CHAPTER 7

Urban Food Security and Sustainability in Asian Cities

With Daisy Tam

For the first time in history, more than 50% of the world's population now lives in cities. As the trend continues, this figure will rise to 70% in the next 30 years. As the UN World Urbanization Prospects estimates, over 2.5 billion urban residents will be added by 2050 and the majority of this growth will take place in Asia and Africa, accounting for 90% of growth in these two parts of the world (United Nations 2017). In the rapidly changing world with increasing global population, massive urbanization and climate change, feeding cities will certainly be a major challenge to sustainability in the coming decades. In this chapter, taking the cases of two Asian cities, Singapore and Hong Kong, we will elucidate the mounting challenges for and grappling responses to urban food security in the age of vulnerability complicated largely by climate change.

Cities are resource-intensive places, despite only taking up 2% of the earth's surface; they consume 75% of global natural resources and produce equal amounts in carbon emissions (UNEP 2013). However, cities are also regarded as crucial sites for sustainable solutions especially where urban food systems are concerned (Ilieva 2017; Sonnino 2018). Urban food systems improve food security, defined by the FAO as when "all people, at all times, have physical and economic access to sufficient, safe

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and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO 2018) and contribute to the Sustainable Development Goals by reducing hunger and poverty, improving health, addressing inequality as well as reducing greenhouse gases through cutting down waste (Lang and Barling 2012; Shaw 2007; Ericksen 2008; Sonnino 2009).

Emerging sustainable urban food systems strategies (UFSS) yielded many insights into how cities developed plans on both a policy and governance level as well as grassroots and community level to tackle the issue. A combination of top-down and bottom-up initiatives can be observed, the term governance captures the "non-hierarchical modes of coordination, steering and decision-making" (Cattacin and Zimmer 2016) to describe the mixture of urban actors from both private and public sectors in addition to formal government structures (Zvolska et al. 2019). However, the vast majority of these case studies are based in Europe, Australia, and the United States (Ilieva 2017; Haysom and Tawodzera 2018), and there is a gap in the literature documenting cases in metropolitan cities in Asia. Taking into account how the next spurt of growth will take place in Asia (and Africa), this chapter offers a timely contribution to the global debate on food security by offering case-specific discussion of Hong Kong and Singapore, two of the four tigers in Southeast Asia, to map out some of the similarities and differences and also to offer a comparative study of how these two cities have approached the question of food security in the twenty-first century.

Singapore and Hong Kong exemplify the vulnerabilities of metropolitan food systems: as wealthy global cities, both are fully urbanized, capital-rich but resource-poor. Heavily dependent on imports, its population nevertheless has an appetite for premium energy-intensive foods. Scarcity and excess go hand in hand, while there is still want in the population, waste is also an issue. Against this backdrop, the chapter seeks to address three critical research questions: (i) Despite economic prosperity, why are both Singapore and Hong Kong vulnerable to food security? In other words, what are the central challenges both cities facing in ensuring food security? (ii) What is the current state of food security in terms of demand and supply in both cities? (iii) What broader responses and policies do both cities have to battle food insecurity for its growing inhabitants and to what extent are they successful? This chapter is intended to offer an understanding of how vulnerable highly dependent food-importing countries or cities like Singapore and Hong Kong

can survive in increasingly urbanized, capitalistic, and environmentally eroding world.

Challenges for Urban Food Security

A close examination of our complex inextricable global food system reveals a number of core factors contributing to urban food insecurity around the world (Ericksen 2008). As cities offer lucrative jobs and modern amenities, there is an increasing trend of rural–urban migration, especially in Asian agricultural nations. Hence, even as billions of additional people need to be fed, fewer people will be working as food producers and less land will be allocated for food production. FAO, on the question of the trends related to the future of food and agriculture, identified a number of challenges (Table 7.1).

The four pillars of food security, as identified by FAO, are food availability, access, utilization, and stability (FAO 2006). We can discern a number of challenges associated with these pillars (Table 7.2), grouping

Table 7.1 Trends related to future agriculture and food system

No.	*Challenges and trends*
1	A rapidly increasing world population marked by growth "hot spots," urbanization, and aging
2	Diverse trends in economic growth, family incomes, agricultural investment, and economic inequality
3	Greatly increased competition for natural resources
4	Climate change impacts from extreme weather effects, droughts, floods, crop diseases, etc.
5	Plateauing of agricultural productivity for many crops and animals
6	Transboundary pests and diseases
7	Increased conflicts, crises, and natural disasters
8	Persistent poverty, inequality, and food insecurity
9	Dietary transitions affecting nutrition and health
10	Structural changes in economic systems and employment implications
11	Increased migration
12	Advanced food production systems and resulting impacts on farmers' livelihoods
13	Persisting food losses and waste
14	New international governance mechanisms for responding to food and nutrition security issues
15	Changes in international financing for sustainable development

Sources Adapted from FAO (2017) and Calicioglu et al. (2019) [no copyright issue]

Table 7.2 Challenges for urban food security

1.	Availability and stability
	• Sustainably improve agricultural productivity to meet increasing demand
	• Ensure a sustainable natural resource base
	• Address climate change and intensification of natural hazards
	• Prevent transboundary pests and diseases
2.	Access and utilization
	• Eradicate extreme poverty and reduce inequality
	• End hunger and all forms of malnutrition
	• Improve income-earning opportunities in rural areas and address the root causes of migration
	• Build resilience to protracted crises, disasters, and conflicts
3.	Systemic challenge
	• Make food systems more efficient, inclusive, and resilient
	• Address the needs for coherent and effective national and international governance

Sources Adapted from FAO (2017) and Calicioglu et al. (2019) [no copyright issue]

into three main clusters: challenges related to food availability and stability, challenges related to food access and utilization, and systematic challenges (Calicioglu et al. 2019).

