

ISSUE 14 • JAN 2019

# URBAN SOLUTIONS

---

## Interview

Giuseppe Sala  
Ngiam Tong Tau

---

## Opinion

KF Seetoh  
Lily Kong

---

## Essay

Max Opray  
Thinesh Kumar  
Elyssa Ludher &  
Tan Poh Hong

---

## City Focus

Seattle

---

## Case Study

Singapore  
New Taipei City  
Wageningen  
New York City

---



— Food Secure Cities —

A bi-annual magazine  
published by

CENTRE for  
**LiveableCities**  
SINGAPORE

SEE YOU AT

# WORLD CITIES SUMMIT 2020

5 – 9 JULY 2020

STAY TUNED FOR MORE DETAILS!

[www.worldcitiessummit.com.sg](http://www.worldcitiessummit.com.sg)



## URBAN SOLUTIONS

ISSUE 14 • JAN 2019

**URBAN SOLUTIONS** is a bi-annual magazine published by the Centre for Liveable Cities. It aims to equip and inspire city leaders and allied professionals to make cities more liveable and sustainable.

Set up in 2008 by the Ministry of National Development and the Ministry of the Environment and Water Resources, the Centre for Liveable Cities (CLC) has as its mission “to distil, create and share knowledge on liveable and sustainable cities”. CLC’s work spans four main areas – Research, Capability Development, Knowledge Platforms, and Advisory. Through these activities, CLC hopes to provide urban leaders and practitioners with the knowledge and support needed to make our cities better. [www.clc.gov.sg](http://www.clc.gov.sg)



CLC is a division of



### Advisory Panel

#### Dr Liu Thai Ker (Chairman)

Chairman  
Centre for Liveable Cities

#### Benny Lim

Special Advisor  
Centre for Liveable Cities

#### Tan Gee Paw

Special Advisor  
PUB, Singapore’s National Water Agency

#### Prof. Marilyn Jordan Taylor

Professor of Architecture and Urban Design  
University of Pennsylvania

#### Prof. Rahul Mehrotra

Founder Principal of RMA Architects

### Editorial Team

#### Joanna Tan

#### Nicole Chew

#### Tan Pei En

### Editorial Consultant

#### Alvin Pang

### Design Consultant

#### Redbean De Pte Ltd

**URBAN SOLUTIONS** welcomes feedback from readers.

### Contact

#### Joanna Tan

T +65 6645 9560 E [MND\\_CLC\\_enquiries@mnd.gov.sg](mailto:MND_CLC_enquiries@mnd.gov.sg)

45 Maxwell Road #07-01, The URA Centre

Singapore 069118

ISSN 2301-3540 (print)

ISSN 2301-3532 (e-version)

© 2019 Centre for Liveable Cities, Singapore

Opinions expressed in **URBAN SOLUTIONS** do not necessarily represent the views of CLC. While the publisher has taken reasonable care in compiling the magazine, it shall not be liable for any omission, error or inaccuracy.

E-version: [www.clc.gov.sg/research-publications/publications/urban-solutions](http://www.clc.gov.sg/research-publications/publications/urban-solutions)

### Image Credits

- 4 – 11: City of Milan
- 12: Milan Urban Food Policy Pact
- 14: Centre for Liveable Cities
- 16: Dean Hochman - <https://flic.kr/p/oN8lvU>, CC BY 2.0
- 16-17: Sustenir Agriculture
- 17: Agri-Food & Veterinary Authority of Singapore
- 19: Seng Choon Farm Pte Ltd
- 20: Lou Linwei/Alamy
- 21: Apollo Aquaculture Group
- 30 – 31: Community Garden Builders
- 32: Didier Zylbering/Alamy
- 33: Zero Carbon Food
- 34(1): Prinzessinnengarten: wachsen lassen! - <https://flic.kr/p/dE6c1c>, CC BY-NC-SA 2.0
- 34(2): Prinzessinnengarten: wachsen lassen! - <https://flic.kr/p/de1eAK>, CC BY-NC 2.0
- 35(1): Deu Horta Na Telha (Facebook)
- 35(2): People’s Daily, China (Facebook)
- 37: CC plantagon, Illustration: Sweco
- 38 – 39: Metabolic
- 40: Dimitri dF - <https://www.flickr.com/photos/dimitridf/431851672/in/photostream/>, CC BY NC ND 2.0
- 41: Sky Greens
- 42: World Fish - <https://www.flickr.com/photos/theworldfishcenter/6325396890/> CC BY-NC-ND 2.0
- 44: DC Central Kitchen - <https://www.flickr.com/photos/dccentralkitchen/21998378685/in/album-72157659132670399/>, CC BY 2.0
- 45: Francesca Castelli - <https://www.flickr.com/photos/franciui/25899594590/>, CC BY-NC-ND 2.0
- 47: Michelle Robinson - <https://www.flickr.com/photos/michmutter/8130184052/>, CC BY-NC-ND 2.0
- 48(1): Michelle Robinson - <https://www.flickr.com/photos/michmutter/8130186324/>, CC BY-NC-ND 2.0
- 48(2): William Cho - <https://www.flickr.com/photos/adforce1/6036636784/>, CC BY-NC-ND 2.0
- 50: Courtesy of National Archives of Singapore
- 51: British Council Singapore - <https://www.flickr.com/photos/britishcouncilsingapore/5499360834/>, CC BY-NC-ND 2.0
- 52: szlady - <https://www.flickr.com/photos/ozlady/2215803963/>, CC BY-NC-ND 2.0
- 52 – 53: British Council Singapore - <https://www.flickr.com/photos/britishcouncilsingapore/5499356440/>, CC BY-NC-ND 2.0
- 53: Bryan Allison - <https://www.flickr.com/photos/bryangeek/84264223/>, CC BY-NC-ND 2.0
- 55: Centre for Liveable Cities
- 56: Aerofarms
- 57: Photo courtesy of Alesca Life, [www.alescalife.com](http://www.alescalife.com)
- 58(1): Nick Gammon/Alamy
- 58(2): Beladon
- 59(1): EnerGaia
- 59(2): Elyssa Ludher
- 60: Image courtesy of JTC
- 62 – 63: Jonathan H Lee, [subtlestreams.com](http://subtlestreams.com)
- 65(1): Seattle’s Office of Sustainability & Environment
- 65(2): Seattle Neighbourhoods P Patch Community Gardens Program
- 67: Seattle’s Office of Sustainability & Environment
- 68: Jonathan H Lee, [subtlestreams.com](http://subtlestreams.com)
- 69: Greenwalksblog, <https://www.flickr.com/photos/29476346@N08/3748689510/>
- 71, 72(2): Centre for Liveable Cities
- 72(1): People’s Association
- 74: Centre for Liveable Cities
- 75: People’s Association
- 79(1): The Journalist
- 79(2), 80: Education Department of New Taipei City Government
- 83: ZEye
- 84 – 85: Edible Garden City
- 86, 87(2): Thinesh Kumar
- 89: Foodvalley NL
- 90: Wageningen University & Research
- 91 – 92: Foodvalley NL
- 93: Solynta
- 95: Tony Hisgett - <https://flic.kr/p/89Qygf>, CC BY 2.0
- 96, 98: Brooklyn Grange Rooftop Farm
- 97: “Hortorium” by Adrian Coleman
- 99: Richard Levine/Alamy

