

# Food Policy in Singapore

**Cecilia Tortajada**, National University of Singapore, Singapore, Singapore  
**Zhang Hongzhou**, Nanyang Technological University, Singapore, Singapore

© 2016 Elsevier Inc. All rights reserved.

---

<b>Introduction</b>	1
<b>From Self-sufficiency to Self-reliance</b>	1
<b>Diversification</b>	2
Singapore's Food Investment in China	3
Sino-Singapore Jilin Food Zone	4
<b>Food Security Strategies</b>	4
Rice Stocks	5
<b>Food Safety Policies</b>	5
<b>National and International Initiatives</b>	5
<b>References</b>	6

---

## Introduction

The Food and Agriculture Organization of the United Nations (FAO, 1996) defines food security as a condition “when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.” It considers availability (food production, stock levels, and net trade), physical and economic access by consumers, and utilization.

Food security policies can be defined in terms of self-sufficiency or self-reliance. In general, food self-sufficiency implies meeting food needs from domestic supplies and minimizing dependence on international trade. Food self-reliance relies on international markets for availability of food in the domestic market (Clapp, 2015).

According to Business Monitor International (2013), per capita food consumption in Singapore is among the highest in the region. This, coupled with scarce natural resources and low domestic food production, means that the city-state is dependent on imports not only of raw materials but also of food.

As part of a long-term strategy based on self-reliance rather than self-sufficiency, Singapore imports most of the food the population consumes (approximately 90%). Food security strategies include diverse food sources in approximately 170 countries, local production, and stockpiling of essential food items such as rice. Food sources are diversified not only among countries but also among zones within countries (Low, 2011; AVA, 2016a).

This article discusses food policies in Singapore in a framework of self-reliance, security, and resilience. It comprises diversification efforts, including overseas agricultural and food investments, food security and safety strategies, innovations, and international initiatives.

## From Self-sufficiency to Self-reliance

Singapore is a city-state of approximately 719.1 km<sup>2</sup>, a population of 5.54 million, GDP of S\$391.3 billion at 2010 prices, and per capita gross national income of S\$69,283 (Singapore Department of Statistics, 2016a).

The Agri-Food & Veterinary Authority of Singapore (AVA) is the statutory board responsible for ensuring food supply within a framework of resilience. That is, it ensures that food products (whether locally produced or imported) are safe for consumption at stable prices, it harnesses technology for intensive large-scale farming, and facilitates agritrade, among other responsibilities. In 1965, when Singapore became independent and had a population of 1.6 million, family farming was considered the keystone of food security (Chou, 2015; Kai, 2012/13). There were 20,000 farms, which occupied 25% of the land (145 km<sup>2</sup> at that time) and produced 60% of the vegetables that were consumed. As Singapore developed, farmland shrank. The trend was toward more intensive agriculture and a smaller number of farms.

Between 1960 and 1967, in spite of the decrease in farmland, production of vegetables, pigs, fowl, ducks, cattle, goats, and eggs increased to a total value of S\$285 million. Between 1964 and 1990, family farms achieved near self-sufficiency in pigs, poultry, and eggs. They produced numerous types of leafy vegetables throughout the year for the local market (Chou, 2015).

In 1974, it was decided that pig farms would be relocated to one specific area (Punggol). The purpose was to move the pig farms out of the water catchment area of a new reservoir, Kranji-Pandan, to avoid pollution, and also develop intensive commercial pig farming. Over a period of 6 years, 547,000 pigs (70%) were relocated (Tortajada et al., 2013).

**Table 1** Merchandise imports by commodity type (SGD millions)

Commodity type	2009	2010	2011	2012	2013	2014	2015
Food	8083.5	9290.3	10,295.7	10,035.6	10,590.7	11,353.5	11,254.1
Coffee, tea, cocoa, spices, and manufactures	1035.3	1173.3	1410.3	1282.5	1248.2	1525.2	1568.5
Fish, seafood (excluding marine mammals), and preparations	1170.0	1295.7	1435.8	1316.8	1318.5	1387.0	1482.4
Vegetables and fruits	1369.4	1523.1	1665.6	1723.5	1874.4	2012.9	2148.5

International Enterprise Singapore in Yearbook of Statistics Parliament of Singapore, 2016, Budget – Committee of Supply – Head T (Ministry of National Development), Official Reports – Parliamentary Debates (Hansard), Parliament No: 13, Session No: 1, vol. 94, Sitting No: 16, Sitting Date: 11-04-2016.