Cities like Singapore and Hong Kong, where efficient infrastructure including affordable transportation and grocery facilities and numerous home delivery services are readily available, the physical "access" component of food security is not a major concern. Also, due to global trade and geopolitical significance, these two cities are regarded as Asian tigers inhabited largely by wealthy people. The "utilization" component in these two cities is a minor issue. Although obesity epidemic is still a major issue in the developed urban centers, today the overall burden of this epidemic and other chronic diseases is greater in the developing countries (Malik et al. 2013; Szabo 2016; Wang 2019; Assem et al. 2019). The food "availability" in terms of consumption patterns, food production, and supply process as well as food "stability" in terms of disaster preparedness, resilience, supplies, and policies are far more critical for these two cities. Although access and utilization are crucial for food security, our study mainly focuses on food availability and stability that have broader implications for sustainable food systems in both Singapore and Hong Kong. Figure 7.1 shows the framework of our analysis.

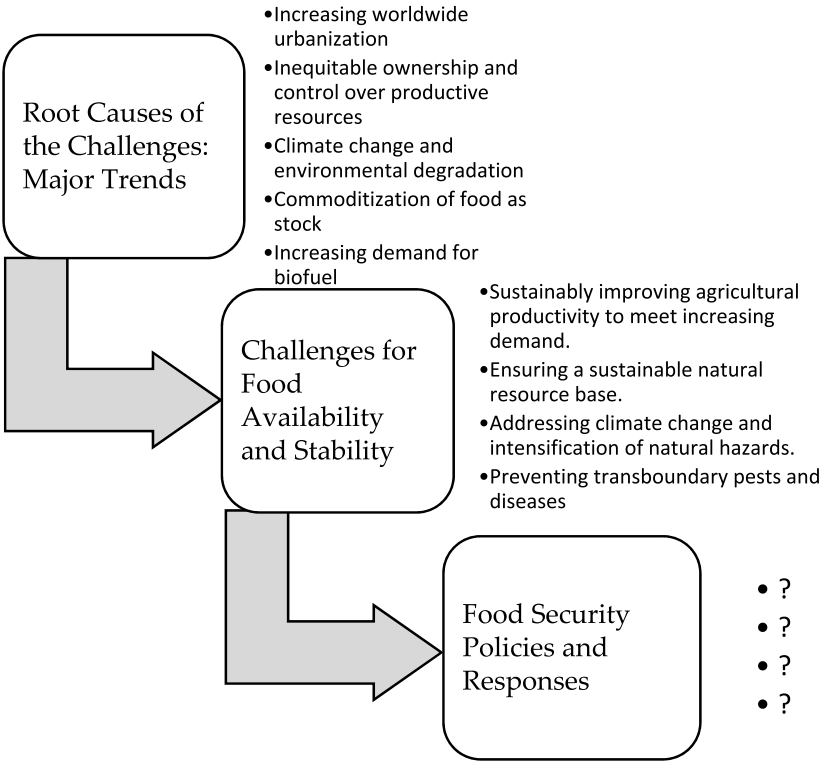

Fig. 7.1 Study framework [Authors' own; no copyright issue]

Materials and Methods

This chapter is based on a robust content analysis substantiated by a number of primary methods employed in both Singapore and Hong Kong in order to gain deeper insights into the food security dynamics. For the content analysis, we examined relevant materials in order to capture trends or patterns in food production systems and food security studies across the world. A number of approaches and variables suggested by academic journals to understand urban food security were identified and critically analyzed. Along with credible peer-reviewed sources, we also collected and examined other soft sources such as newspapers, government documents, and internet reports for our analysis.

For the Singapore case, the content analysis provided a bulk of data for our analysis, yet we employed focus group discussion, informal interviews, and ethnography to substantiate our findings. Three separate focus group discussions were held with three significant groups: the Agri-food and Veterinary Authority of Singapore (AVA) officials ($N = 9$), the NTU Food security expert group ($N = 10$), and regional experts on food security ($N = 15$). Informal qualitative interviews were conducted with 21 consumers, 5 food traders, and 3 government officials—a total of 29 respondents. We gained critical information regarding choice, habit, expectation on food security, and grocery and dining venues from the consumers; origin, management, demand, forecast, and regulations of various food commodities from the food traders; and various ways in which AVA is managing food security in Singapore from the AVA officials. For our ethnography, we visited wet markets in Jurong and Little India as well as a number of supermarkets such as Fairprice, Giant, and Prime Supermarket. We also visited a number of high-tech agrifarms in the Kranji areas. Taken as a whole, a combination of methods provided with us a comprehensive understanding of the complex issue of urban food security dynamics in Singapore.