[info@worldcities.com.sg](mailto:info@worldcities.com.sg)

[@worldcitiessummit](https://www.facebook.com/worldcitiessummit)

[@World Cities Summit](https://www.linkedin.com/company/world-cities-summit)

[@The\\_WCS\\_SG](https://twitter.com/The_WCS_SG)

[@WorldCitiesSummit](https://www.youtube.com/channel/UC...)

ORGANISED BY:



HELD IN CONJUNCTION WITH:



HELD IN:



SUPPORTED BY:



EVENT ORGANISER:



- CC BY 2.0 – <http://creativecommons.org/licenses/by/2.0/legalcode>
- CC BY NC – <https://creativecommons.org/licenses/by-nc/2.0/>
- CC BY-NC-SA 2.0 – <https://creativecommons.org/licenses/by-nc-sa/2.0/legalcode>
- CC BY-NC-ND 2.0 – <http://creativecommons.org/licenses/by-nc-nd/2.0/legalcode>

Some original images have been edited for page layout purposes. Every effort has been made to trace the copyright holders. The publisher will correct any omission of due acknowledgement in the online version, and in any subsequent printing.

Cover: Locals in Seattle who participate in the Seattle Department of Neighbours P Patch Community Gardening Program are able to earn an income by selling their produce at markets. Image courtesy of Seattle Neighbourhoods P Patch Community Gardens Program.





## Contents



### INTERVIEW

4 Giuseppe Sala  
A Holistic Approach  
to Urban Food  
Systems

14 Ngiam Tong Tau  
Keep the  
Food Coming



### OPINION

22 Viewpoint: KF Seetoh  
Support Food Hawkers  
to Preserve Local  
Food Culture

26 Counterpoint: Lily Kong  
To Sustain Local Food  
Culture, Go Global



### ILLUSTRATION

30 Urban Agriculture in  
Disused Spaces  
Growing Food in  
Unlikely Places



### ESSAY

36 Max Opray  
Cities: The Solution  
to World Hunger?

46 Thinesh Kumar  
It's No Mirage,  
It's A Food Oasis!

54 Elyssa Ludher &  
Tan Poh Hong  
Producing More  
with Less



### CITY FOCUS

62 Seattle  
Growing Food,  
Cultivating  
Communities



### CASE STUDY

70 Singapore | Food  
Waste Management  
Cooking Food Once,  
Using It Twice

76 New Taipei City |  
Eat with Love  
Free Meal Society

82 Singapore |  
Citizen Farm  
Farming for the  
Common Good

88 Wageningen |  
Foodvalley  
The Silicon Valley  
of Food

94 New York City |  
Rooftop Farming  
Top of the Crops



FROM THE EXECUTIVE DIRECTOR

# Food for Thought

Food is so ubiquitous that we often take it for granted.

But the last decade has seen a rising number of destructive weather events with a devastating impact on crops, as well as numerous food scares—the contamination of baby milk in China in 2008 and the recent recall of romaine lettuce in the United States are just two memorable cases. Such events have prompted cities to take a closer look at their food sources.

Through conversations with city leaders at the forefront of the urban farming movement, case studies and CLC's own research, this issue of *Urban Solutions* explores how cities can address the challenges of producing food efficiently as well as sustainably, and ensuring citizens have easy access to healthy and affordable food.

Some key points are clear:

**Governments must take the lead in ensuring food security.**

The Mayor of Milan Giuseppe Sala shares how the Milan Urban Food Policy Pact brought together 180 cities and towns to collaborate in working towards a comprehensive and sustainable food strategy. Ngiam Tong Tau recounts how Singapore overcame its challenges of insufficient agricultural land and lack of natural food resources. With good urban planning, the city-state has in fact become well-known for its accessible hawker centres and its local food culture. In New York City, a rooftop urban farming industry is flourishing thanks to a nurturing system of grants and thoughtful legislation.

**Communities play a key role.**

On the ground, empowered communities are not only involved, they are leading the way. Citizen Farm has attracted many converts with its closed-loop system that produces edible greens and black soldier flies to process food waste. At Our Tampines Hub, the local community helps to package and distribute recycled food waste produced by its eco-digesters. To ensure school children have easy access to healthy and affordable food, convenience store chains in New Taipei City are working with the city government to provide meals for youth in need through the Eat with Love programme.

**Most of all, a spirit of innovation is needed to see new possibilities.**

Indeed, inspiring examples of cities fostering a culture of entrepreneurship and resilience already exist. In the Netherlands, Dutch companies have banded together to create Foodvalley, an ecosystem of like-minded businesses promoting innovation in urban agriculture. Meanwhile, in cities with limited land for agriculture, urban farms are popping up on barren land and taking root in offices and underground tunnels.

As the effects of climate change become increasingly real, cities must adapt and evolve. We hope this issue of *Urban Solutions* provides insights and inspiration in the movement to ensure sustainable food production for growing populations. I wish you all an enjoyable read.

Khoo Teng Chye

**Executive Director**

Centre for Liveable Cities



Giuseppe Sala,  
Mayor of Milan.