More changes followed. In 1980, the government decided all farming would be commercial, and none would be subsidized. In 1984, the government made its most important change in food security policy: the goal was changed from self-sufficiency to self-reliance ([Parliament of Singapore, 1984a](#)). The then director the Primary Production Department, Mr. Goh Keng Swee<sup>1</sup> proposed that farms be phased out ([Chou, 2015](#)). In the case of pig farming, the main objective was to abate the very serious pollution ([Parliament of Singapore, 1984b](#)). The rationale was also that Singapore should not focus on agricultural production but on producing goods and services in which it had a competitive advantage ([Goh, 1984](#)). Farmers who decided to retire received a one-time compensation grant. Those who were not using land required for development and who wanted to keep their farms could do so as long as they maintained pollution control standards ([Parliament of Singapore, 1984b](#)). As mentioned by [De Koninck et al. \(2008\)](#) following the reduction in agricultural land use and employment, overall production declined considerably and irreversibly. Pig farming disappeared in 1989–90.

The Primary Production Department was given the responsibility to open investment opportunities for the development of agrotechnology projects and services in aquaculture, horticulture, livestock, and other services. Farmland was transformed into agrotechnology parks for high-technology farming ([Ministry of National Development, 1989](#)).

Agrotechnology parks provide the city with a large variety of fresh leafy vegetables and eggs. In 2015, there were six agrotechnology parks and 217 farms on 608 ha for production of livestock, eggs, milk, aquarium and food fish, vegetables, fruits, orchids, ornamental and aquatic plants, and breeding of birds and dogs ([AVA, n.d.](#)).

Singapore's farm sector also provides some 15% of the world's supply of cut orchids ([De Koning et al., 2008](#)). It is also one of the major ornamental fish exporters in the world. In 2012, the city-state exported S\$77.3 million worth of ornamental fish to more than 80 countries.

More recently, in 2012 the Ministry of National Development formed the Inter-Ministry Committee on Food Security. Its objective is to coordinate and examine holistic measure to mitigate food security risks and vulnerabilities. It focuses on reducing food wastage and increasing industry production capacity and resilience ([Parliament of Singapore, 2014](#)).

## Diversification

As mentioned earlier, Singapore imports over 90% of its food, locally produces certain food items, and stores staples such as rice (it holds a reserve equal to 2 months of imports) ([Ludher, 2016](#); [Teng, 2013](#)).

In terms of imports, the main source countries are Malaysia, China, United States, Brazil, South Africa, Philippines, India, Thailand, Vietnam, Indonesia, Australia, and New Zealand. In 2015, imports of food were on the order of S\$11,254 million, down slightly from S\$11,354 million in 2014. The consumer price index was 0.5% lower than in 2014.

Singapore's imports of food increased 28.17% from 2009 to 2015 ([Table 1](#)). Reexports, although much smaller in comparison, increased 36.12% in the same period ([Table 2](#)).

In terms of vegetables and fruits, a high percentage of imports are from Malaysia and China ([Fig. 1](#)). Malaysia is Singapore's main exporter for both vegetables and fruits ([AVA, 2015](#)). Examples of individual vegetable imports dominantly from a specific country include tomatoes (Malaysia, 93.2%); cabbage, cauliflower, kohlrabi, kale, and similar edible *Brassicaceae* (China, 70.1%); cucumbers and gherkins (Malaysia, 96.8%); and leguminous vegetables (Malaysia, 69.6%) ([UN Comtrade, n.d., a](#)).

Examples of individual fruit imports dominantly from a specific country include melons and papayas (Malaysia, 85.6%); bananas (Malaysia, 41.0%; Philippines, 49.5%); and nuts (excluding coconuts, Brazil nuts, and cashew nuts—Indonesia, 83.9%).

For rice, the three main sources are India (41.0%), Thailand (30.4%), and Vietnam (21.7%). In terms of fish, Indonesia (43.1%), Malaysia (26.3%), and Thailand (10.6%) are the main three sources ([UN Comtrade, n.d., a](#)).