For the Hong Kong case study, content analysis also provided the bulk of data for our analysis which was then supplemented by fieldwork and site visits, interviews, and participation observation. Over the course of research, the investigator visited 2 peri-urban farms and 2 rooftop farms, interviewed 6 local farmers, visited 10 local wet markets and 10 supermarkets in various districts, and interviewed members of staff from 2 food charities and interviewed 12 beneficiaries from food assistance programs. Taken as a whole, the research aims to get a holistic view of how food security is understood from different levels, from policy formulations to public reception. The 32 interviewees were stakeholders from a cross-section of the food system, farmers, retailers, consumers, charities, and their respective service users.

We employed almost similar methodologies in two cities: Content analysis substantiated by ethnography and qualitative interviews. Due to local dynamics, we used focus group discussions in Singapore as an additional method for consistency check, while participant observation as an additional method for Hong Kong. Singapore is robust in government policies and therefore the focus group discussion with the AVA, for example, was necessary; while Hong Kong has more civic activism and therefore the

participant observation as an additional method was necessary. Taken as a whole, we tried our best to employ a robust triangulation of methods in both cities to capture the comprehensive dynamics for our analysis.

Foodscape in Singapore and Hong Kong

Singapore embraced remarkable transformation over the decades. Known widely as a "fishing village" in the precolonial era, Singapore was transformed as an Agricultural Hub in the 1960s producing 80% of its poultry demand, 60% of vegetable, 100% of eggs, and even exporting pork to neighboring regions before it became a trade hub for the world some fifty years later. It is now one of the wealthiest countries per capita in the world. Although small in size (721.5 km^2), Singapore has a GDP of around 486 billion dollars (Per capita GDP 57,714.30 USD in 2017). It is now widely known for its crystal skyscrapers and perfectly clean streets and not for its pork production (Eisenberg 2017).

With a population of 5.2 million people and a land area of 723 km^2, very little of Singapore's landmass has been allocated for the purposes of food production; the priority has been to build a modern urban city. In fact, the total farming area has declined by more than 9.5% since 2002 as the urbanized nation state has continued to develop. In 2011, only 729 ha or 1% of available land was allocated for food production. When the total food output from all the local farms is combined, it only accounts for 23% of eggs, 4% of fish, and 7% of leafy vegetables consumed (AVA 2010). As such, Singapore is highly dependent on food imports. It imported more than 90% of its food from 31 countries (AVA 2018). Figure 7.2 shows the major items imported by Singapore in 2017–2018.

Over the years, the household income for all income groups in Singapore increased, with households in the higher brackets registering higher income growth rates (AVA 2018). The increasing affluence of Singaporeans affects their food needs in two ways: quantity and quality. The average Singaporean's diet has seen an increase in chicken, pork, beef, vegetables, and hen eggs. There is a growing demand for high-end premium foods too. This trend is reflected in the increasing number of upscale supermarkets such as FairPrice Finest that "aimed at bringing the *fine* life closer to shoppers." The first FairPrice Finest outlet opened in 2007 and in only six years, FairPrice Finest expanded their operations to nine outlets. Examples of premium fare available at the store include live oysters from Australia, musk melons, Kyoho grapes and wagyu beef from

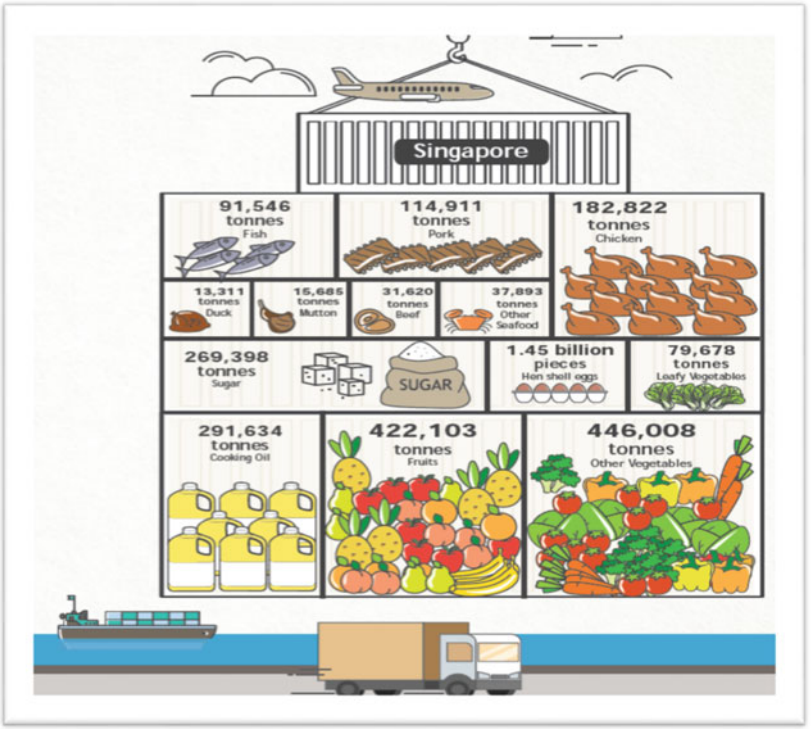

Fig. 7.2 Major food items imported by Singapore in 2017–2018 (AVA 2018) [public document; no copyright issue]

