Food Security and Community Bonding in a Globalised City-State: The Case for Urban Farming in Singapore

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Agriculture—including horticulture, livestock, fisheries, forestry, and fodder and milk production—is increasingly spreading to towns and cities.

Globally, food matters—big time. From farm, to factory, then market shelf and table, the global food system generates up to one-third of all anthropogenic greenhouse-gas emissions.[1] And whilst climate instability increasingly threatens agricultural yields,[2] anticipated population increases and dietary changes are likely to increase global food demand by 70 percent by 2050. [3]

During the same period, the human population is projected to grow ever more urbanised, with 66 percent of the world's people due to live in cities by 2050 (compared with 54 percent in 2014).[4] The world has seen a rise in international migration since 1990,[5] and the global pace of population ageing is increasing.[6] Both of these trends are more pronounced in more developed regions. As cities sprawl over former agricultural land, and the children of rural farmers migrate to cities to pursue new opportunities, more responsibility for food provision may fall upon city governments and businesses, urban sites, and even city-dwellers themselves. Cities must also seek solutions to help integrate and accommodate the social needs of populations of diverse origins and generations.

The Republic of Singapore stands out from its region in its record of rapid economic advancement despite very limited natural resources, and it is noted for its integrated approach to land use planning and implementation of infrastructure, from housing to transport and green spaces. Now, as the globally-networked city-state faces new challenges including climate change, an ageing population, and low native birth rates, its government and people must consider how to ensure the population is well-nourished both bodily and culturally, whilst advancing the local economy, promoting social cohesion, and minimising environmental impact. In this context, it is interesting to explore how some international trends regarding food production and consumption manifest in one of the world's wealthiest and most densely populated countries.[7]

The need for sustainable urban agriculture

A recent report by an international coalition of agricultural experts urged that "widespread uptake of sustainable practices in the agriculture and food supply chains is essential to meet current and future threats to food security and environmental resilience."[8]

Urban and periurban agriculture already produces up to 15 percent of the world's food,[9] providing the majority of food for 800 million people,[10] a number roughly equivalent to the populations of the United States and European Union combined. According to the Food and Agriculture Organization of the United Nations, "the rapid growth of cities in the developing world is placing enormous demands on urban food supply systems. Agriculture—including horticulture, livestock, fisheries, forestry, and fodder and milk production—is increasingly spreading to towns and cities. Urban agriculture provides fresh food,

Singaporean attitudes to farming

Eating is said to be Singapore's national pastime, and many citizens pride themselves on their detailed knowledge of where to buy the best local dishes, at the best price. Yet, with notable exceptions, general interest in the root sources of food (the how and why of how ingredients reach plates) is considerably less intense. This appears to be changing, as Singaporeans take growing interest in issues of food security and the links between nutrition and health, and seek ways to connect meaningfully with their heritage and their communities.

Singapore's compressed period of modernisation since 1965 has seen a dramatic contraction in the amount of land dedicated to agriculture. During the colonial era, a large percentage of Singapore's land area was given over to plantations growing commodity crops for export, such as gambier, spices and rubber.[21] In the 1960s, the decade within which Singapore gained independence, many residents were still involved in agriculture, with about 20,000 farms taking up 140 square kilometres of land.[22] According to one source, during this time "most farmers and fishermen were poorly educated and they used traditional farming methods."[23] The government began licensing farms in 1968, and from the 1970s onwards, many traditional farmers were relocated to accommodate new development and privilege a new style of more intensive farming. While the amount of land and number of workers dedicated to farming steadily decreased, economic yields increased.[24] This pattern was intensified in the 1980s and 1990s through the formal creation of "Agrotechnology Parks", which cluster in the northwest of the island and occupy approximately 15 square kilometres.[25]

In 2015, Singapore had about 200 food farms, including 130 fish farms, 50 vegetable farms, and 3 egg-producing farms.[26] Some of the traditional style farms that remain, notably within the "Kranji Countryside" area, integrate educational and recreational activities with their crop-growing functions. These numerically less-productive farms are subject to challenges by competing land uses, an ever-present reality in a land-scarce country.[27]

As of 2013, only 0.9 percent of Singapore's 720-square-kilometre-large land area was given over to farming, compared with 4.9 percent in similarly dense financial capital Hong Kong and 23.9 percent in neighbouring Malaysia, with Singapore ranking third lowest globally in this regard.[28] This percentage has decreased from 10 percent in the 1980s, despite the island nation having expanded its total land area through land reclamation during that time to accommodate industrial, business, transport and recreational

generates employment, recycles urban wastes, creates greenbelts, and strengthens cities' resilience to climate change." [11]