Giuseppe Sala

# A Holistic Approach to Urban Food Systems

**F**ood is an issue that affects everyone. The city of Milan has been championing sound information and strong partnerships in ensuring food security, both at home and abroad. In this interview, Mayor of Milan **Giuseppe Sala** shares how his city has sought to bring together stakeholders from across societies, and even across borders, to ensure the sustainability of a vital resource—through an integrated food policy and other initiatives.

## Food policy is usually developed at the national level. What is the city's role?

Food policy matters at all levels—globally, nationally and locally—because it affects everyone: our communities and livelihoods, our environment, ecosystems and the climate, our nutrition and health. Food policy shapes who eats what, why and at what cost.

Cities are assuming a central and growing role in achieving sustainable development. More than half of the world's population now live in urban areas. World hunger and malnutrition, coupled with (often) hidden poverty and rising inequalities, are increasingly taking on an urban dimension. Food-related issues have become pressing at the city level.

## “Food policy shapes who eats what, why and at what cost.”

For a long time, food production was considered beyond the competence of cities, because food is normally produced outside city limits. Now there is growing recognition of the role cities and local authorities can play in the development of sustainable food systems.

The city of Milan, in my opinion, is a good example of what cities can do with regard to food policy at the local level.

### How is Milan pursuing its urban food policies?

The most significant challenge for implementing urban food policy is developing an integrated governance model, which is fundamental to achieving efficiency. Milan's strategy is to define a holistic framework for the City to work in synergy with different municipal departments and agencies, engage with local stakeholders (i.e. horizontal integration), and connect with Metropolitan and Regional authorities (i.e. vertical integration).

Implementing Milan's Food Policy involves three main approaches: creating projects that can generate institutional legacy, streamlining day-to-day activities, and establishing incentives to generate impact.

After two years, we have achieved many results, particularly in the fight against food waste—one of our most important priorities. One interesting initiative is a city-wide 20% tax reduction for food businesses that donate food to charities. This measure is likely to reach more than 10,000 potential beneficiaries, with an economic impact of 1.8 million euros (\$2.8 million). Another ongoing pilot project is a “Local Food Waste Hub” in three neighbourhoods, where a union brings together supermarkets and corporate canteens to collect their unsold food, which is redistributed as donations. A university lab conducts food flow monitoring, calculating the volume of food that comes through the hub, to understand how to replicate this model in all nine Milan neighbourhoods.

### Milan's Food Policy was the outcome of a collaborative process. How did it come about, and what are its key drivers?

Food is at the confluence of many policies and is a crucial entry point for sustainable development. Since it affects the daily life of all citizens and actors, urban food topics are of common interest to cities in all European countries. Rarely is an issue more cross-cutting than this.

In 2014, the City launched a public consultation, engaging its different departments, universities, Civil Society Organisations (CSOs), start-ups and the private sector: a process which resulted in the Milan Food Policy.

The Milan Food Policy strategises and organises the city's cross-cutting food-related issues, competencies and projects for a period of implementation (2015-2020). It is based on five priorities:

- 1) Ensure healthy food and water for all citizens;
- 2) Promote the sustainability of the food system;
- 3) Promote food education;
- 4) Fight against food waste;
- 5) Support scientific research in the agrifood sector.

The Milan Food Policy is based on rigorous research, with the support of a local foundation and a local research centre. Its implementation is guided by sound scientific data from regularly updated analysis of the local food system.

Political commitment is an important aspect of driving food policy. A Vice Mayor was appointed to coordinate Food Policy implementation, with the technical support of dedicated staff.

## “Food is at the confluence of many policies and is a crucial entry point for sustainable development.”

A ratified document that addresses the city's food issues, a strategic approach and strong political commitment—all these are factors that can help the Municipality achieve synergies and accomplish its ambitious food goals.

### What else has Milan done in engaging with the public to improve its urban food planning and systems?

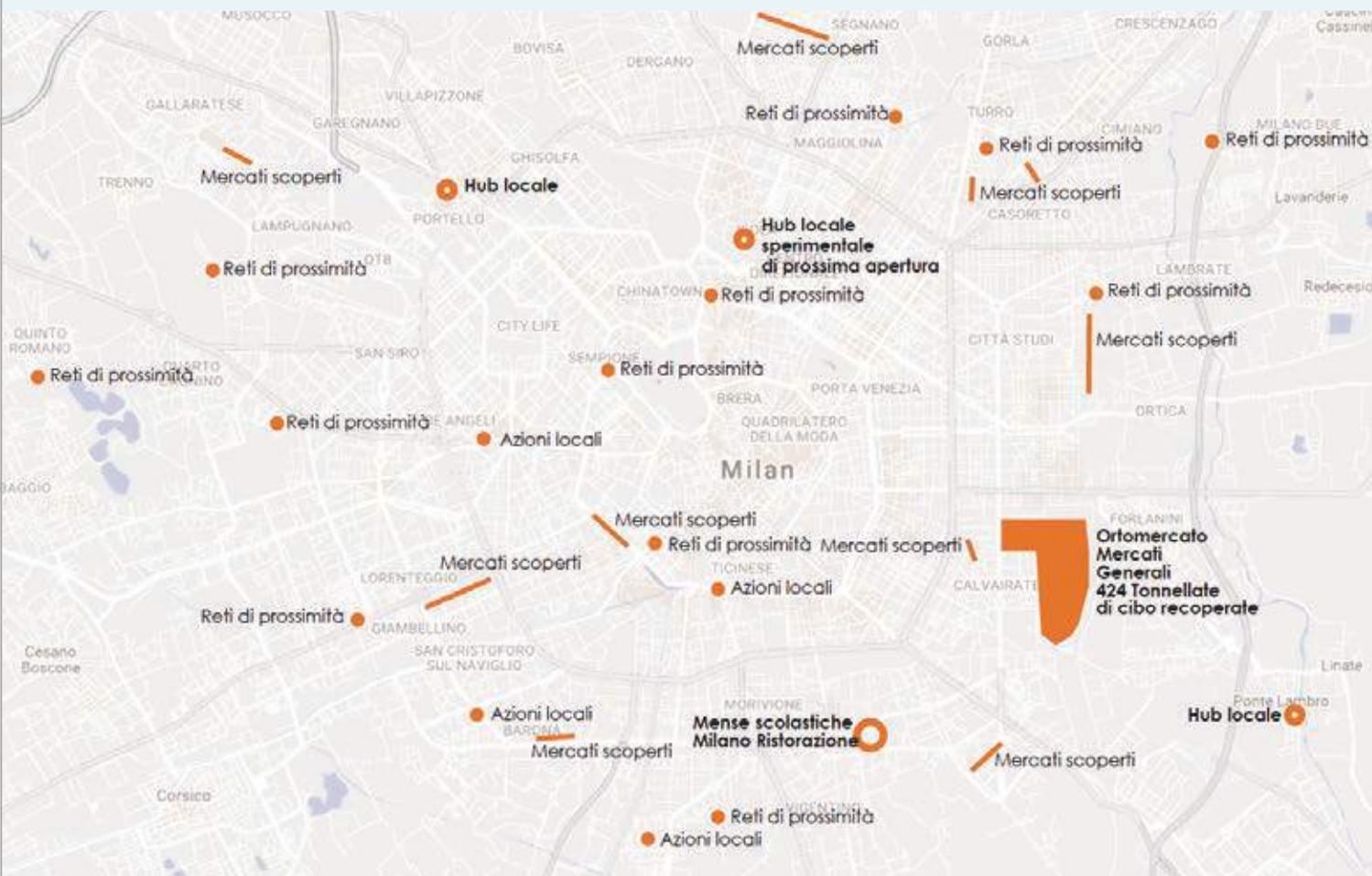
In civic engagement, we often convene local actors: we invite them to build maps of their neighbourhood initiatives, so we can understand how to steer our actions and build consensus.