Japan, organic sugar from Brazil, organic eggs from New Zealand, Extra Virgin olive oil from France, and gourmet coffee from Italy (AVA 2018). Currently, FairPrice Finest supermarket chain has 25 locations in Singapore, including one at the Jewel Changi Airport (78 Airport Boulevard) (SHOPSinSG 2020).

Questions arise whether Singapore can continue to supply more and higher quality food as an increasing percentage of the population enters the upper and middle classes, and how these premium supermarkets can affect the economic access and nutritional welfare of citizens from the lower classes who cannot afford such luxury goods. Interestingly, in 2018 and 2019, Singapore topped the Global Food Security Index of 113

countries (GFSI 2019). Although Singapore scored high on food security measures such as affordability, availability, and safety, it is, as noted in the report, very vulnerable to climate and natural resource risks (EIU 2018; Koh 2018).

Hong Kong, alongside Singapore, is known as one of the four dragons of Southeast Asia because of its intense pace of modernization and urbanization. The city also had its humble beginnings as a fishing village and had a strong agricultural sector in the 1950s–80s, producing enough vegetables, livestock, poultry, fish, and seafood as well as rice and tea to support 30–40% of what the population consumed. Today Hong Kong has become a financial center, with a GDP of 340.1 billion USD (46,000 USD per capita) (PSR 2016), it is ranked 10th highest in the world. Like many urbanizing cities, agriculture was left behind as Hong Kong's economy took off. The lack of public investment in research and development coupled with continual decline of farming resources such as labor and land contributed to the fall in local production over the last five decades. In 2015, there are only around 4300 farmers left in Hong Kong, a far cry from 26,131 in 1986. Despite having nearly 4500 hectares of agricultural land, 84% is fallow and only 685 hectares are currently farmed producing a mere 1.7% of the population's consumption of vegetables (NGMR 2017; AFCD 2018).

With a population of 7.3 million and a landmass of 1106 km^2, Hong Kong relies mainly on imports, spending 5.26% of its GDP on buying food. The most important food source is Mainland China, which provides much of the city's fresh food needs: 94% of fresh pork, 100% of fresh beef, 92% vegetables, and 66% of its eggs (PSR 2018). The city also imports substantial amounts of chilled and frozen meat from Brazil, Australia, the United States, and New Zealand. Fresh fruit and vegetables, live and frozen seafood come from Thailand, Indonesia, the Philippines, and Norway (Figs. 7.3 and 7.4).

Hong Kong households spend on average 27% of their income on food (HKSAR 2016), and corresponding to global trends, increased affluence is also correlated to increased meat consumption. It is reported that Hong Kong consumes 664 g of meat/capita/day, equivalent to two pieces of 10 oz steak (Yau et al. 2018), one of the highest in the world. As consumer demands for resource-intensive and premium produce are high, supermarkets, which account for 56% of all retail food sales (USDA 2017) have shown continual expansion in premium and upscale outlets. Socioeconomic inequalities are a major challenge to food security in affluent

Fig. 7.3 Hong Kong food import map (*Credit* Jensen Choy) [no copyright issue]

Top 15 Countries of Food Import into Hong Kong by Quantity

Countries	Quantity	%
China	2,042,706,411	27.8%
USA	1,045,153,118	14.2%
Thailand	886,501,076	12.1%
Brazil	523,965,182	7.1%
Australia	238,744,246	3.3%
Netherlands	210,252,154	2.9%
Vietnam	197,429,763	2.7%
Chile	168,519,568	2.3%
Germany	156,711,703	2.1%
South Africa	155,076,952	2.1%
Japan	143,840,785	2.0%
Korea	143,502,292	2.0%
Philippines	109,156,742	1.5%
Malaysia	104,718,716	1.4%
Taiwan	98,020,583	1.3%
Other	1,122,366,845	15.3%

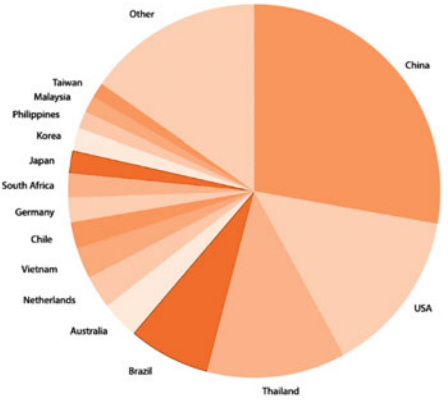

Fig. 7.4 Hong Kong food import figures (*Credit* Jensen Choy) [no copyright issue]

cities like Hong Kong and Singapore. From a macro-perspective, high-income countries are rated as more food secure due to their capacity to source food and lower average percentage of household income spent on food. While on the whole, wealthy cities fare better, this macro-perspective does not illuminate the polarized distribution of wealth, with an income disparity measured by the GINI index of 0.539 for Hong Kong and 0.458 for Singapore, the lowest 20% of Hong Kong's population spend 43% of their income provisioning for food (PSR 2016; NGMR 2017).