Moving up Maslow's hierarchy of needs, in cities across the developed world from Toronto to London, Seoul to Sydney, a growing "locavore" movement, wherein people strive to eat as much locally grown produce as possible, "dovetails with an increasing awareness of the health benefits of choosing fresh vegetables and fruits over highly processed foods. In response, municipalities, nonprofit organisations, developers, and entrepreneurs are bringing agrarian practices into the city, shrinking food deserts,[12] helping educate people about gardening practices, and reconnecting city dwellers to the source of their food." [13]

A growing body of research in fields including public health, psychology, and leisure studies examines the social, environmental, economic, and health benefits of food growing by urban communities.[14] Community-focused urban agriculture can provide opportunities for intercultural exchange, and strengthen social ties and neighbourhood attachment.[15] Urban agriculture can create employment, education and entrepreneurship opportunities for a wide variety of people.[16] Urban agriculture that involves sweat equity can lead to savings on food costs.[17] Community gardeners enjoy access to fresh, nutritious foods.[18] Participation in urban agriculture may also contribute to mental health[19] and brings with it the benefits of physical activity.[20]

1. Preschool students tour Green Circle Farm, Kranji, to learn about organic farming techniques (Photo: Zero Waste SG).

uses. In comparison, 8 percent of land area is currently dedicated to parks and nature reserves.[29]

Economically, measured in terms of value added as a percentage of GDP, agriculture is a negligible industry in Singapore (0.0 percent in 2014), the lowest of international rankings for all countries with available data.[30] This puts it in the company of other wealthy, land-constrained nations like Hong Kong (0.1 percent) and Luxembourg (0.3 percent).[31]

Singapore currently imports 90 percent of its food from overseas.[32] Malaysia and China are the country's number one and two suppliers of fruits and vegetables,[33] with other key food exporters including the United States and Australia.[34] The Agri-Food and Veterinary Authority of Singapore (AVA), the body tasked with ensuring a "resilient supply of safe food",[35] states that its "primary strategy . . . is to diversify our food sources [to include a wide range of international suppliers]. This is to reduce reliance on any single country and allow us to switch quickly to alternative sources when the need arises."[36]

This source-diversified, import-reliant approach earned Singapore second place in The Economist Intelligence Unit (EIU)'s 2015 Global Food Security Index, which ranks countries' food security according to criteria of affordability, availability, quality and safety. Food affordability, for which the EIU judged Singapore to be first worldwide, appears to be a key factor in the city-state's high ranking.[37] According to the AVA, after source diversification, "local production is an important secondary strategy in ensuring food supply resilience for Singapore."[38] Local farms currently provide 26 percent of the eggs consumed in Singapore, 8 percent of the leafy vegetables and 8 percent of the fish. AVA aims to increase these levels to 30 percent, 15 percent and 10 percent respectively, within an unspecified period.[39]

To increase local productivity, AVA has a specific kind of cultivation in mind: "as land is scarce in Singapore . . . farms will need to achieve even higher productivity and use farmland more efficiently."[40] An AVA spokesman explained that "some farmers from the older generation need

help" in learning the necessary tools and methods to intensify land use and that AVA helps to facilitate technology transfer accordingly.[41] Interestingly, Singapore's relatively low level of "public expenditure on agricultural R&D" was the sole challenge identified by the EIU in its food security ranking assessment.[42] However, a government funding scheme to help local farms upgrade production and develop technology has existed since 2009, and AVA's new SGD 63 million (USD 44 million) Agricultural Productivity Fund (APF) aims to cultivate local farms and landscape nurseries "into a high-tech and innovative sector that makes efficient use of land and labour resources."[43] At the same time that the APF was launched, AVA also announced new licensing conditions including land use specifications and minimum production levels.[44] In the past 10 years, investments in new agricultural technology have contributed to a 30 percent increase in local vegetable yields.[45]

Improving food security

Advanced technology is tasked with addressing the global challenge of climate change and the local challenge of land scarcity in part by decoupling farming from the very elements that used to define it: the vagaries of weather (for example, through enclosed, temperature controlled environments) and the need for traditional soils (for example, through the use of hydroponic and aeroponic systems). Estimated climate change impacts on Singapore include a rise in mean temperature of 1.4 to 4.6°C by 2100,[46] and a less predictable water supply. While this approach is often framed in terms of practical adaptation to a changing climate, it also often seeks to mitigate environmental impact