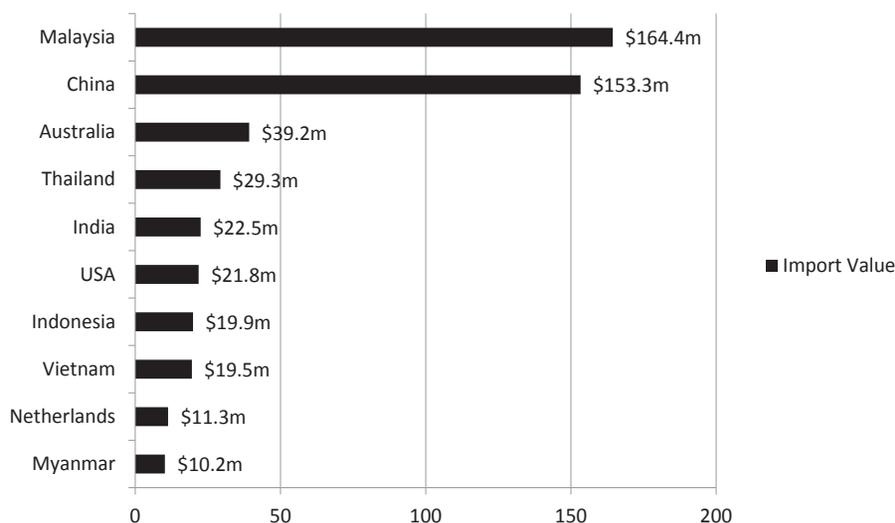
China plays a very important role in Singapore's food market. First, with Chinese representing 74.3% of the resident population of Singapore ([Singapore Department of Statistics, 2016b](#)), Singapore's food culture is very similar to China's. In recent years, as

<sup>1</sup>Mr. Goh Keng Swee was former deputy prime minister, minister of education, and chairman of the Monetary Authority of Singapore. In 1984, he was director of the Primary Production Department. The Primary Production Department, established in 1959, was restructured into a statutory board becoming the Agri-Food and Veterinary Authority (AVA) on April 1, 2000.

**Table 2** Reexports by commodity type (SGD millions)

Commodity type	2009	2010	2011	2012	2013	2014	2015
Food	1579.9	1815.6	2554.6	2027.4	2115.4	2364.6	2473.4
Coffee, tea, cocoa, spices, and manufacturers	402.1	418.0	946.1	593.4	541.4	719.2	715.0
Fish, seafood (excluding marine mammals), and preparations	246.0	308.0	310.6	261.5	256.4	262.8	352.1
Vegetables and fruits	244.6	279.9	364.8	351.5	368.1	410.8	432.0

International Enterprise Singapore in Yearbook of Statistics Parliament of Singapore, 2016, Budget – Committee of Supply – Head T (Ministry of National Development), Official Reports – Parliamentary Debates (Hansard), Parliament No: 13, Session No: 1, vol. 94, Sitting No: 16, Sitting Date: 11-04-2016.



**Figure 1** Top 10 import value markets for vegetables in 2015. UN Comtrade, n.d., Singapore exports of Edible Vegetables and Certain Roots and Tubers in 2015, <https://comtrade.un.org/labs/BIS-trade-in-goods/?reporter=702&partner=0&commodity=07&year=2015&flow=2>.

a significant number of new immigrants, foreign workers, and travelers have come from Mainland China (Lim, 2015), more Chinese cuisines from different regions of China have been introduced to and become popular in the city-state.

With the rise of e-commerce, more fruits, vegetables, meat, fishery products, and other food products are sources directly from Mainland China through online platforms such as HuiDa (<http://www.huida.sg/>) and Yan (<http://www.yan.sg/shuiguolaila/>) and through social media, WeChat in particular.

Second, China plays a critical role in the global food market. The country is by far the largest food producer, particularly of fruit, vegetables, and meat. According to FAO (2016) in 2014, China produced over 56% of the vegetables in the world; 48% of the apples; and over 50% of plums and sloes, peaches and nectarines, kiwi, and watermelons; as well as nearly 50% of the pigs.

China has also become the biggest food consumer in the world and also one of the main importers of food products such as soybean, rice, wheat, maize, sugar, palm oil, and increasingly meat products. This means that any change in China's food security strategy, consumption patterns, etc., will have major implications for regional and global food markets, which will directly affect Singapore's food markets.

From 2001 to 2015, Singapore's total food imports from China rose by 300% to almost \$1 billion (Table 3). Between 2001 and 2013, these increased by 283%, more than the growth rate of its total food imports (213%) over the same period. Meanwhile, Singapore's food exports to China also expanded significantly, reaching \$463 million in 2015, from merely \$88 million in 2004. This suggests the growing importance of China in Singapore's overall food supply and highlights the critical role of China in Singapore's effort to become a major food trading center.

### Singapore's Food Investment in China

To complement Singapore's diversification strategy, overseas agricultural and food investment is crucial. On July 31, 2009, Singapore's National Development Minister Mah Bow Tan announced that the government was encouraging local agribusiness firms to "work with farms overseas to ensure that Singapore has a ready and stable supply of produce" (Luo et al., 2011). Partially thanks to strong support from the government, Singapore has become one of the top investors in foreign agricultural sectors, purchasing or leasing land in countries in Southeast Asia and beyond. In Australia, Singapore's foreign investment in agriculture was approved for a total of A\$294 for five-year period (2007–08 to 2011–12) (Parliament of Australia, 2014).

