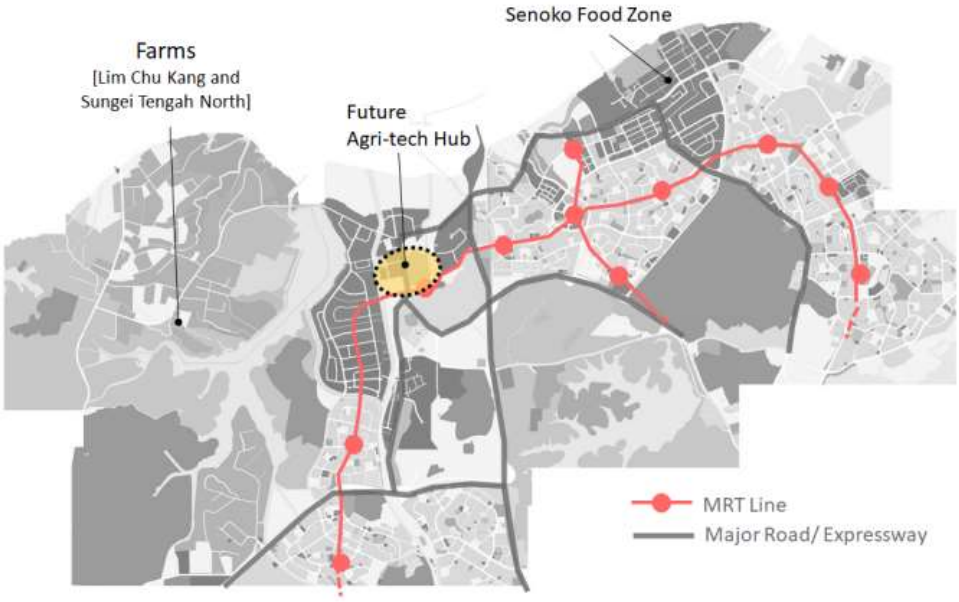


Source: Singapore Food Agency, "Master Plan Exercise to Transform Lim Chu Kang into a High-Tech Agri-Food Cluster," October 2, 2020.[48]

[45] Singapore Food Agency and SkillsFuture Singapore, "Skills Framework for Agrifood (Agriculture and Aquaculture)," accessed August 2, 2024, https://www.skillsfuture.gov.sg/initiatives/early-career/skills-framework/agrifood.
[46] Parliament of Singapore, "Master Planning of 390-hectare Lim Chu Kang Area for High-Tech Agri-food Cluster," Vol. 95, August 2, 2022, https://sprs.parl.gov.sg/search/#/sprs3topic?reportid=written-answer-11097##.
[47] Singapore Food Agency, "A Sustainable Food System for Singapore and Beyond," *Food for Thought,* November 11, 2022, https://www.sfa.gov.sg/food-for-thought/article/detail/a-sustainable-food-system-for-singapore-and-beyond.
[48] "Master Plan Exercise to Transform Lim Chu Kang into a High-Tech Agri-Food Cluster," Media Release, Singapore Food Agency, October 2, 2020, https://www.ourfoodfuture.gov.sg/speeches-and-media-releases/lckmasterplan/.

Similarly, the government has developed an 18-hectare Agri-Food Innovation Park[49] at the Greater Sugei Kadut area, and intends to strengthen the Park's infrastructure to encourage innovation in the agri-food industry and attract agri-tech companies to Singapore. Here, high-tech urban agriculture and aquaculture are co-located with research and development activities. There are also plans for the Park and farms in the Lim Chu Kang and Senoko food zone to form the Northern Agri-Tech and Food Corridor (Figure 7).

Figure 7: Future Agri-Tech Hub at Sugei Kadut



Source: Ministry of Trade and Industry, "Agri-Food Innovation Park (AFIP)," March 1, 2019.[50]

Research and Best Practices

The Singapore Aquaculture Plan was announced in 2022 with the following aims:

- Build up research and development capabilities in the tropical aquaculture industry; and
- Expand and enhance space for aquaculture, along with guidance to sea-based farms on best practices and better technology to increase productivity.