Milan was chosen as the host city for Expo 2015, which Milan themed “Feeding the Planet, Energy for Life”. It was an occasion to prepare for and work on food issues, and spur political engagement. It led to an ongoing series of food-related discussions among the Municipality, research bodies, CSOs and grassroots groups. Milan has a rich tradition of community groups and associations: these have stepped up to meet this new social need.

### To what extent are Milan's food priorities integrated with efforts to address other urban challenges such as climate change and building resilience?

Food security is the top priority of our Food Policy: this is consistent with the UN's Sustainable Development Goals (SDGs) framework. It is addressed through a range of social, education and economic programmes. The challenge for the City is to achieve this goal by integrating the full range of the policy spectrum.

01



01 Food hubs comprise partners such as street markets (*mercati scoperti*) and school canteens (*mense scolastiche*), which provide leftover food that can be redirected to beneficiaries like soup kitchens.

Several Milan Food Policy initiatives have shown that it is possible to tackle food security with climate mitigation and adaptation, particularly with urban-rural linkages. For example, we have focused efforts on components of the local food system that are under the City's direct supervision, such as school canteens and municipal agencies. We also engage with local actors such as farmer districts, research centres, and other institutions and non-profit organisations.

Through this multilevel approach, we have been able to align local public procurement with peri-urban agriculture patterns. For example, the Municipality of Milan connected school canteens' procurement with the local food supply chain of rice in the Milan Agricultural District (which produces an average of 180,000 kg of rice each year). We are working to achieve similar results with 19 other horticultural supply chains, by supporting the participation of Milan farmers in the Rural Development Programme. This is a financial mechanism to support Lombardy's agricultural and forestry entrepreneurs under the EU Common Agricultural Policy.

#### **What other interesting initiatives has Milan introduced to enhance the urban food system?**

According to our Food Policy, the Municipality should play an active role in providing healthy food, produced in a sustainable way, to certain segments of society: schoolchildren, the elderly, socially vulnerable groups and city employees.

We work with Milano Ristorazione (MiRi), a public company 100% owned by the Municipality, to provide some 85,000 meals to schools and social centre canteens daily.

MiRi prioritises healthy Italian products in its procurement process, preferring local, short chain, organic or integrated production foodstuffs, with some fair-trade products added to the menus.

One of the first initiatives undertaken in school canteens was to reduce children's consumption of salt. To promote healthy food during lesson breaks and also avoid food waste, MiRi designed a "Morning break with a fruit" programme. Fruit is distributed in the classroom as a morning snack, in lieu of other less healthy options, and instead of at the end of lunchtime. Students are then more inclined to eat fruit, and have better appetites to finish their lunches, minimising food waste. The trial programme last year involved 779 classes—this year it is scaling up to all school classes in the Milan area.

We are also building a consensus on food-related issues with other cities. In Europe, we chair the Eurocities Working Group Food—a network of 51 cities interested in food policy. Globally, we work with the C40 Food Systems Network. Through the Milan Urban Food Policy Pact (MUFPP), or simply the Milan Pact, we collaborate with other cities, compare initiatives and work directly with their Mayors on common actions we can take.

#### **Why is it necessary for cities to work together to tackle the world's food challenges?**

While food-related actions are gaining priority in city agendas, they remain challenging because they require the integration of many segments of society, various levels of governance and collaboration between different policy areas.



01 Each of the pavilions at the 2015 Milan Expo was dedicated to food: encompassing technology, innovation, culture, traditions, creativity and how they relate to food and diet.

02 Social enterprise Recup is one of many non-governmental organisations that work to reduce food waste in Milan.

“...cities are more likely to succeed in their efforts by cooperating with other cities with similar goals.”



01



02

Cities implement their food system activities in different ways: some develop comprehensive documents and long-term plans, while others work on sectoral policies and projects. But the long-term ambition is to have a comprehensive and sustainable food strategy.

From our experience with the Milan Pact, we know that cities are more likely to succeed in their efforts by cooperating with other cities with similar goals. Collaboration can be in terms of sharing project outcomes, or a participative process in which a municipality acts as facilitator for a range of stakeholders, such as citizens' associations.