Responses to and Policies for Food Security

The Singapore Story

As Singapore imports more than 90% of its food from more than 31 countries worldwide, it is very difficult to solve Singapore's food insecurity without looking at the global picture. The issue, as expressed by the interview and focus group respondents, is thus whether supplying countries can continue to provide Singapore with food over the next 50–100 years. Without any increase in farm productivity from continued use of science and technology, an additional 1.6 billion hectares of land globally will be needed by 2050 to grow enough food (Syngenta Global 2012). This leaves Singapore with only two options: increasing the yield per unit of land or increasing the total area for agriculture. However, as stated earlier, due to greater urbanization and ecological devastation, increasing the total land area for agriculture might not even be possible. It is therefore vital to promote sustainable agriculture using modern techniques on a far greater scale, as the amount of arable land per person is in decline. Singapore responded to this crisis with the following strategies.

(i) *Singapore Food Fund*: As part of a larger push for ensuring a stable food supply, Singapore Food Fund was initiated in 2008 with the recommendation of the National Development Ministry and the Trade and Industry Ministry. In 2010, the AVA allocated $10 million to support local companies and farmers to enhance the production and import of leafy vegetables, eggs, and fish. The goal of this fund was to produce 30% of eggs, 15% of fish, and 10% of leafy vegetables Singapore consumes (Eco-Business 2011).

(ii) *Becoming a Food Research and Development Hub*: Due to land scarcity, Singapore may not be an agricultural hub, but it wishes to be an experimental hub and testing ground for different kinds of farming technologies and innovations. According to Feng (2012), a crop research laboratory in Singapore has developed a new type of rice that repels the brown plant hopper insect and is resistant to the viruses it spreads. The brown plant hopper is dangerous to rice crops in Asia because it feeds on them and spreads viruses which stunt their growth. By putting together knowledge and expertise from both the public and private sectors, Singapore sees itself in taking the lead in areas such as development of seed banks and improving seed varieties, farming systems, and post-harvest technologies for vegetables, breeding and farming systems for fish, and waste treatment and management systems. Such facilitation and technology transfer have a great potential in allowing Singapore to empower rural farmers in its supplying countries and improve their productive capacity (Teng et al. 2014). These were also echoed by the AVA officials during the focus group discussions.

(iii) *Increasing Fish Supply through Vertical Fish Farming*: Singapore is on track to reach its target for producing fish locally. Its 130 fish farms produced 10% of local consumption (5916 tons) in 2017 up from 4.5% in 2009 (AVA 2018). The AVA, targeting to raise this figure eventually to 15%, has been working closely with 120 coastal farms and 10 inland farms, providing different kinds of technical and research supports. The rise of vertical fish farming is another new initiative that promises to boost Singapore's fish production. Land-based fish farming is now moving toward multilayered fish farms on land, evading both the growing problem of land scarcity in Singapore and the vulnerability of sea farming, which can fall victim to pollution and plankton blooms (Lee 2012; AVA 2018).

(iv) *Jilin Food Zone*: In order to meet a substantial portion of its future food needs, Singapore supported a multi-billion-dollar proposal led by Temasek Holdings for a commercially driven enterprise that involves developing an "agricultural zone" twice the size of Singapore (1450 km^2, with a core area of 57 km^2) in the Chinese province of Jilin. This ambitious project, known as the Sino-Singapore Jilin Food Zone (SSJFZ), represents a "strategic

step towards securing a safe, reliable, and sustainable supply of pork for Singapore in the long run," as opined by an AVA official. Investors have so far settled in the start-up area of SSJFZ and the first of the goods produced under the "Brilliance 430" brand, particularly the famed Jilin rice, has been launched for sale in Singapore. In December 2016, a batch of 60 tons of Japanese sticky rice from the Jilin Food Zone landed at FairPrice Xtra hypermarts and Finest supermarkets (Tan 2015).

(v) *Urban and Peri-Urban Agriculture (UPA)*: AVA has helped to develop six agrotechnology parks to promote agrotechnology-assisted food production methodologies in Singapore. The parks are well maintained and are equipped with modern infrastructure and facilities. The parks take up a combined land area of about 1465 hectares and are located at Lim Chu Kang, Murai, Sungei Tengah, Mandai, Nee Soon, and Loyang (AVA 2012a). Despite land scarcity in Singapore, a total of 700 hectares of land in the agrotechnology parks were allocated to 224 farms in 2012, while an additional 36 hectares of land outside the parks were allocated to 25 farms. The allocations include freshwater fish farms, layer farms for egg production, marine fish farms, goat and cattle farms, vegetable farms, orchid and floriculture farms, and ornamental fish farms. There were, in addition, 119 coastal fish farms (about 93 hectares of sea space) in the coastal waters of Singapore (AVA 2012b).