In November 2022, SFA launched Aquapolis, an aquaculture research and development programme to support Singapore's ambition of becoming a leading aquaculture research hub. Institutes of Higher Learning, farms, research institutes and companies are gathered under the umbrella of Aquapolis to advance research in aquaculture. SFA's Marine Aquaculture Centre on St. John's Island is the main research campus for the programme. Suitable sites along the Straits of Johor and the Southern Waters to support aquaculture at higher productivity levels have also been identified and will be offered on 20+10-year leases to farmers.

In the same vein, the Urban Agriculture Centre for Innovation has been set up by Enterprise Singapore at RP to further research and development capabilities, and collaborations across the urban agriculture value chain.

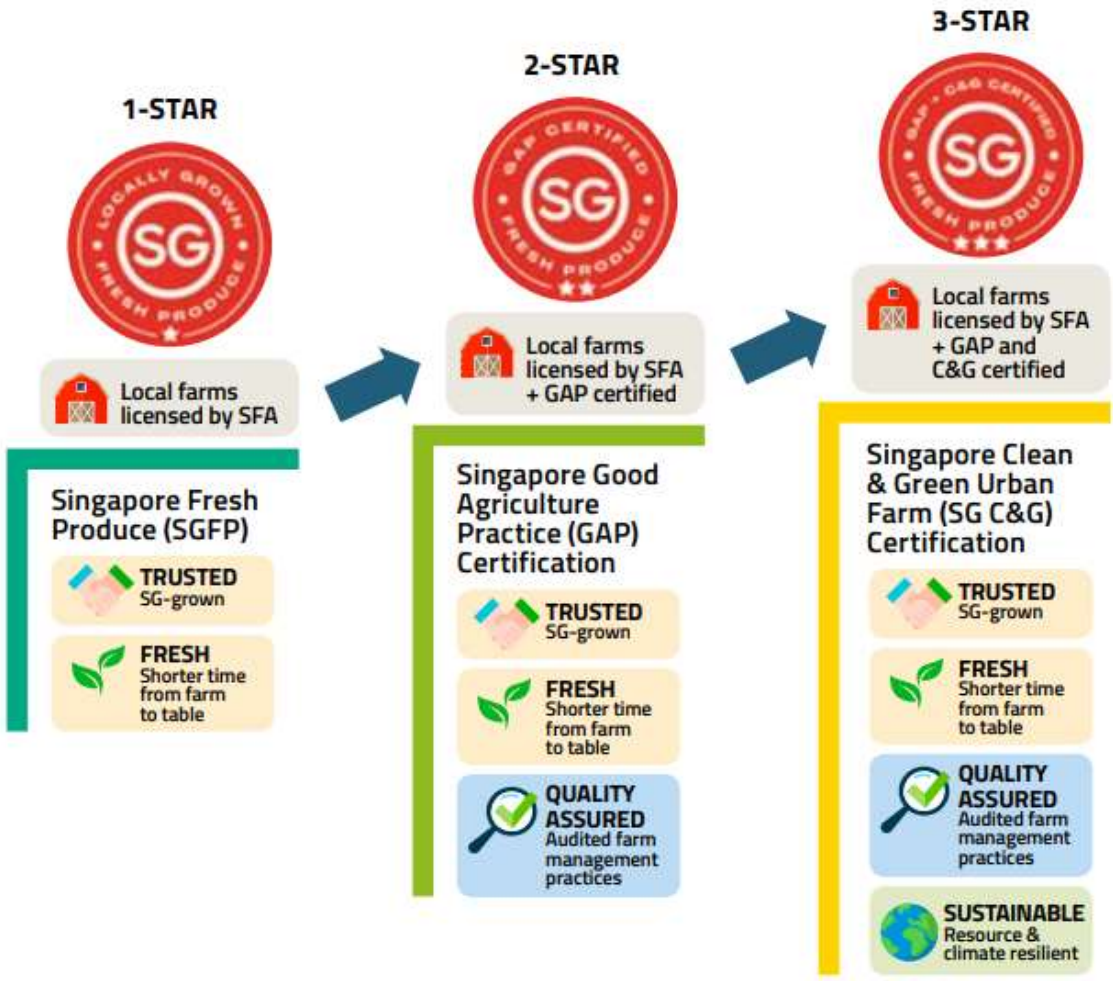
[49] "Agri-Food Innovation Park (AFIP)," Factsheet, Ministry of Trade and Industry, March 1, 2019, https://www.mti.gov.sg/-/media/MTI/COS-2019/Factsheet_AFIP.pdf.
[50] Ministry of Trade and Industry, "Agri-Food Innovation Park (AFIP)."