#### **What is the Milan Urban Food Policy Pact (MUFPP) and how does it equip cities to plan for food?**

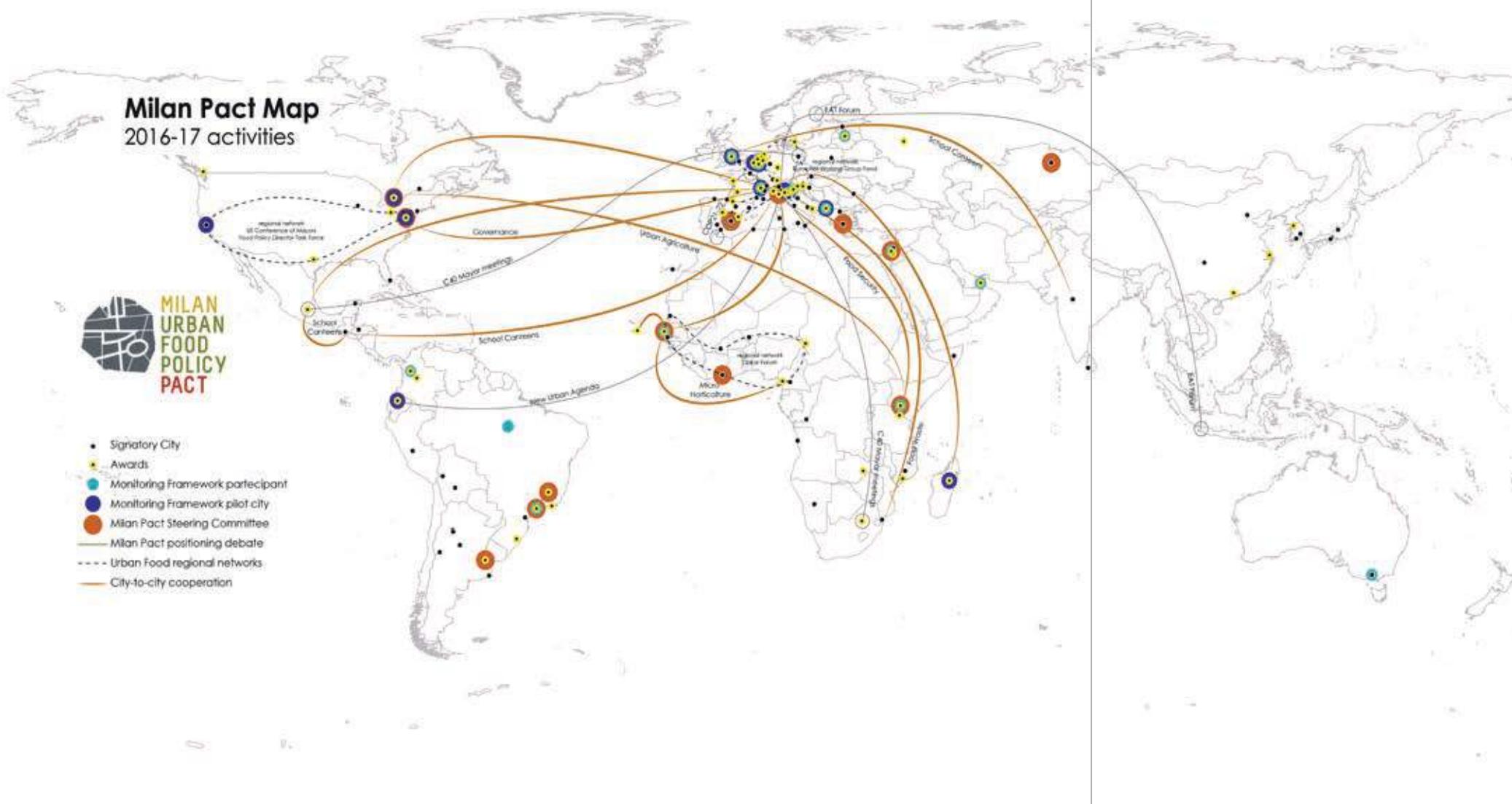
The Milan Pact is one of the main legacies of the 2015 Milan Expo. It brings together Mayors from 180 cities and towns from 62 countries around the world that consider food an entry point for sustainable

development. One of its aims is to foster the exchange of ideas and solutions for food issues among cities. It does so in a variety of ways, such as through the Milan Pact Awards, which promotes the sharing of urban food-related best practices. It also co-develops knowledge products, such as a recent report on food policies and city food practices produced by MUFPP, Food and Agriculture Organisation of the United Nations (FAO) and Italian research centre, EStà. The MUFPP collaborates with international organisations to keep cities better informed about the latest ideas on food systems, which local governments may not have access to.

At the MUFPP Annual Gathering in Tel Aviv in September 2018, we released a framework of 44 indicators to help cities assess their progress towards their food system goals. This was a tool many member cities had been asking for since the launch of the Pact in 2015.

01 Milan's 134 school vegetable gardens expose children to nature, create greater awareness of where food comes from, and encourage interaction across generations and cultures.

02 Serving fruit during snack time both encourages children to eat a healthier diet and minimises food waste.



**The MUFPP Annual Gathering has just completed its 4<sup>th</sup> edition. In what ways has it supported cities in improving their food systems?**

The MUFPP Annual Gathering and Mayors' Summit offers cities and the international "urban food" community an excellent opportunity to meet and engage in substantive dialogue on food-related issues that matter most at the local level. This year's edition saw around 250 participants, including city officials, public administrators, policymakers, professionals and scholars from more than 70 signatory cities and organisations.

The participating cities shared many experiences and initiatives on food policy, healthy and sustainable nutrition, food waste reduction as well as food supply in an era of climate change and sustainable urban procurement.

Cities at the Summit showed strong interest in getting more involved at the technical level in tackling issues related to food systems. They were keen on city-to-city technical cooperation in implementing food-related projects, peer assistance between Pact cities, and urban food system assessment, among other issues. There was also interest in joining forces for a more integrated approach to food systems between cities.

The participants also heard from other stakeholders: food networks, civil society, the private sector and the international research community. Their energy and support have mobilised the Milan Pact from the ground up.

We will follow up on the numerous opportunities and connections surfaced in Tel Aviv, and continue forward with new initiatives. ○



Ngiam Tong Tau,  
Chairman of Sky Greens.



Ngiam Tong Tau

# Keep the Food Coming

Cities can take their easy access to cheap, abundant and safe food for granted. But changing environmental and other conditions can quickly threaten food availability. Drawing examples from Singapore and around the world, former Chief Executive Officer of Agri-Food & Veterinary Authority **Ngiam Tong Tau** reflects on strategies cities can adopt to ensure a safe and sustainable food supply, now and in the future.