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security. "We often talk about food security in the quantitative sense such as having enough to eat," say the members of the Foodscape Collective, "but it is time to now look at it also from the aspect of preserving the integrity of our food sources [including] how the food is produced and its social and environmental sustainability such as food miles, as well as environmental and social impact on the local community."[50] The Collective goes on to link this with a form of urban agriculture that engages citizens directly with growing their own food, identifying in Singapore "a growing interest in securing food that is grown organically, free from pesticides, chemicals; food that does not harm the environment, promotes biodiversity and is sustainably grown. In fact, many people are motivated to grow their own food for this reason: to promote and nurture better health not only for their family, but also for the environment and society they live in."[51]

Renewing interest in local agriculture

Consumer interest in locally grown food seems to be growing, despite it often being more expensive than imported alternatives.[52] There is also evidence of rising popular interest in growing plants, whether for leisure, ornamental, or consumption purposes. Growing edibles like vegetables and herbs is especially popular—in recent years, the Singaporean press has frequently reported stories of individuals, families, and micro-enterprises from all walks of life that have taken to growing food plants in their own residential spaces, from public housing corridors to back yards.[53] Organisers of local harvesting and cooking classes and farming-based educational and leadership workshops both report increased demand.[54] At a collective level, Community in Bloom (CIB), a gardening programme initiated by the National Parks Board (NParks) in 2005, has seen the number of registered community gardens, increase to over 900 across the island by 2015. Nearly 80 percent of CIB gardens grow edibles and herbs[55] and an edible growing competition organised by NParks

in the attempt to reduce the resources that must be expended, for example, on irrigation and food transport.

The focus on cultivating new technologies and local agribusiness as an area for economic growth aligns with the national economic development strategy, which has shifted to emphasise Singaporean innovation and small-to-medium enterprises.[47] A frequently-cited example of the export potentials of locally-incubated agri-tech business is Sky Greens, a vertical growing system that has generated interest in China, the Middle East and beyond.[48] Another example of intensive agriculture, which adapts international technology for the local context is Singapore's first indoor vegetable farm certified by AVA, a project by Panasonic. This indoor, multitier, LED-lit farm uses Japanese technology and seeds, with locally-sourced fertilisers and soils to grow pesticide-free vegetables. By enabling more frequent and stable year-round harvests, the Panasonic farm aims to contribute 5 percent to Singapore's local production of root and leafy vegetables by 2017, at up to a 50 percent cost savings compared with premium imported produce.[49]

In contrast to Singapore's prevailing import- and technology-focussed strategies, some local activists propose an expanded definition of food

2. The Sky Greens vertical farming system rotates crops to access natural sunlight. (Photo: Sky Urban Solutions Holdings).
3. Crops within Panasonic indoor farm in Singapore are grown in vertical racks, and with the aid of LED lights (Photo: Panasonic Factory Solutions Asia Pacific).
4. Mr Derrick Ng grows edible greens in the corridor outside his Housing and Development Board flat (Photo: POSB NeighboursFirst.sg, as seen on www.neighboursfirst.sg).
5. The first place winners of Community in Bloom's 2015 edibles competition (Photo: National Parks Board).

6. At Comcrop, located on the rooftop of the SCAPE building in Orchard Road, crops are grown using vertical farming techniques in water pipes, which also use recycled water from fish tanks (Photo: Cybil Kho).
7. Open Farm Community, a project by Edible Garden City, offers diners a farm-to-table approach (Photo: Johan Lim and Open Farm Community).
8. Comcrop Co-Founder and Chief Executive, Allan Lim (Photo: Dixie Wu).

in September 2015, received over 900 entries.[56] Some community gardens emphasise helping the needy, either through direct donations of excess produce to underprivileged households in their local area, or by working with charitable organisations. In 2014, AVA organised a series of workshops to train community gardeners how to grow vegetables, and convened a Community Farmers Market, which brought together gardeners to sell their edible produce to raise funds for charity.[57]

The Singapore government supports the ground-up interest in food growing, along with the more production-focussed initiatives. "There are many value propositions for urban farming in Singapore that go beyond local food production. It fosters closer interaction, and community bonding, and provides a great platform for partnership between people, public and private sectors," says Woo Wee Meng, Secretariat of the Ministry of National Development (MND)'s Taskforce for Urban Farming (TURF).[58] Led by MND, and comprising a range of member agencies, TURF was formed at the start of 2014 to implement recommendations from a cross-agency study group that researched international precedents, and examined the potentials of urban farming for Singapore.[59]

The taskforce's scope for urban farming covers "farming in non-agricultural land, such as commercial buildings, public housing estates, and vacant interim state land, as well as unconventional spaces like rooftops and indoor spaces."[60] Notably, this scope is distinct from the activities already taking place on traditionally designated farmland, and includes nonprofit, community, and commercial operations.