The Centre for Innovation is driven by the Agriculture Research and Innovation Centre which aims to build closer partnerships between different stakeholders across the urban agriculture community, and to help local farms raise productivity levels and adopt sustainable farm practices and solutions. These efforts are further sustained by the Centre for Research and Opportunities in Plant Science at Temasek Polytechnic. Similarly, the NUS Agritech Centre aims to provide a conducive environment as a sandpit for agri-tech startups to explore innovative urban farming solutions for productivity and efficiency improvements.

Increasing the Demand for Local Produce

In 2020, SFA launched a three-tier SG Fresh Produce logo to brand and promote local produce (Figure 8). Under this initiative, consumers are assured of the quality of fresh produce from local farms by relevant certification schemes.

Figure 8: SG Fresh Produce Tiers



Source: Ministry of Foreign Affairs, "Feeding the Future," Experience Singapore Issue 77, accessed August 2, 2024.[51]

[51] Ministry of Foreign Affairs, "Feeding the Future," *Experience Singapore* Issue 77, accessed August 2, 2024, https://www.mfa.gov.sg/Newsroom/Resources/Experience-Singapore/Issue-77.

A Farm to Table (FTT) Recognition programme[52] was also introduced in March 2023, so that businesses in the hotel, catering and restaurant industries are awarded the FTT logo when at least 15% (in dollar value) of their ingredients are locally sourced. The award is divided into three tiers – base, mid and highest tier – and they are awarded to businesses that acquire at least 15% of their ingredients from local farms in one, two and three food categories respectively.[53]

SFA has collaborated with supermarket retailers as touchpoints[54] to promote local produce. It also partners the Singapore Agro-Food Enterprises Federation Limited to organise the SG Farmers' Markets at community spaces and via internet platforms (eg Lazada and Redmart) to promote the sale of local produce.

Other measures include:

- A Citizens' Workgroup on Increasing Demand for Local Produce was convened to brainstorm ways to increase demand for local produce;[55]
- An Alliance for Action on demand offtake and consumer education[56] was formed to match supply from farms to commercial demand offtakers, and to encourage consumers to purchase local farm produce; and
- SFA's Retail Incubation Programme provides post-production business and marketing support to selected local farmers.

Alternative Food Sources

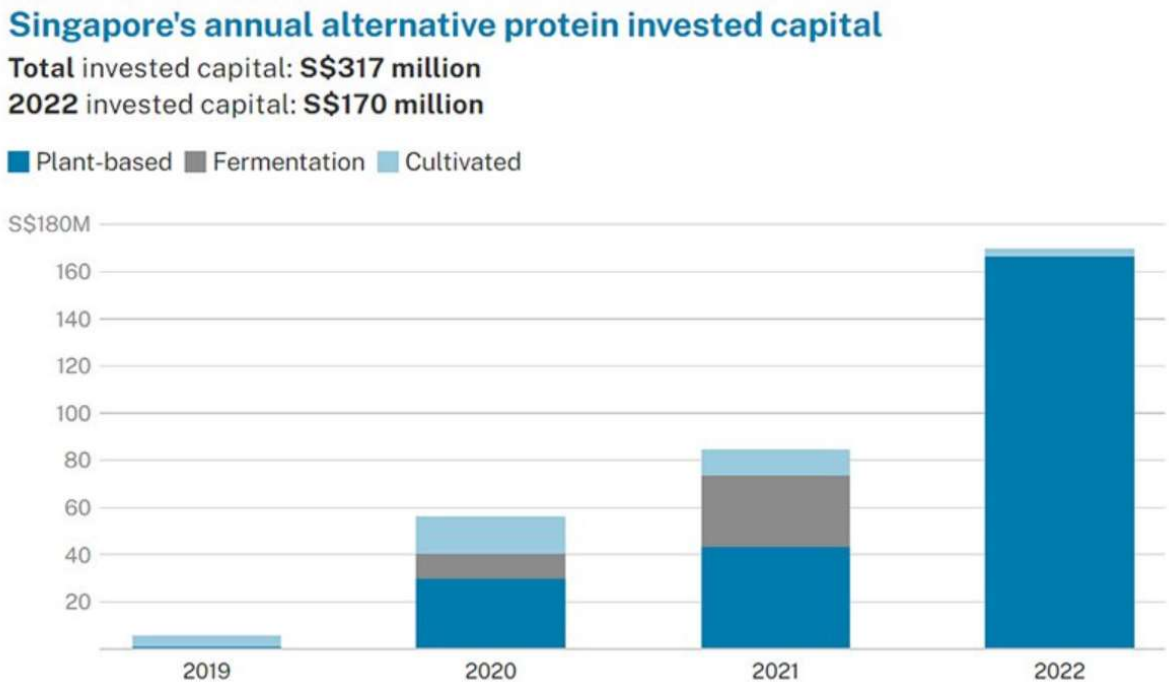
The potential of novel foods to contribute to Singapore's food security was acknowledged by Minister Grace Fu:

> *Novel foods such as cultured meat, and plant-based alternative proteins, have the potential to contribute to our "grow local" strategy.*[57]

[52] Ministry of Sustainability and the Environment, "Launch of the Farm-to-Table (FTT) Recognition Programme – Dr Koh Poh Koon," March 27, 2023, https://www.mse.gov.sg/resource-room/category/2023-03-27-farm-to-table-programme.
[53] "SFA Launches Farm-to-Table Recognition Programme to Recognise HoReCa Businesses That Source from Local Farms," Media Release, Singapore Food Agency, March 27, 2023, https://www.sfa.gov.sg/docs/default-source/food-for-thought-doc/sfa-media-release-launch-of-ftt-recognition-programme.pdf.
[54] "Where to Buy Local Produce," Singapore Food Agency, accessed December 17, 2024, https://www.sfa.gov.sg/fromSGtoSG/where-to-buy.
[55] "Citizens' Workgroup on Increasing Demand for Local Produce," Singapore Food Agency, accessed December 17, 2024, https://www.sfa.gov.sg/docs/default-source/our-singapore-food-story/cwg-report-increasing-demand-for-local-produce-draft-6-compressed.pdf.
[56] "Alliance for Action (AFA) on Demand Offtake and Consumer Education," Media Factsheet, Ministry of Sustainability and the Environment and Singapore Food Agency, accessed December 17, 2024, https://www.sfa.gov.sg/docs/default-source/newsroom/2023/cos2023-media-factsheet-on-alliance-for-action-on-demand-offtake-and-consumer-education-28-feb3bbf3bd8-9f3f-4ac5-9cca-2e2b8203b56a.pdf.
[57] Parliament of Singapore, "Laboratory-Grown Food Options as Significant Component of Food Security in Singapore," Vol. 95, September 12, 2022, https://sprs.parl.gov.sg/search/#/sprs3topic?reportid=written-answer-na-11279##.

On 2 December 2020, Singapore became the first country to approve the sale of lab-cultivated chicken meat. It is positioned to become a hub for the cultivation of such alternative protein. As illustrated by Figure 9, Singapore's annual alternative protein invested capital has increased substantially.

Figure 9: Singapore's annual alternative protein invested capital



Source: EDB Singapore, "Where Can Singapore Take the Lead in Alternative Proteins?" March 24, 2023.[58]

However, in 2024, it was reported that the enthusiasm for alternative protein had waned, with previous players scaling back on ambition and goals:

- Eat Just, a US-based company that broke ground on a new facility in 2020 in Bedok to manufacture "tens of thousands of pounds of meat"[59] a year had since temporarily halted operations at the facility;
- Other companies had either stopped offering alternative protein or, like Shiok Meats and Umami Bioworks, had merged to consolidate operations and cost. Shiok Meats had planned to offer lab-grown crustacean meat but "met the perennial challenge of scaling production".[60]

With the novelty and high cost of alternative protein relative to real meat, it is unsurprising that this industry seems to have stagnated. Indeed, Shiok Meats founder Dr Sandhya Siram thought that:

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[58] EDB Singapore, "Where Can Singapore Take the Lead in Alternative Proteins?" March 24, 2023, https://www.edb.gov.sg/en/business-insights/insights/where-can-singapore-take-the-lead-in-alternative-proteins.html.