**Table 3** Singapore's food trade with China (2012–16 in USD millions)

<i>Year</i>	<i>Import</i>	<i>Export</i>
2001	219	0
2004	293	88
2013	840	463
2015	968	460

Ministry of Commerce, 2002–2016. China Monthly Imports and Exports Statistical Report-Agricultural Products. Ministry of Commerce, Beijing, P.R. China.

Singapore's agricultural and food investment in China has been evidenced as well by the high-profile Sino-Singapore Jilin Food Zone.

### Sino-Singapore Jilin Food Zone

Among the several initiatives to facilitate source diversification is the Sino-Singapore Jilin Food Zone in Jilin, China. The project was first proposed by Prime Minister Lee Hsien Loong and then Chinese Premier Wen Jiabao in 2008. In 2010, a 40%-Singapore-owned joint management firm was established. The 1450 km<sup>2</sup> food zone is being developed as a joint venture between the Jilin city government and Singapore's Ascendas-Singbridge, which is majority-owned by Temasek Holdings. It has several investment projects, including an integrated pig farm between Singapore Food Industries and Thailand's Charoen Pokphand Group; an infant formula project; and herbal beverage production. In 2012, it was recognized as a Disease-Free Zone by the Chinese Ministry of Agriculture. Many concerns have been reported. However, in spite of this, in December 2015, the first product of the new food zone, Fragrance 43°N japonica rice, was sold in Singapore's NTUC FairPrice supermarket (AVA, 2013a).

### Food Security Strategies

Diversification of food sources goes beyond importing a wide variety of food products from as many countries as possible. It is meant to ensure supply and mitigate disruptions. It is also coupled with overseas agricultural investment and industry development.

AVA acknowledges that Singapore may be vulnerable to fluctuations in food supply due to price volatility, food safety problems in the countries of origin, or climate variability to mention only a few possibilities. Short-term impacts could include temporary lack of certain food supplies, increased competition with major global buyers, and price increases. Long-term impacts could be unavailability of specific food supplies, increased competition over increasingly tight food supplies, and higher food prices.

To prepare, Singapore has developed a Food Security Roadmap (AVA, 2013b). It includes the following:

- Core strategies: diversifying sources of imports (investing abroad and strengthening industrial development); developing strategies to offset limitations in diversification (local production and stockpiling).
- Supporting strategies: research and development; reducing food wastage; strengthening infrastructure; developing financial instruments; focusing on welfare.
- Enabling strategies: cross-government coordination; emergency planning; communication; market and performance indicators; monitoring; strengthening fiscal, legal, and regulatory frameworks.

To assist local farmers in improving yield and productivity, an S\$30 million Food Fund was established in 2009. Two more tranches were launched in 2011 and 2013 to support food diversification efforts and productivity by developing local farm capabilities. In 2014, an S\$63 million Agriculture Productivity Fund replaced the Food Fund to support innovation and the adoption of new technologies (AVA, 2013/14). Support has been extended to food and nonfood farms.

To encourage investments on farming, there is the realization that some policies need to be revised. One of them relates to land tenure for agricultural land. Land leases at present are for 10 years plus 10 additional uncertain years, if the land is not being planned for development. Farmers have indicated their preference to have longer tenure so that they can invest sufficiently (Parliament of Singapore, 2016).

In terms of fisheries, AVA manages two fishery ports (Jurong and Senoko). They are wholesale and distribution centers for both locally produced and imported seafood (live, chilled, and frozen). In 2015, in Jurong port, 46,520 tonnes of fish were sold from foreign fishing vessels, local fish farms, and those imported via land and air. The same year, Senoko port, which is mainly for local fishing vessels, sold 7170 tonnes of fish from local fishing vessels, local fish farms (land and sea), and imports.

Overall, the food diversification strategies have had positive results. An example is Vietnam's ban on rice exports in 2008 that did not affect Singapore (Parliament of Singapore, 2014). Another one is Malaysia's 2-month ban on the export of five species of fish in 2013. It did not affect the city-state because of wide availability in the market (Khaw, 2013; Ludher, 2016). During the mass fish

deaths in the Straits of Johor in 2014, losses were in the order of 500 metric tonnes. They did not affect food supply because local farms produced only 6% of the fish consumed in Singapore (Parliament of Singapore, 2014).

### Rice Stocks

Rice stocks are important for food security. However, there is a concern that the policy (2 months' worth of rice stock) may have to be revised, as it is based on calculations made decades ago, when consumption was lower (Teng, 2013).