(vi) *Research and Development of Local Fisheries (R&D)*: To improve the quality of local produce while simultaneously achieving higher yields, as AVA officials reveal during the focus group discussions, AVA's research and development projects mainly focused on breeding, disease control, nutrition, aquaculture and vegetable production systems, and various post-harvest technology. AVA has two R&D centers for aquaculture. Research relating to marine aquaculture is carried out at the Marine Aquaculture Centre (MAC), while freshwater aquaculture research is done at the Sembawang Research Station (SRS). MAC was mainly established to oversee the development of tropical marine food fish aquaculture technology. It has succeeded in developing fish fry that are fast-growing and good-quality for intensive farming. AVA also conducts R&D projects with other private and public institutions. The knowledge, technology, and expertise exchange can

add to synergies and deliver greater productivity and outcomes in research. For instance, AVA collaborated with Temasek Life Sciences Laboratory (TLL) on a "Selective Fish Breeding" project that aimed to develop cutting-edge genomics tools to find out, for example, Mozambique tilapia and Asian sea bass with good traits for breeding, fast growth, and disease resistance (AVA 2012b; 2018).

(vii) *Reducing Food Wastage*: Singapore is losing about 1 billion USD a year due to food waste. Although food waste is responsible for 10% of the total waste generated in Singapore, only about 17% of the food waste is recycled. National Environmental Agency in Singapore has recently taken a number of measures to reduce and manage food waste such as consumer education campaigns. According to Teng and Escaler (2011), "these campaigns must include messages that points to actions that consumers can adopt to reduce food wastage and draw attention to cost savings as a result of doing so." Looking at the retail, manufacturing, food service-sector level, strategies suggested by the interviewees include productive recycling of surplus food, improving demand-forecasting technologies, and developing sensor technologies to detect spoilage.

(viii) *Singapore Food Agency*: In order to consolidate all food-related functions—formerly carried out by the Agri-Food and Veterinary Authority of Singapore (AVA), National Environment Agency (NEA), and the Health Sciences Authority (HSA)—the Singapore government has introduced a new institution called Singapore Food Agency (SFA). SFA had set a target for 30% of homegrown food in Singapore by 2030, up from 10% now. Along with the "availability" component, SFA is working as a single umbrella to focus on access, utilization, and stability dimensions of food security (Wong 2018).

The Hong Kong Case

Compared to Singapore, Hong Kong does not have a clearly articulated urban food systems strategy as such; however, emerging initiatives on both a government and community level have begun to address different aspects of food security, creating a form of governance that is both formal and informal, bottom-up and top-down, involving private and public

actors. In the following, we will adumbrate current responses and indicate opportunities and challenges for further development. Overall, the government's attitude toward food security is in line with its neoliberal values, so the response is largely market-driven in nature. In terms of local production, the Agricultural, Fisheries and Conservation Department (AFCD) pursues a high-value strategy. Going premium was identified as the way to help farmers sustain their livelihoods and a strategy to maintain competitiveness in a market-driven economy (AFCD 2018; EB 2014). Since the 2000s, the AFCD established a pilot conversion scheme for farmers to convert to organic farming as an extension of going premium. Hong Kong Organic Resource Center was established two years later and is currently the certification body for local organic production. To date, there are around 300 organic farms in Hong Kong (AFCD 2018; LCS 2019).

In order to reduce health risks and environmental pollution, the government aims to phase out animal husbandry, and has introduced a Buyout Scheme and a Volunteer Surrender Scheme for Poultry and Pig Farms in 2008, 2005, and 2006, respectively. The production has dropped despite annual figures showing a 94.6% increase in poultry supply, but that is due to a drastic cut to importing live chickens from mainland China due to the avian flu (LCS 2019). In addition to land-based production, new methods such as hydroponic and aquaponic cultivation were also included as part of the modernizing strategy for agriculture. In 2013, the Vegetable Market Organisation and AFCD established the Controlled Environment Hydroponic Research and Development Centre to explore and promote alternative methods of production, particularly models that are not dependent on land. The R&D center experiments with vertical cultivation, energy-saving technologies, and produces vegetables in shorter cycles in controlled indoor environments. Out of the 37 hydroponics farms, some have been set up privately in industrial buildings; however, without having changed the Town Planning Ordinance in parallel to support the use of industrial spaces for hydroponic farming, many farms face rezoning issues. Despite conservative policy initiatives, the public has responded with keen interest in urban agriculture. Driven by a combination of food scares and increased awareness for food and well-being, many urbanites have turned to growing their own food. Interviewees report concerns about unknown amounts of chemicals used in commercial produce and feel more confident about the health benefits if they produced their own. Subdivided

agricultural plots of land provide allotments for families, while rooftop farming provides opportunities to grow in the heart of the city. In the last 10 years, over 60 rooftop farms have sprung up in the city (AFCD 2018; EB 2014).