[59] Cheryl Tan, "Eat Just Receives Approval from SFA to Produce Serum-Free Cultivated Meat," *The Straits Times*, January 29, 2023, https://www.straitstimes.com/singapore/eat-just-receives-approval-from-sfa-to-produce-serum-free-cultivated-meat.

[60] Justin Ong, "After a Promising Beginning, Is Singapore's Cultivated Meat Industry on the Way to the Slaughterhouse?" *CNA*, May 17, 2024, https://www.channelnewsasia.com/singapore/labgrown-cultivated-meat-technology-eat-just-acceptance-4332656.

> *It will take at least another decade for cultivated meat or seafood to scale and for it to be available for the consumers to buy easily in restaurants and supermarkets. Until then, it will be a niche and premium market.*[61]

Nevertheless, there is still promise in this industry, albeit one that will take time to materialise. Associate Professor Alfredo Franco-Obregon from the Institute for Health Innovation and Technology at NUS stated that "[t]he truth is that the livestock industry is not sustainable…we have to acknowledge this at one point, and so this science will go forward when (lab-grown meat) is globally accepted".[62] The challenges posed by climate change will affect meat production, as the livestock industry is "responsible for more greenhouse gases emissions than most other food sources".[63]

As an environmentally friendly alternative to meat, Singapore also recently approved for consumption 16 insect species which contain high protein content.[64] For instance, there are 65 grams of protein per 100 grams of crickets, which is more than double that of chicken breast[65] along with a much lower carbon footprint.

Challenges in Meeting the Goal of "30 by 30"

Five years after the launch of "30 by 30", there has been a mix of successes and failures. Recent failures of large local farms[66] has thrust the Plan and its overall progress under the spotlight.

Lack of Demand for Local Produce

Insufficient public awareness of local produce and its advantages, along with higher prices relative to imports, have deterred local consumers. Going by weight, locally produced eggs and vegetables cost more, from a few cents to a dollar. As for fish, locally produced ones cost $1–$3 more relative to imports.[67] According to a YouGov survey, lower prices were cited as the foremost reason for consumers to switch to local produce.[68]

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[61] Justin Ong, "After a Promising Beginning."
[62] Justin Ong, "After a Promising Beginning."
[63] "Livestock Solutions for Climate Change," Food and Agriculture Organization of the United Nations, accessed August 3, 2024, https://www.fao.org/family-farming/detail/en/c/1634679/.
[64] Cheryl Tan, "SFA Approves 16 Insect Species for Food; Companies Gear Up to Offer New Dishes and Products," *The Straits Times*, July 9, 2024, https://www.straitstimes.com/singapore/sfa-approves-16-insect-species-for-food-companies-gear-up-to-offer-new-dishes-and-products.
[65] "FAQ: Craving Nasi Lemak Topped with Crickets? What You Need to Know about Eating Insects,", *CNA*, July 12, 2024, https://www.channelnewsasia.com/singapore/eating-insects-bugs-taste-nutrition-health-benefits-protein-halal-food-4472196.
[66] Cheryl Tan, "Mega Indoor Veggie Farm I.F.F.I Shuts Down in Latest Blow to Local Food Production," *The Straits Times*, May 27, 2024, https://www.straitstimes.com/singapore/mega-indoor-veggie-farm-iffi-shuts-down-in-latest-blow-to-local-food-production.
[67] Nur Hikmah Md Ali, "The Big Read: Buy Local but at What Price? Costlier Singapore Produce Could Hamper Quest for Greater Food Security," *CNA*, June 12, 2023, https://www.channelnewsasia.com/singapore/big-read-buy-local-what-price-costlier-singapore-produce-could-hamper-quest-greater-food-security-3552611.
[68] Samuel Tan, "Local vs Imported Food: Which Do Most Consumers in Singapore Prefer and Why?**"** *YouGov*, June 28, 2024, https://sg.yougov.com/consumer/articles/49871-local-vs-imported-food-which-do-most-consumers-in-singapore-prefer-and-why.