### Food Safety Policies

Responsibility for food safety and hygiene rests with AVA from production to the point just before retail. AVA also inspects and accredits local and overseas source farms, abattoirs, and food processing establishments. It controls imports and inspects primary production and processed food at points of entry into Singapore. In addition, the National Environment Agency ensures the hygienic preparation of food sold at retail outlets (NEA, 2017). As Singapore imports 90% of its food from so many sources, these regulatory and legislative measures are meant to ensure that all imports meet the safety and quality standards (AVA, 2016b).

On several occasions, Singapore has suffered from outbreaks of foodborne diseases from imported food (Huang et al., 2012; Ministry of Health, 2011; Ty et al., 2010). As a result, surveillance has been strengthened, including microbiological tests, import control, standards of environmental sanitation and hygiene through the licensing and control of food factories and food establishments, and health education and supervision of public food handlers (Huang et al., 2012; Ty et al., 2010).

AVA administers a total of nine statutes. These include the Agri-Food and Veterinary Authority Act, Animals and Birds Act, Control of Plants Act, Endangered Species (Import and Export) Act, Feeding Stuffs Act, Fisheries Act, Sale of Food Act, Wholesome Meat and Fish Act, and Wild Animals and Birds Act, and their subsidiary legislation. (They can be found in Singapore Statutes online, <http://statutes.agc.gov.sg/aol/home.w3p>.)

The following laws apply to sources supplying food products to Singapore (They can be found in Singapore Statutes online):

- The Wholesome Meat and Fish Act of 1999 regulates the slaughtering of animals and the processing, packing, inspection, import, distribution, sale, transshipment, and export of meat and fish products (Government of Singapore, 2000).
- The Control of Plants Act of 1994 regulates the import, transshipment, and export of fresh fruits (Government of Singapore, 1994).
- The Animal and Birds Act of 1965 regulates the import of fresh eggs (Government of Singapore, 2002a).
- The Sale of Food Act of 1973 ensures that food is fresh and safe (Government of Singapore, 2002b).

To ensure food safety, there have been increasing import restrictions over time.

### National and International Initiatives

Nationally, there are numerous initiatives on food security. They focus mainly on innovations not only in technological development (e.g., more efficient production of seedlings; saving of water; intensification of farming systems; and aquaponic and vertical farming) but also in public education. They encourage consumption of local produce and reduction of losses and waste (e.g., recycling of by-products). Reduction of food waste is important since this has increased by 48% since 2005, and it is expected to increase even more (Ludher, 2016). In terms of recycling, in 2014, only 13% of the more than 100,000 tonnes of food waste produced was recycled. The rest was disposed and incinerated.

Vertical farming and greenroof and greenwall projects are increasing in number (International Greenroof & Greenwall Projects database, <http://www.greenroofs.com/blog/tag/singapore-housing-and-development-board-hdb/>). One of the largest public housing projects built by the Housing Development Board of Singapore includes a 7460 m<sup>2</sup> roof garden. Foodscaping businesses are creating landscapes of herbs, vegetables, and fruits (Edible Garden City, <http://www.ediblegardencity.com>).

Regarding research, project areas of the Food Science and Technology Programme of the National University of Singapore focus on the manufacture of safe foods by minimizing the risk of foodborne illness (NUS, 2017). As for the Food Science and Technology Programme of Nanyang Technological University, research focuses on the development of modern technology for urban farming (agriculture and aquaculture), making food longer-lasting, and ensuring that it is safe for consumption. It also focuses on converting food waste into high-value food ingredient (for example, soya bean waste into a medium for yeast to grown on) and using nanotechnology for eco-friendly food packaging. The NTU Food Technology Centre develops science-based solutions in food technology looking for "more efficient, safer, and sustainable production" (NTU, 2012).

From an industry perspective, examples include the International Enterprise (IE) of Singapore and the Singapore Food Manufacturers' Association's production center at the Sino-Singapore Tianjin Eco-city; SG Food Makers through which manufacturers work with students on ideas, prototyping, testing, and marketing validation; and the Food Services Industry Transformation Map, a roadmap for the adoption on business formats and technology, to mention some of them.

Internationally, Singapore is part of Asia-Pacific Economic Cooperation (APEC) initiatives: The proposed APEC Food Emergency Response Mechanism and the ASEAN Plus Three Emergency Rice Reserve Mechanism. Brunei Darussalam, Indonesia, Malaysia, Philippines, Thailand, and Vietnam are also members.

In 2013, Singapore joined the FAO to increase its participation in international bodies that can enhance its food security. As mentioned by [Teng and Oliveros \(2015\)](#), high-income, net food-importing countries such as Singapore can increase their support for the above regional efforts to enhance their own food security.