The major challenge to producing food in the city is land, with real estate prices being one of the highest in the world, land is at a premium in Hong Kong. The scarcity, however, is man-made. There are 4400 hectares of agricultural land in Hong Kong of which 3686 hectares are left fallow. The government's rehabilitation initiative resulted in 22 hectares being successfully rented out to tenants in the last 5 years. This is not due to a lack of demand, as there are still 400 applicants waiting to be matched. The issue is to do with land ownership as 78% of the abandoned land is privately owned. This historical legacy has its roots in colonial times, where leasehold grants are sold by auctions or tenders (Dwyer et al. 1971). Selling land at a slow pace to the highest bidders was a very profitable model, accounting for 33% of government revenues between 1970 and 1996. Because of this controlled scarcity, developers are incentivized to hoard, buying up cheap agricultural land in the 1960s as land stock. Two major developers hold 56.8 million square feet of agricultural land, accounting to 1% of all non-built-up lands in Hong Kong (Poon 2011a, b).

The New Agricultural Policy launched in 2015 earmarked HKD$500 million for the Agricultural Development Fund aimed at modernizing and promoting sustainable agriculture. A key element is the setting up of Agri-Parks, which provides educational services to schools on the one hand and nurtures agrotech and agrobusiness on the other. Agriculture Priority Areas were also identified which will be supported for continued farming, and some 50 hectares of fallow farmland were promised to tenant farmers while the rest would be rezoned for development (FHB and AFCD 2014). Zoning is at the heart of contention between agriculture and development, both in the cases of industrial buildings for hydroponics, but also the rezoning of agricultural land. The policy has been criticized as a disguise to regain agricultural land for real estate development. Local farmers were also critical, saying that areas designated for farming are insufficient, lacking infrastructure and located even further out in the New Territories. Chuk, one of the farmers bitterly said "the only thing they know how to grow on our lands are buildings, not vegetables" referring to the policy.

Food waste is a major issue for cities, in Hong Kong, Municipal Solid Waste (MSW) is the single largest category of waste being thrown away at landfills, around 9000 tons everyday, of which 40% are putrescibles, organic matters that decompose and create greenhouse gases. Food waste constitutes the majority of putrescibles and the government has set the goal of reducing 40% by 2022, from 3600 tons a day to 2160 tons a day over the course of 8 years. This multipronged approach consists of 4 steps: the prevention and reduction of food waste at source through mobilizing the community, including the donation of surpluses; promoting separation and sorting of waste for better recycling; and an emphasis on food waste to energy where it is transformed into biogas or electricity as a form of renewable energy (Fig. 7.5). This aggressive target is largely due to the saturated landfill sites in Hong Kong, which are expected to be at capacity in 2020 (EB 2014).

Food waste management is another major policy area which touches food security. This is run by the Environmental Protection Department overseen by the Environment Bureau, responsible for environmental protection, energy conservation, and sustainable development. In 2014,

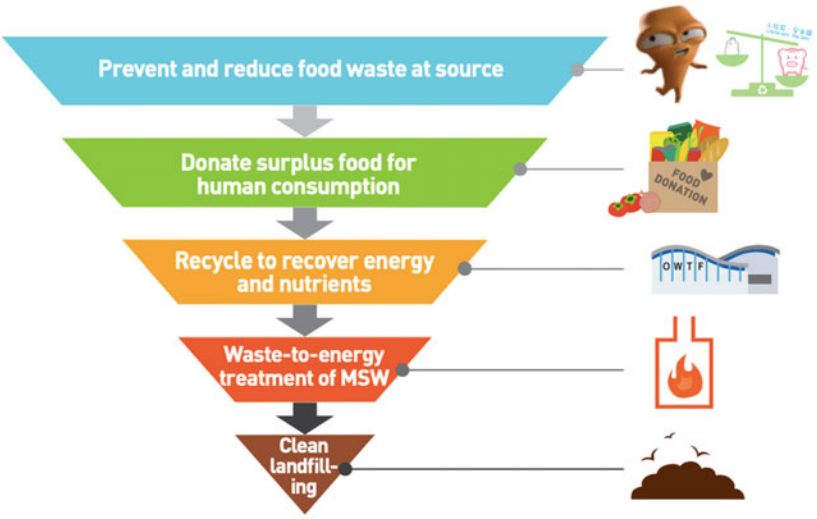

Fig. 7.5 Food waste and yard waste plan for Hong Kong 2014–2022 HKSAR Environment Bureau 2014 (EB 2014) [no copyright issue]

the Environment Bureau published a *Food Waste and Yard Waste Plan for Hong Kong 2014–2022* proposing a strategy that could be largely grouped into three areas—policy, social mobilization, and infrastructure. The two largest categories of the hierarchy: of prevention and reduction of waste at source and donating surplus for human consumption have been undertaken mainly as a social campaign, with sharing of best practices being promoted in the C&I sector and awareness-raising campaigns held in schools with $150 million HKD earmarked to retrofit schools to portion smaller meals on site. The Food Wise Campaign established in 2012 was expected to reduce 5–10% of the city's food waste by 2017/18 but figures continued to be on the rise. In terms of policy and legislation, this takes the form of MSW charging scheme, where quantity-based charging will be introduced to industries as well as private consumers (EB 2014). In terms of infrastructure, the Organic Waste Treatment Plant has been envisaged to employ anaerobic digestion technology to break down organic matter while producing biogas that can be converted to energy. The newly established OWTF in Siu Ho Wan is currently in operation and has a capacity of 200 tons a day and is currently in operation. If proven successful, the government plans a total of five to six for the city (Trading Economics 2020; EB 2014).