For local food production to increase, there needs to be a complementary increase in demand. As noted by Senior Minister of State for Sustainability and the Environment, Dr Koh Poh Koon:

> *Ultimately, for the agri-tech sector and the agri-food sector to thrive, our farmers will need sufficient consumer demand to be commercially viable. Some farms are, in fact, ready to ramp up production, but our farmers need to know that it will be met with a corresponding increase in demand. Food security is, therefore, a joint responsibility. As consumers, we all have a part to play in strengthening Singapore's Food Story.*[69]

Local farmers have been faced with excess produce due to a lack of market demand and many have resorted to giving or throwing away excess stock.[70]

High Costs

High production costs involving land leases, raw materials, manpower, technology and electricity have made it challenging for local farmers to compete with lower-priced imports. In Singapore, where less than 1% of land has been earmarked for agriculture, land leases are expensive.[71]

- The land lease of parcels over 20,000m^2 in Sungei Tengah and Lim Chu Kang amount to between $198,000 and $306,000.[72]

Better technology and methods promise increased productivity yield but the costs are very high.

- The monthly operating cost for a 200m^2 rooftop farm is approximately $500 while a similar indoor farm would cost about $7,000,[73]
- Initial startup cost for a traditional farm going high tech would mean investing approximately $4 million in new equipment and land space.[74]

Lower economies of scale also mean higher costs for local farms. While there are funding opportunities, these are largely targeted at capital expenditure rather than operating expenditure, making it difficult for local farmers to sustain operations amidst high operating costs.

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[69] Parliament of Singapore, "Committee of Supply – Head L (Ministry of Sustainability and the Environment)," Vol. 95, March 4, 2024, https://sprs.parl.gov.sg/search/#/sprs3topic?reportid=budget-2372##.

[70] Clara Lee and Darelle Ng, "Unsold Greens a Persistent Issue for Singapore's Vegetable Farms; Businesses Urge Support for Local Produce," *CNA*, July 13, 2023, https://www.channelnewsasia.com/singapore/urban-rooftop-farming-vegetables-greens-unsold-leftover-lack-support-3623701#:~:text=SINGAPORE%3A%20Some%20urban%20farms%20in,local%20farming%20scene%2C%20they%20said.

[71] Nur Hikmah Md Ali, "The Big Read: Buy Local but at What Price?"

[72] Singapore Food Agency, "Sale of Agriculture Land for Farm Use – Tender no. SFA000/(R)004(23)," April 4, 2024, https://www.sfa.gov.sg/docs/default-source/food-farming/past-tender-results-new.pdf?sfvrsn=fbc0f794_2.

[73] William Chen, "Commentary: If You Love Eating Vegetables, Why Not Homegrown Greens?" *CNA*, August 3, 2023, https://www.channelnewsasia.com/commentary/singapore-vegetable-local-produce-urban-farming-agriculture-support-3661161.

[74] Judith Tan "Farmers Face Hurdles in Push to Innovate and Boost Singapore's Food Security," *The Straits Times*, April 1, 2024, https://www.straitstimes.com/singapore/farmers-face-hurdles-in-push-to-innovate-and-boost-singapore-s-food-security.

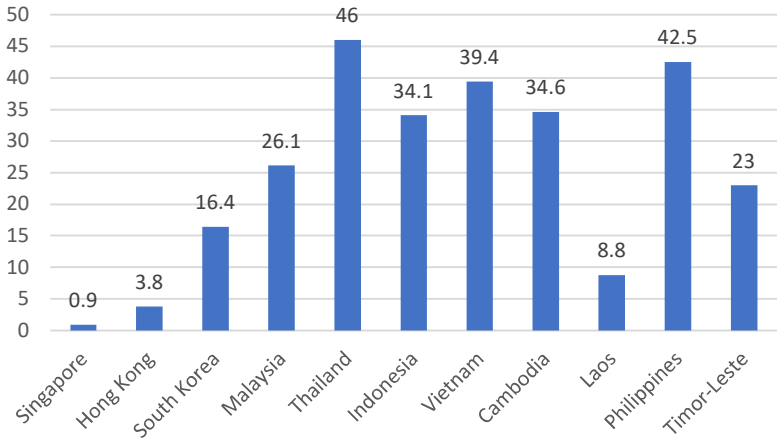
Competing Land Uses

Several farms have had to relocate as their land had to be returned for military use.[75]