TURF's initial focus has been on "capability and ecosystem building; as well as facilitation of local and foreign interests in urban farming in Singapore."[61] Woo explained, "As urban farming in unconventional spaces is still a fairly nascent field in Singapore, there are certain policy impediments that need to be worked through among agencies. TURF therefore plays a facilitative role in creating synergies amongst the public, private and people sectors."[62]

Meanwhile, a new breed of agricultural entrepreneurs seeks to match Singaporeans' enthusiasm for consuming tasty food with a deeper appreciation for how, and where, it is produced, and to bridge the gap between top-down demand for production and bottom-up desire for engagement. Two such businesses that have attracted popular and official interest as potential partners for furthering the potentials of urban farming are Comcrop and Edible Garden City. Employing creative commercial models that privilege social benefits, both companies are growing edibles in non-traditional locations in central Singapore, and attracting a younger generation of Singaporeans to take part.

Comcrop occupies an area of 500 square metres on the roof of SCAPE, a shopping mall targeting the young adult market in the middle of the prime shopping district Orchard Road.[63] The company employs a vertical aquaponic system that cycles the waste of live tilapia fish to fertilise tomato, herb and leafy green crops growing above. Its monthly capacity as of 2014 was 3,000 kilograms of vegetable produce.[64] In addition, harvested fish are sold in a local wet market. The company seeks to provide "meaningful employment" for young people and seniors alike and to "inspire a sense of hope" amongst Singaporeans. (See interview with Allan Lim).

Whilst Comcrop is a relatively high-capital business, Edible Garden City operates a service model. It works with restaurants, hotels, schools, and charity partners to design, install, and manage on-site edible gardens, often drawing on principles of permaculture and biodynamic agriculture. It also holds events to reconnect urban-dwellers with nature and conducts workshops for businesses to learn about sustainable agriculture. The company describes itself as a champion of a "Grow Your Own Food" movement and emphasises productive reuse of small city-centre spaces. Its current major project, Open Farm Community, has transformed a former golf course into a community garden, café, playground and events space. (See interview with Bjorn Low).

The future of urban farming in Singapore

Reflecting on Singapore's substantial food security achievements, some experts caution that "the next 50 years are likely to be more complex as alternative possibilities depend on external forces and are subject to global change over which the city-state will have no control."[65]

Given demands for intensification of scarce

land area, signs point to an ever more closely integrated mix of uses, which could see a wide range of buildings and spaces hosting food growing, a trend already evident in recent buildings like the Khoo Teck Puat Hospital,[66] and in plans for future developments by the Housing and Development Board.[67] Other speculative areas of progress include the dramatic reduction of local food waste, a focus of recent government and civil society public education campaigns;[68] the location of high-tech greenhouses on bespoke ships moored in Singapore's waters; or the initiation of international contract farming in large, stable countries like Australia or the United States.[69]

The achievement of any of these possibilities will require further clarification and integration of relevant government agency jurisdictions, and coordination (or productive competition) amongst a diverse ecosystem of public, private, and nonprofit actors, not forgetting the role of Singaporean citizens—the end recipients of such efforts—whether they are city farmers or enthusiastic eaters. CG

In their own words: Allan Lim, Comcrop[70]

My interest in urban farming started off with a political motivation. The 2011 General Elections highlighted the sense of uncertainty in Singapore. My friend, and now business partner, Kenny and I discussed how growing food for people could be a way to connect communities. Growing food is more material and practical as compared to connecting through social media.

There are currently seven members of staff—four seniors and three youths. The idea is to run a for-profit business with a social mission. It has an ambition of closing the gap between more abled and less abled. The farm creates meaningful work for seniors (compared to working at the food court, for example). Our younger farmers are involved in daily operations, which include analytics, plant health, and data collection.

The farm has to remain relevant to people through its location in the centre of the city—it increases convenience as compared to travelling to Kranji.