## How important is it for cities to maintain a continuous food supply?

People living in cities take food supply for granted because it is always easily accessible from the supermarket. But lately, concerns about climate change have made some of us realise that food may become unavailable if producing countries suffer natural disasters that affect food production. So we do need to keep an eye on the supply of food in the world, to ensure that food can be continually transported to the city and sold at prices that are affordable enough for the poor. If we don't maintain a continuous supply, it could lead to malnourishment and famine.

Famines have occurred throughout history. While they can be due to environmental changes, they can also be caused by policies, by inequality of wealth, or by diseases in the food supply chain. During China's "Great Leap Forward" in the 1960s, it is estimated that 10 million people died of malnourishment—they starved to death. People were made to go to the communes, everybody worked on the farms, and productivity was very low. Coupled with wealth inequality between the cities that grew from the steel industries and the rural areas, it led to a great famine. Another example: Irish farmers in the mid-1900s suffered losses from potato blight, a fungal disease, and people starved from malnourishment. As a result, many of the Irish migrated to America.



01

So the lesson in all this is to keep an eye on the production of food around the world, and be aware of how it might change because of natural disasters or political decisions. Just imagine if Singapore's sea routes were cut off: we wouldn't get food.

**What early challenges did Singapore face in terms of food access and how were they overcome?**

Singapore is a very small country with very little land for farming. In the 1950s until mid-1970s we were able to produce enough fresh food for ourselves: things like pork, chicken, eggs, vegetables and fish. Of course, our population was only about two million at that time.

But as Singapore industrialised, much of the farmland was taken away—from about 15,000 hectares of farmland in the 1960s, we now have less than 1,000 hectares. Just for fresh food alone—and not even considering staple foods like rice—we knew from the very beginning that we would never be able to produce enough food: from the very outset we would have to buy food from overseas.



02

**“It is not ideal to produce 100% locally. You need some competition from imports to keep prices affordable.”**

So we went out and looked for food supply sources. One of the important things we considered was that food supplied to Singapore must be safe. They cannot contain contaminants, poisons or infectious bacteria.

We also decided to continue producing fresh foods in Singapore, as a means of controlling prices and quality. For example, if we grow vegetables in Singapore, we can demand the same quality from exporting countries: it has to be pesticide free. For eggs, it has to be salmonella enteritidis-free. Producing our own fresh foods means we can increase our own production in cases where our food supply sources is unable to supply us with safe, cheap food.



03

But in terms of food supply it is not ideal to produce 100% locally. You need some competition from imports to keep prices affordable.

**What food does Singapore produce or not produce?**

In the 1960s and 1970s in Singapore, we promoted the production of pigs and were very successful. Singapore was self-sufficient in pork. But the smell from the pig farms was not tolerated by city folks, and there was pollution of the waterways by pig waste, so the government decided to phase out pig farming. We had to look overseas for supply, from Australia, Thailand, Malaysia, Europe and America. We started a pig farm in Pulau Bulan, south of Pulau Batam. It is the largest pig farm in the world: a quarter million pigs in one place, supplying Singapore with slightly more than a thousand pigs a day for slaughter.

Likewise, for eggs, in the 1980s we had six egg farms, but nearby residents always complained about the smell from the poultry farms. The government decided to compensate the poultry farms and they closed down. But three persisted and stayed on. Today, one of the major farms, Seng Choon, can control the smell by housing the poultry indoors, scrubbing the air that comes out from the buildings, and treating the waste. With three

egg farms, we can produce almost 30% of the five million eggs we need for consumption in Singapore every day.

Although multi-story farming of pigs is a possibility, you still have to work out the economics of it. But even so I think the problem of smell will be tremendous because pigs produce a lot of waste.

**How has Singapore's high-density environment created opportunities in food production?**

I think our environmental conditions and scarcity of farmlands have pushed our farmers to innovate.

One of our innovations, Sky Greens, is a vertical farm that can produce 10 times more vegetables per unit area of land compared to traditional farming. Sky Greens is the first commercially viable vertical farming system for vegetables in the world, and it has won many awards.

We don't have enough land for farming, so for fish, vegetable and egg farms we have gone vertical. There are many indoor farms in Singapore now, like Sustenir. They control the environment for lighting, carbon dioxide, temperature, and so on, and can grow any vegetable in Singapore, even strawberries, all year round.

01 The abundance of food in supermarkets belies challenges in food supply.  
 02 Sustenir's indoor growing technology achieves clean produce free of soil, pesticides and pollution.  
 03 Trucks of live ducks are delivered into Singapore daily from Malaysia.

If we had large expanses of land, nobody would think about indoor farming or vertical farming. The infrastructural cost is high. But these are things that put us one step ahead of other countries. In 20, 30 years' time, they will also have the same land concerns, and will have to use technologies like what we are using now to produce food.

#### How does Singapore keep food relatively affordable?

Having free trade and an open market helps to keep food prices down in Singapore and allows us to have ready access to food. We have local production to buffer the prices, and we have our importers who are very skilled in buying from overseas, from accredited, safe sources.

For example, Americans do not like to eat chicken wings and legs, so we buy these parts from America for very cheap. About 60% of the pork consumed in Singapore today is imported frozen pork: it is cheaper and of the same quality. Our grain traders also go round the world to buy the cheapest rice, wheat, corn, soya bean and so on.

#### How can technology be leveraged to address urban food needs?

Singapore's biotechnology industry is very well developed and we can influence food production around the world. We are not looking just to benefit farmers in

Singapore—because we know we cannot grow enough—but we can help other countries which are selling food to us to produce at a cheaper cost.

For example, even though Singapore doesn't grow rice, we have the technology to produce disease-free rice, drought-resistant rice. We anticipate that in the future, with climate change, our rice will be in demand. This rice, developed by our Temasek Life Sciences Laboratory, is being grown in Indonesia and in China right now. This will help ensure that there will be a supply of rice back to Singapore.

#### Is it possible for cities to be self-sufficient in food?

Cities can selectively produce some foods, where there's economic advantage for them to produce. For example, vegetables cannot travel very far; they have to be fresh. But cities cannot produce all the food that they require, because there's not enough land for growing food, especially crops; they must always look for other highly productive areas to supply food to them.