Agricultural land is leased on a 20-year basis, with the option of a 10-year extension subject to SFA's approval. This short duration acts as a disincentive for farmers to invest in new, expensive technology to increase productivity.[76]

As reflected in Figure 10, only 0.9% of Singapore's land was devoted to agriculture in 2021. This was the lowest in Southeast Asia, and a quarter of that in Hong Kong.

Figure 10: Agricultural land as a percentage of land area



Source: World Bank, "Agricultural Land (% of Land Area) – Singapore.[77]

Lock of Infrastructure and Technical Support

Poor infrastructure and the lack of technical support have made it difficult for local farms. For instance, the Southern Waters lack infrastructure to support fish farming, resulting in the withdrawal of the only company (Barramundi Asia) from the area. According to its spokesperson, "farming in the Southern Waters comes with higher-than-usual operating costs due to inadequate infrastructure, making it challenging to be cost competitive and to achieve long-term profitability."[78]

[75] Ministry of National Development, "Written Answer by Ministry of National Development on Replacement Sites for Lim Chu Kang Farms," August 1, 2022, https://www.mnd.gov.sg/newsroom/parliament-matters/q-as/view/written-answer-by-ministry-of-national-development-on-replacement-sites-for-lim-chu-kang-farms.

[76] Derrick A Paulo and ShuShan Lam, "Singapore's Farms Face an Even Greater Challenge in a Post-COVID-19 World," *CNA*, November 1, 2020, https://www.channelnewsasia.com/cnainsider/post-covid-19-world-challenge-singapore-farms-30-food-vision-515836.

[77] World Bank, "Agricultural Land (% of Land Area) – Singapore."

[78] Singapore Food Agency, "SFA to Improve Fish Farming Infrastructure in Southern Waters after Barramundi Group Exits," *The Business Times*, May 20, 2024, https://www.businesstimes.com.sg/companies-markets/sfa-improve-fish-farming-infrastructure-southern-waters-after-barramundi-group-exits1.

While there are plans to develop the infrastructure of the agri-food industry, this requires time. A large portion of government aid goes to capital expenditure on farming technology, but relatively little attention has been given to post-implementation technical support.

Manpower Challenges

Unlike the established financial industry, the agri-food industry is a growing one with labour challenges. As of 2022, the industry employed a total of 2,000 people,[79] including a sizeable number of foreign workers as farmhands under the Agritech Work Permit Scheme. Perceptions of the industry must change to attract young Singaporeans. As agri-tech consultant Lee Eng Kiat observed:

> *{T}here is a shortage of farm production workers in Singapore…On the one hand, there are currently not enough Singaporeans to fill these roles, but employing too many low-skilled workers from overseas may not be desirable from a social standpoint either.*[80]

For comparison, an entry-level position with a minimum educational qualification of O-Level in the financial industry paid $2,300–$3,950 per month in 2023,[81] while a position with similar educational requirements in the agri-tech industry paid $2,000–$3,000.[82] Yet wage costs form a substantial portion of operating costs in the agri-food industry.

Policy Options

Agriculture Cooperatives for Small Local Farms

Agricultural cooperatives could serve as a potential solution to the lack of economies of scale for small local farms. Cooperatives are "membership-based business entities…owned, controlled and run by their members to realise their common economic and social objectives."[83] A cooperative for small farms would pool resources and help them realise economies of scale that they otherwise would not enjoy. It would create an eco-system that allows small farms to work together towards a common goal of sustainability. An instance of a successful agricultural cooperative is Sunkist, which comprises citrus farmers from California and Arizona. Cooperative members benefit from economies of scale and share common amenities such as research and development, packinghouse facilities and retail assistance that support members' post-production needs.