The city-state is considered one of the most food-secure countries in the world, third only to the United States and Ireland ([Economist Intelligence Unit, 2016](#)) in food affordability, availability, quality, and safety. This is despite its heavy dependence on food imports, for which its strategies for diversification have proven resilient up to now. It is also considered as an ideal center for regional exporters because of its location ([Business Monitor International, 2013](#)). Even then, considering its susceptibility to external factors that may disrupt food prices, production in the source countries, or transportation in or between countries, the city-state may have to further strengthen its food security policies to make them more robust to possible disturbances.

## References

- AVA (Agri-Food & Veterinary Authority of Singapore), 2000. Animals and Birds Act (Chapter 7). [https://www.ava.gov.sg/docs/default-source/legislation/animals-and-birds-act/7web\\_abact.pdf?sfvrsn=2](https://www.ava.gov.sg/docs/default-source/legislation/animals-and-birds-act/7web_abact.pdf?sfvrsn=2).
- AVA (Agri-Food & Veterinary Authority of Singapore), 2002. Sale of Food Act (Chapter 283). [https://www.ava.gov.sg/docs/default-source/legislation/sale-of-food-act/51web\\_saleoffoodact1](https://www.ava.gov.sg/docs/default-source/legislation/sale-of-food-act/51web_saleoffoodact1).
- AVA (Agri-Food & Veterinary Authority of Singapore), 2005. Sale of Food Act (Chapter 283, Section 56(1)) Food Regulations. [https://www.ava.gov.sg/docs/default-source/e-service/2web\\_foodregulations\\_1august2013.pdf?sfvrsn=2](https://www.ava.gov.sg/docs/default-source/e-service/2web_foodregulations_1august2013.pdf?sfvrsn=2).
- AVA (Agri-Food and Veterinary Authority of Singapore), 2013/14. AVA Vision, Bumper Issue: AVA Launches 3rd Tranche of Food Fund. [https://www.ava.gov.sg/files/avavision/issues3-4\\_2013/food-security-food-fund.html](https://www.ava.gov.sg/files/avavision/issues3-4_2013/food-security-food-fund.html).
- AVA (Agri-Food & Veterinary Authority of Singapore), 2013a. AVA Vision, Issue 1. [https://www.ava.gov.sg/docs/default-source/publication/ava-vision/ava\\_issue1\\_2013\\_j](https://www.ava.gov.sg/docs/default-source/publication/ava-vision/ava_issue1_2013_j).
- AVA (Agri-Food & Veterinary Authority of Singapore), 2013b. AVA's Food Security Roadmap for Singapore, AVA Vision, Issue 3&4. [http://www.ava.gov.sg/files/avavision/issues3-4\\_2013/food-security-roadmap.html](http://www.ava.gov.sg/files/avavision/issues3-4_2013/food-security-roadmap.html).
- AVA (Agri-Food and Veterinary Authority of Singapore), 2015. The Food We Eat. <https://www.ava.gov.sg/explore-by-sections/food/singapore-food-supply/the-food-we-eat>.
- AVA (Agri-Food & Veterinary Authority of Singapore), 2016a. Annual Report 2015/16. <https://www.ava.gov.sg/files/annualreport/2015-16/#p=1>.
- AVA (Agri-Food & Veterinary Authority of Singapore), 2016b. AVA's Role in Meeting Singapore's Food Supply. <https://www.ava.gov.sg/explore-by-sections/food/singapore-food-supply/meeting-singapores-food-supply>.
- AVA (Agri-Food & Veterinary Authority of Singapore), 2016c. Legislation. <https://www.ava.gov.sg/legislation>.
- AVA (Agri-Food & Veterinary Authority of Singapore), 2017. Bringing Food into Singapore & Exporting, Commercial Food Imports. <https://www.ava.gov.sg/explore-by-sections/food/bringing-food-into-singapore-and-exporting/commercial-food-imports>.
- AVA (Agri-Food & Veterinary Authority of Singapore), n.d. Types of Farming Activities in Agrotechnology Parks, <http://www.ava.gov.sg/explore-by-sections/farms/land-farms/farming-in-singapore>.
- Business Monitor International, 2013. Singapore Food & Drink Report (Five Year Forecasts to 2017) Q2 2013. [www.businessmonitor.com](http://www.businessmonitor.com).
- Chou, Cynthia, 2015. Agriculture and the end of farming in Singapore. In: Barnard, Timothy (Ed.), *Nature Contained: Environmental Histories of Singapore*. NUS Press, pp. 216–240.