The logistics and supply chain, which has improved around the world, has made it much easier for cities to gain access to food. In Singapore we have our fish auction markets, fishing ports, vegetable wholesale centre, as well as our three months' supply of rice stocked in warehouses.

“We don't have enough land for farming, so for fish, vegetable and egg farms we have gone vertical.”





01

Beijing says it can produce enough food in the surrounding hinterland for the whole city of 21 million people. Personally I observed how they brought the vegetables into the city. During winter, truckloads of vegetables are brought in everyday from Yunnan, from Guangzhou and so on to Beijing, by road. Vegetables are auctioned off to buyers in whole lorries.

So for cities like Beijing and New York, being on a continent, their hinterland is the whole continent, in addition to their own country. Singapore is a small island; the Southeast Asian region is our hinterland. We look to our neighbouring countries to supply us with fresh food.

**What would be needed for Singapore to become self-sufficient in some foods, such as leafy vegetables, fish or eggs?**

We would need to set aside some land for intensive farming. With 100 ha of land, we can provide 100% of the leafy green vegetables consumed in Singapore. Right now we have three egg farms producing on 60 ha;

## “Cities can achieve food security by simply having food available and affordable.”

we would need another seven more farms: 140 ha more land, to produce all the eggs we want.

Studies show that by 2030 there will be a decline in the fish population of South China Sea, which we rely on for a lot of our fish supply. So it is incumbent on us to farm fish right now. We can actually produce the fish we need if we maximise the use of our land and sea space, as well as some of the coastal areas for inland fish farming.

The key is to make sure we have a stable supply to meet our needs for critical foods during times of emergency. There is benefit in having some local supply, but over the long term, we cannot actually rely on our own production for all our food needs.



02

**What can Singapore learn from other cities about food security?**

Cities can achieve food security by simply having food available and affordable.

We need to learn from other countries how they bring in food, the logistics of it. We worry in Singapore about what happens if we cannot import a lot of food by ship, so we need to look into alternative logistics of food coming over land.

We need to anticipate what the food supply is going to be like worldwide. With satellites, markets can now estimate how much farm produce is going to be available in six months' time. AVA has an intelligence unit looking into this, so that we can take action to overcome problems if they should arise.

What happens if Thailand is flooded and cannot sell us rice? You need to know alternative areas to get rice from. And you must cultivate this trade. So we need to diversify our sources.

In some cities, small plots of land are given to citizens to grow their own food. In Germany this started after World War II, when food supply was very low. It has become a tradition, and today it is the students who farm in the city. In Japan, the policy is to have rice produced in Japan, because it's their culture. Every empty piece of city land is used to grow rice. But the quantities grown are quite limited, and they are still forced to import some rice. 🍚

Watch the interview here:



<https://youtu.be/oMFbnCrhqH8>

01 People in China go to wholesale markets to shop for fresh produce.

02 Fish are reared locally at Apollo Aquaculture Group without the use of antibiotics and hormones.



OPINION

Viewpoint: KF Seetoh

# Support Food Hawkers to Preserve Local Food Culture



“Singapore’s hawker food culture has evolved and flourished, becoming a national institution in itself.”

Originating on the streets, Singapore’s colourful hawker food culture has become an iconic part of the city-state’s way of life. Noted hawker food champion **KF Seetoh** celebrates its origins and argues that more than be done to support Singapore’s hawkers and keep this unique culinary tradition alive.

Food is more than a mere passion in Singapore. What Singaporeans fondly term Hawker Food is where our history—its many places, faces and tastes—converges. It is part of our identity, and a key part of our culinary DNA. To this day, the best way to get an idea of the flavours that colour the city is to visit some of the 30,000 or so food hawker stalls islandwide.

The story is a familiar one: migrants came to this growing city over a century ago, and many sold food on the streets to earn a living. They fed the comfort food needs of their fellow migrants with a variety of affordable fare prepared based on traditional recipes they brought with them from their home countries across Asia.

**“But continuity and sustainability remain challenges ... there are no clear pathways into the hawker business.”**

When these street vendors were relocated to purpose-built hawker centres in the 1960s for sanitation and safety reasons, it had the unintentional effect of preserving these heritage flavours and culinary traditions. Over the years, Singapore’s hawker food culture has evolved and flourished, becoming a national institution in itself.

Today, there are 114 public hawker centres in Singapore—each built like a shed roughly the size of a football field and housing about 50–180 individual food stalls. Hawker stalls are also to be found in private coffee shops, food courts, canteens and standalone shops. What they offer is a spread of authentic culinary delights at affordable prices, available all across one of the most expensive cities in the world. Over 5 million hawker meals are served each day, in this city with a population of under 6 million.

Diverse flavours of the world can be found in our public hawker centres. The menu ranges from Japanese ramen, tandoori meats and

vegetarian fare to Thai moo yang, English pub grub, Mexican tacos, Vietnamese pho...the list goes on. In their midst is a clutch of iconic local favourites, born of the ingenuity and desperation of hawkers who fought to survive in the early days. Localised dishes such as rojak, roti john, char kway teow, bak chor mee, Katong laksa and sup tulang have become part of our unique culinary vocabulary. Any food that settles into a hawker centre and is favoured by the masses becomes a part of Singapore’s gastronomic landscape.

Take Hainanese chicken rice, a top Singaporean favourite that has evolved beyond its predecessors, with local tweaks such as a spicy, fragrant chili sauce not found in the original recipe. In each platter of chicken rice, you can discern not just a deep love for food, but a dynamic ecology. Each platter is a portal into a whole world of culture, which yields opportunities in food entrepreneurship, tourism, education, jobs, trade, service provision—not to mention many happy tummies.

Many of the 17 million visitors Singapore hosts each year would happily queue for an iconic Singaporean dish, because the whole experience of waiting and eating alongside locals is a culinary souvenir memory they can bring home. They get a sense of the taste to get a sense of the place.

Hawker centres show culinary democracy in action. From well-heeled professionals to proud blue collared workers, the young and old, retirees, graduates and school dropouts, all races and creeds, families, single parents, the retrenched, even celebrities—everyone is equal here. A marketing director waiting to order 50 packs of nasi lemak for his office team will queue patiently in line behind a mother buying one pack for her child’s lunch. And at S\$3 a packet, there’s little reason to complain.