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[79] Annabeth Leow, "Singapore's Agri-Tech Sector Will Add 4,700 jobs by 2030; New Scheme Launched to Retrain Mid-Career Workers for Industry," *The Business Times*, January 14, 2022, https://www.businesstimes.com.sg/international/singapores-agri-tech-sector-will-add-4700-jobs-by-2030-new-scheme-launched-to-retrain-mid-career-workers-for-industry.

[80] Cheryl Tan, "S'pore Vegetable, Seafood Production Fell in 2023 Due to Construction Challenges, Inflation: SFA," *The Straits Times*, May 20, 2024, https://www.straitstimes.com/singapore/s-pore-vegetable-seafood-production-fell-in-2023-due-to-construction-challenges-inflation-sfa.

[81] "Salary Guide Singapore 2023: Banking Industry," mycareersfuture, accessed August 3, 2024, https://content.mycareersfuture.gov.sg/salary-guide-singapore-2023-banking-industry/.

[82] "Salary Guide Singapore 2023: Agritech Industry," mycareersfuture, accessed August 3, 2024, https://content.mycareersfuture.gov.sg/salary-guide-singapore-2023-agritech-industry/.

[83] Singapore National Co-operative Federation, "What are Co-ops?" Singapore National Co-operative Federation, accessed August 3, 2024, https://www.sncf.coop/what-are-co-ops.

Government Support for Post-Production Work

Post-production work includes "processing, sorting, packing and delivery" of produce which the agri-food industry struggles with.[84] Government assistance should include funding for post-production work and greater investment into common post-production facilities that farms can use.

Changing Mindsets

There needs to be an overhaul in the perceptions of agriculture as a back-breaking, labour-intensive endeavour to one which is high tech and rooted in science. In support of SFA's efforts to foster a skilled labour force for the agri-food sector, campaigns to raise awareness and improve popular perceptions of jobs in the agri-food industry in Singapore could be considered.

In this vein, social media platforms and popular media forms such as television dramas could change popular perceptions of agricultural work as labour intensive and strenuous to attractive career options in a promising industry based on technology and science.

Building Agricultural Collaborations

Similar to encouraging local companies to venture abroad, Singapore could consider deepening agricultural collaborations with neighbouring countries such as Brunei, Indonesia, Malaysia and Thailand. The creation of special economic zones[85] will make it easier for local firms to expand into these countries to benefit from lower land and labour costs, and export lower-priced food products back to Singapore, thus benefiting Singaporeans. As expressed by Ms Victoria Yoong of Atlas Aquaculture, "labour and energy costs were drastically lower [in locations like Sarawak and Lombok], and land was essentially free".[86]

Conclusion

The agri-food industry is still growing and finding its footing amidst challenges such as the COVID-19 pandemic, high costs and low demand. While the government has provided significant support, at this point the quest for "30 by 30" has seen both successes and failures.

The "30 by 30" plan is a work in progress. Nevertheless, given the challenges of climate change and the resulting impact on food supplies worldwide, Singapore has no choice but to press forward in its quest for food security. "30 by 30" may thus be less an option than an existential necessity for Singapore.

[84] Davina Tham, "In Focus: Will Singapore Meet Its 30 by 30 Food Sustainability Goal?" *CNA*, June 29, 2024, https://www.channelnewsasia.com/singapore/vegetables-seafood-singapore-food-price-cost-farmers-security-4442626.
[85] Karthik Rajan, "Food in Our Backyard: Let's Aim for 35 by 35," *The Straits Times*, June 15, 2024, https://www.straitstimes.com/opinion/food-in-our-backyard-let-s-aim-for-35-by-35.
[86] Tham, "In Focus: Will Singapore Meet Its 30 by 30 Food Sustainability Goal?"

Discussion Questions

1. How important is food security as a form of non-traditional security in the global context? Why?
2. How feasible is the "30 by 30" plan as a strategy in ensuring food security in Singapore? Why?
3. What are the major challenges that Singapore faces in ensuring food security via the "30 by 30" plan?
4. What are the trade-offs of the "30 by 30" plan in Singapore?
5. How can the effectiveness of "30 by 30" be improved? What is the role of non-governmental stakeholders in such an approach to food security?