- Clapp, Jennifer, 2015. Food Security and International Trade: Unpacking Dispute Narratives, Background Paper Prepared for the State of Agricultural Commodity Markets 2015–26. FAO, Rome.
- De Koninck, Rodolphe, Drolet, Julie, Girard, Marc, 2008. *Singapore: An Atlas of Perpetual Territorial Transformation*. NUS Press, Singapore.
- Economist Intelligence Unit, 2016. Global Food Security Index. <http://foodsecurityindex.eiu.com/>.
- Edible Garden City, Services, 2017. Singapore. <http://www.ediblegardencity.com/services/>.
- FAO (Food and Agriculture Organisation of the United Nations), November 13–17, 1996. World Food Summit, Rome Declaration on World Food Security. Rome. <http://www.fao.org/docrep/003/w3613e/w3613e00.htm>.
- FAO (Food and Agriculture Organization of the United Nations), 2016. FAOSTAT. <http://www.fao.org/faostat/en/#data/QC>.
- Goh, Keng Swee, March 18, 1984. Self-sufficiency not the aim. *Straits Times* 9.
- Government of Singapore, 2000. Wholesome Meat and Fish Act. <http://statutes.agc.gov.sg/aol/download/0/0/pdf/binaryFile/pdfFile.pdf?Compld:73ee3019-ec5e-4c36-82d2-c1940c1b0500>.
- Government of Singapore, 2002a. Animals and Birds Act. <http://statutes.agc.gov.sg/aol/download/0/0/pdf/binaryFile/pdfFile.pdf?Compld:b39eb414-ccf3-415e-8b4d-541340b82590>.
- Government of Singapore, 2002b. Sale of Food Act. <http://statutes.agc.gov.sg/aol/download/0/0/pdf/binaryFile/pdfFile.pdf?Compld:c3c00511-3c08-4f51-89be-eabc6e913d1d>.
- Huang, Yunle, Ghate, Vinayak, Phua, Leslie, Yuk, Hyun-Gyun, 2012. Prevalence of *Salmonella* and *Vibrio* spp. in seafood products sold in Singapore. *J. Food Prot.* 75 (7), 1320–1323. <http://foodprotection.org/doi/abs/10.4315/0362-028X.JFP-12-007?code=fopr-site>.
- Kai, Puah Y., 2012/13. Pig Farming and the State: Rethinking Rural Development in Post-independence Singapore (1065–1990). Department of History, National University of Singapore.
- Khaw, B.W., October 10, 2013. Speech by Mr Khaw Boon Wan, Minister for National Development, at AVA Food Industry Convention. [https://www.nptd.gov.sg/PORTALS/0/NEWS/MIN\\_S\\_SP.PDF](https://www.nptd.gov.sg/PORTALS/0/NEWS/MIN_S_SP.PDF).
- Lim, T., 2015. The Chinese community: Huashe and its contributions. In: Zheng, Y., Lye, L.F. (Eds.), *Singapore-China Relations: 50 Years*. World Scientific, Singapore, pp. 201–226.
- Low, Lai K., March 3, 2011. Food Security and Singapore's Position, Agri-food & Veterinary Authority of Singapore, Presentation. [http://icrm.ntu.edu.sg/NewsnEvents/Doc/ICRM\\_Sym/Documents/2ndICRM/Tan-Low%20Lai%20Kim.pdf](http://icrm.ntu.edu.sg/NewsnEvents/Doc/ICRM_Sym/Documents/2ndICRM/Tan-Low%20Lai%20Kim.pdf).
- Ludher, Elyssa K., 2016. Singapore's smart governance of food. In: Deakin, Mark, Diamantini, Davide, Borrelli, Nunzia (Eds.), *The Governance of City Food Systems: Case Studies from Around the World*. Fondazione Giangiacomo Feltrinelli, pp. 131–154.
- Luo, Phoebe, Donaldson, John A., Zhang, Qian F., 2011. The transformation of China's agriculture system and its impact on Southeast Asia. *Int. J. China Stud.* 2 (2), 289–310. [http://ink.library.smu.edu.sg/soss\\_research/1087](http://ink.library.smu.edu.sg/soss_research/1087).
- Ministry of Commerce, 2002-16. China Monthly Imports and Exports Statistical Report-agricultural Products. Ministry of Commerce, Beijing, P.R. China.
- Ministry of Health, 2001. Food-Borne Diseases, Reports. Government of Singapore. [https://www.moh.gov.sg/content/dam/moh\\_web/Publications/Reports/2001/2/chap3\\_00.pdf](https://www.moh.gov.sg/content/dam/moh_web/Publications/Reports/2001/2/chap3_00.pdf).
- MND (Ministry of National Development), 1989. Annual Report 1989, Singapore.
- NEA (National Environment Agency), 2017. Food Hygiene Standards in Singapore. Singapore Government. <http://www.nea.gov.sg/public-health/food-hygiene>.