Conclusion

Like many other urban centers, both Singapore and Hong Kong face similar challenges with regard to their food security; however, they demonstrate different ways of response. On the whole, it could be observed that Singapore's development is driven by strong state policies, while Hong Kong's efforts are mainly led by civil society, advantages can be seen in both top-down and bottom-up approaches and insights from the comparison could help both cities move toward food security. The major vulnerability of Hong Kong and Singapore's food system is its heavy reliance on imports; and while self-sufficiency is not the goal, there is nevertheless a need to build resilience by anticipating the consequences brought about by volatilities in the global food supply chain. The immediate price hikes exhibited in the Hong Kong case study demonstrates how brittle the current systems are. Diversifying importing countries could alleviate some of the risks, and Singapore's partnership in the Jilin Food Zone offers an interesting model to consider for land-constrained cities; however, interruptions to transport and border logistics could still

pose a risk as the most recent Corona virus outbreak demonstrates. In this regard, urban agriculture has been embraced by both cities as one of the ways to improve food availability. The Singapore Food Agency places its focus on increasing productivity, setting a goal of providing 30% of its nutritional needs by 2030 (Mahmud 2019). The strategy to increase yield is mainly through technology, using vertical farming for vegetables and protein sources such as fish. Despite similar farmed land area of 700 hectares, Singapore produces 38,000 tons—7% of their own consumption, 2.5 times more than Hong Kong's 14,900 tons, and 1.7% of its consumption (Szabo 2016). Clearly, a centralized drive from the Singapore government is much more effective in terms of increasing yield with little land resource input.

Urban agriculture in Hong Kong's governmental strategy took to quality over quantity, encouraging farmers to go premium and organic in the 2000s. This did answer the public's desire for more local produce in response to food scares and health concerns. Seasonal local produce has shorter, more transparent supply chains which alleviated the publics' distrust of goods from China. The increase in public demand saw an increase in land being farmed and production of market crops—the first time in forty years. The amount of land used for market crops went up from 408 to 419 hectares, and from 265 to 270 hectares for orchards. However, the increased availability of local produce does not necessarily answer to the needs of the food insecure as local, especially organic and premium produce are above market price, which does not answer to the requirements of food security. Personal allotments or other forms of informal urban farming on the other hand answer more directly to the needs of the food insecure as the distribution pathways are more direct (Opitz et al. 2016). While demographic groups in urban agriculture are context specific—it could be a lower income as well as middle-class neighborhood. But across class divide, it has been observed that the produce from the allotments go more directly to the growers and their immediate social network answering more to household needs.

Despite the low average household income spent on food, both Singapore and Hong Kong have a large income disparity and a significant number of its population live below means. While food insecurity does not appear as chronic hunger, malnutrition and undernutrition do affect low-income groups. In the case of Hong Kong, charities and community organizations actively fill the gap, using a combination of donation and surplus food rescue to provide for those in need, however this is

not a sustainable solution in the framework of food security. It has been observed that there is an increased trend of premium supermarkets in both Hong Kong and Singapore, as supermarkets constitute a significant proportion of the food retail market, a presence of affordable food outlets should be maintained to avoid imbalance.

The chapter shows that Hong Kong and Singapore face similar challenges with regard to their food security despite their economic prowess. Heavy reliance on imports remains the number one vulnerability. Singapore's state-driven policies and investment in agritech have shown to be effective in terms of boosting yield and increasing self-sufficiency. The Singapore government's initiative to launch the Singapore Food Association (SFA) combining food-related activities, entrepreneurship and trade under one umbrella is a timely effort to boost its availability, access, utilization, and stability dimensions of food security. Hong Kong could benefit from a stronger governmental directive and a clearer goal to put food security on the agenda. On the other hand, Hong Kong's civic society is active, demonstrating a desire to have access to healthy, safe, and nutritious food. Small-scale urban agriculture has become popular which has the potential to fulfill both the availability and access requirements of food security needs of households. Social ventures and community partnerships offer an alternative model to market-driven solutions. Charities bridge the gap for those who are in need, often working within communities to provide food, but also other forms of support to the socially vulnerable. A combination of top-down and bottom-up initiatives would be most effective in terms of facing the challenges of food security. A stronger partnership between government, private small and medium enterprises and grassroots organizations could ensure the delivery of policy initiatives. A strong educational program could also alter attitudes toward food consumption in the long run, creating less pressure on our ecosystem.

Despite similar challenges yet diverse responses, there are multiple avenues in which both Singapore and Hong Kong can learn from each other's experience with regard to food security. While strong state policies for food security need to be accompanied with a vibrant grassroots food movement in Singapore, what Hong Kong needs is just the other way round.

Note: Md Saidul Islam and Daisy Tam claim equal authorship for this chapter.

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