Volunteers come to the farm on Saturdays. The farm will usually host about 20 people during one session. They are very diverse and vary across age from 16 to 70 years old. Each has different motivations and skill sets. They mostly help in harvesting and also to figure out how to engage technology, like solar panels, in farming work.

The young people who first joined us had a pioneering spirit. Comcrop has a clear vision that makes it attractive to youths: practical technology, which enhances efficacy and productivity, and the higher calling of meaningful work.

Our volunteers and visitors derive different benefits from taking part. Parents who bring their kids give them a firsthand experience about sustainability and science. Young adults enjoy being exposed to the nature in the city, relieving stress. The greater public enjoy the problem-solving experience.

We are not about being cool or the hip factor—this is not a theme park. In our communications, we emphasise being authentic and honest about the happenings of the farm to ensure sustainability in the long run.

The cost of living is high in Singapore—prohibitive. The opportunity cost to younger workers is tremendous. Our ability to access horticultural expertise in Malaysia is lacking, and it is challenging to obtain necessary pest control, fertiliser and soil products that are not readily available in Singapore.

Singapore is a unique case. We are bound by resource constraint to a tremendous extent—space, water, price of soil. We have to focus on productivity much more than other cities with hinterland. The source of inspiration in urban farming is that we have to involve the community rather than import a solution.

Being in an Asian society, I believe that "food binds" and brings the whole community together, so growing edible crops is important. I wonder how Singaporeans can be persuaded to buy or pay more for local produce. It is important that Singaporeans embrace our own food growing culture (as compared to air-flown food).

I hope that Comcrop's success gives people a sense of hope—that we can grow our own food even in a city.

In their own words: Bjorn Low, Edible Garden City[71]

I thought there was a more sustainable way to live and noticed a growing disconnection with food amongst many cities. I worked as a volunteer on organic farms abroad, and then I did a diploma in biodynamic agriculture and a farm apprenticeship the United Kingdom. When I came back, initially I looked for spaces to farm in Kranji, but its high entry cost made it unattainable. Then I started looking at urban spaces. The opportunity arose when I had friends who owned restaurants that were trying to grow their own food by themselves but were going nowhere. So we set up an herb garden for them. These were followed by schools, then hotels. Now we are seeing a surge of property developers wanting to integrate edible gardens into their building plans before development.

We are made up of a team of 12 employed staff and apprentices. My colleague Rob is the only one who is agriculturally experienced, the rest are ex-corporate employees. We are trying to find a sustainable model so that we can keep staff and pay them a "liveable" wage. Most of our employees don't want to focus on using the skills from their previous jobs, since they are working with us to get away from those sorts of tasks. We run a traditional landscaping model—designing, building, and maintaining gardens. For some projects, we are paid a flat fee. For private developers, we try to approach them during the development phase of their project so that we can get a designated budget for landscaping of the garden. It is financially easier to incorporate gardens in new buildings than to add them to existing ones, because post-development budgets tend to be much lower. For our current project, Open Farm Community, the Spa Esprit Group have taken a share of our business, which is a more commercially-sustainable model. They pay us for landscape development and maintenance of the gardens.

To us, education is key. We are currently involved with about five schools with devising an entire curriculum, even including their

own farmers' market. But I've noticed that the schools that have engaged us are mostly schools for mentally challenged or "low achiever" students.

We have seen a great surge of people interested in volunteering with us and wanting to learn. I think the work that we do with restaurants is a draw to the young and hip. I also think that interest in local food growing has also been recent growing global trend; Singapore tends to lag behind these trends by several years. Also, our annual pop-up events, which incorporate food, music, and art, have attracted a more diverse group of people who are not only drawn by the farming aspect but the entirety of that movement.

I feel that we have achieved our goal for the commercial sector. And we are fully aware of the inequality issue if we remain only serving high-end restaurants.

Ultimately, we want to create an industry around urban farming, for example, community gardens. We want to empower people to grow their own food, for example those working in offices where there is plenty of climate-controlled space for growing could become part-time urban farmers.

South Korea has recently had a very big push to create community farms and the model is non-commercial, although there is one aspect that is commercial (a central facility that tests foods for biosecurity and has an integrated shop where produce can be sold). Similarly, in Singapore, a central organising body is needed to regulate the semi-commercialised industry to make it commercially-viable.

Looking forward, I'm also interested in increasing Singaporeans' knowledge and use of native herbs in community gardens and of tropical edibles to help avoid the common use of polytunnels.

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