- NTU (Nanyang Technological University), 2012. Food Sciences and Technology (FST). About FST. <http://www.ntu.edu.sg/fst/Pages/AboutFST.aspx>.
- NUS (National University of Singapore), 2017. Food science & technology programme, faculty of science. Food Microbiol. Saf. <http://www.fst.nus.edu.sg/research/ResearchGroup/FoodSafety.html>.
- Parliament of Australia, 2014. Foreign Investment in Australian Agriculture. [http://www.aph.gov.au/About\\_Parliament/Parliamentary\\_Departments/Parliamentary\\_Library/pubs/rp/rp1314/ForeignInvest](http://www.aph.gov.au/About_Parliament/Parliamentary_Departments/Parliamentary_Library/pubs/rp/rp1314/ForeignInvest).
- Parliament of Singapore, 1984a. Parliament No: 5, Session No: 1. Cage Fishing and Supply of Poultry, Vegetables and Pork, Official Reports – Parliamentary Debates (Hansard), vol. 43. Sitting No: 9, Sitting Date: 29-06-1984.
- Parliament of Singapore, 1984b. Parliament No. 5, Session No: 1. Pig Farming (Phasing Out), Official Reports – Parliamentary Debates (Hansard), vol. 44. Sitting No: 1, Sitting Date: 29-06-1984.
- Parliament of Singapore, 2014. Parliament No. 12, Session No: 1. Budget, Title: Head T – Ministry of National Development, Official Reports – Parliamentary Debates (Hansard), vol. 91. Sitting No: 11, Sitting Date: 10-03-2014.
- Parliament of Singapore, 2016. Parliament No: 13, Session No: 1. Budget - Committee of Supply – Head T (Ministry of National Development), Official Reports – Parliamentary Debates (Hansard), vol. 94. Sitting No: 16, Sitting Date: 11-04-2016.
- Singapore Department of Statistics, 2016a. Yearbook of Statistics Singapore 2016. <http://www.singstat.gov.sg>.
- Singapore Department of Statistics, 2016b. Singapore in Figures 2016. <http://www.singstat.gov.sg/>.
- Singapore Government, 1994. Control of Plants Act (Chapter 57A, Section 46), Control of Plants (Import of Fresh Fruits and Vegetables). Singapore Statutes Online. <http://statutes.agc.gov.sg/aol/search/display/view.w3p;page=0;query=DocId%3A%2251542dbf-7484-4e1d-8266-67b78d4e3601%22%20Status%3Apublished%20Depth%3A0%20%20TransactionTime%3A>.
- Singapore Government, 2000. Wholesome Meat and Fish Act (Chapter 349A). Singapore Statutes Online. <http://statutes.agc.gov.sg/aol/search/display/view.w3p;page=0;query=DocId%3A%22c18b39c2-5164-4365-8cbb-6068fce61cc2%22%20Status%3Ainforce%20Depth%3A0;rec=0>.
- Teng, Paul P.S., December 4, 2013. Food Security: What it Means for a Food-Importing Country. RSIS. Commentaries, No. 222/2013.
- Teng, Paul P.S., Olieros, Jurise A.P., 2015. Challenges and responses to Asian food security. Cosmos 11 (1), 3–20.
- Tortajada, Cecilia, Joshi, Yugal K., Biswas, Asit K., 2013. The Singapore Water Story. Routledge, London.
- Ty, Albert U., Ang, Gary Y., Ang, Li Wei, Lyn, James, Goh, Kee Tai, 2010. Changing epidemiology of enteric fevers in Singapore. Ann. Acad. Med. Singap. 39 (12), 889–896. <http://www.annals.edu.sg/pdf/39VolNo12Dec2010/V39N12p889.pdf>.
- UN Comtrade, n.d.,a. Basic Query Results, <https://comtrade.un.org/db/dqBasicQueryResults.aspx?cc=1006&px=HS&r=702&y=2015,2014,2013,2012,2011&p=96,%20116,%20360,%20418,%20458,%20104,%20608,%20764,%20626,%20704&rg=1&so=8>.
- UN Comtrade, n.d.,b. Singapore Exports of Edible Vegetables and Certain Roots and Tubers in 2015, <https://comtrade.un.org/labs/BIS-trade-in-goods/?reporter=702&partner=0&commodity=07&year=2015&flow=2>.