The feeding culture of eating together at a hawker centre is one of the most effective ways to promote bonding and a sense of national identity in Singapore. This is why the government, ordinary citizens, the private sector and hawkers themselves all have vested interests in keeping this culinary culture going.

It is a happy tango: citizens are kept well fed and happy, at modest prices. Some families depend on hawker food as the most affordable comfort food they can get. At the same time, the business world can leverage Singapore’s culinary fame to market related services and products to visitors and the world at large. And the hawkers themselves can make a living while keeping important traditions alive.

Hence, the current bid to enshrine Singapore’s hawker culture as Intangible Cultural Heritage by UNESCO is promising. If it succeeds, it would help shine a spotlight on our diverse hawker community as a whole, not just individual stars like the famed Michelin awards.

But continuity and sustainability remain challenges in Singapore. There are no clear pathways into the hawker business. Many find it daunting to enter the trade, in a city where rents and operating costs are high.

Introducing more layers of management does not help. Instead, we must keep operating costs down so hawkers can run their own businesses viably, and pass savings on to customers who can then continue to enjoy good, affordable meals. Perhaps basic ingredients such as salt, sugar, oil and common sauces could be bought in bulk to lower costs. We must find ways to encourage and train entrepreneurial new players to take up the trade.

Then we must let them do what they do best: figure out how to give us great hawker food. 



OPINION

Counterpoint: Lily Kong

# To Sustain Local Food Culture, Go Global

“The globalisation of local food ... can be a powerful contributor to sustaining local food culture and heritage.”



Singapore's local cuisine is the outcome of different food traditions intermingling through trade and cultural exchange. As what the world eats becomes increasingly globalised, **Lily Kong** argues that the best way to keep Singaporean food culture alive is to share it with others abroad.

It is easy to take for granted the spread of foods across the world, from the availability of sushi in landlocked countries to the ubiquity of French baguettes in households in many parts of the world. Such movements of food across regions, nations and continents are not new, but their scope and speed have increased dramatically in recent years. Originally driven largely by global empire and global trade, they have been fuelled in recent times by the escalation of globalisation.

Such movements are, however, not merely about trade and commerce but have implications for the maintenance and promotion of food heritage and cultural identity. While the globalisation of local food in cities is by no means an exclusive or necessarily better way of preserving and promoting a particular food in its original hearth, it can be a powerful contributor to sustaining local food culture and heritage.

**Enhancing awareness and expanding market demand make it more economically feasible to continue to produce such foods.**

Local foods are commonplace in Singapore and may be found in hawker centres, coffee shops, and restaurants. However the hawker trade, which produces some of the best local favourites, has been the subject of some concern. For instance, there is worry that the quality of local foods served commercially is declining due to the use of “shortcut” strategies in food preparation and cheaper, lower quality ingredients. Retiring hawkers have few to pass their skills to, as not many young Singaporeans are interested in entering a low-paying trade that requires hard work. Newly arrived migrants have begun to take their places, but there have been complaints that they cannot reproduce Singapore dishes to the same standards of authenticity and quality. More attention has recently been directed to preserving and sustaining Singapore’s food heritage, especially local street fare.

It is in this context that the spread of Singapore’s food heritage abroad to other cities becomes significant. Singapore cuisine is enjoying growing popularity and gaining greater awareness overseas. Dishes like laksa, chilli crab, char kway teow, and chicken rice are turning up in cities like London, New York, Toronto, Mumbai, Tokyo, Seoul, Shanghai and Moscow, and becoming recognised and associated with Singapore globally. Food products like kaya, popiah skin, curry pastes and seasonings from Singapore are also making their way to the shelves of supermarkets overseas. Food festivals featuring Singapore cuisine are being held in various countries, helping to introduce home-grown favourites abroad.

This spread of Singapore food overseas is due to the efforts of various agents—including food manufacturers that export Singapore food products, Singapore restaurants opened by entrepreneurial individuals or businesses, and foreign hotels that seasonally promote Singapore fare. Chief among them is the Singapore government, which plans and implements various events, initiatives and policies through different public agencies to promote Singapore foods internationally.

In 1994, the Singapore Tourism Board (STB) launched the first Singapore Food Festival, an annual event showcasing a tantalising spectrum of Singapore’s local cuisine; it continues to run in various countries across the world. STB has also established an internal Food and Beverage Division especially to develop culinary tourism, reflecting the importance that Singapore places on cuisine as a key theme for tourism marketing. STB’s efforts reflect the realisation that food is an attraction that can increase visitorship to the city and increase economic revenue through tourism. In a 2014 survey, more than one-third of leisure travellers in the Asia-Pacific region (APAC) said food and drink is the determining factor in where they choose to vacation. Efforts to promote the city’s food offerings to attract tourist traffic seem to have paid off: leisure travellers voted Singapore the third favourite culinary destination in APAC in 2014.

One interesting multi-agency initiative has been a mobile pop-up kitchen called Singapore Takeout. Launched in 2011, it resembles a shipping container which travels to major international cities showcasing Singapore’s culinary offerings, marketing Singapore as a key gastronomic destination. Celebrated Singaporean chefs are brought to these cities, where they prepare iconic Singapore dishes and conduct cooking demonstrations. Another government programme, the Global Chef Exchange, invites influential chefs from all over the world to Singapore to familiarise them with local culinary culture, with the hope that they will create Singapore-style dishes back home and raise awareness of the cuisine.

Food exports also contribute directly to Singapore’s economy, accounting for some S\$4.2 billion of value in 2012. The government has sought to get Singapore food products onto the shelves of more foreign supermarkets and restaurants, and to help Singapore cuisine attract mainstream consumers in markets overseas where demand is growing. It has done so by building global business networks and inter-country alliances, and by providing services to help local food manufacturing enterprises export, develop business capabilities, find overseas partners and penetrate new markets.

Prima Taste is one local food company that has benefited. It now sells food mixes such as laksa, Hainanese chicken rice and chilli crab in supermarkets and eateries in around 25 countries, and has seen healthy growth in export sales. Other Singapore food manufacturers, such as Tee Yih Jia, bakery Bengawan Solo and sauce manufacturer Chng Kee, have also found their way into mainstream markets in cities abroad with the help of government agencies.

The disappearance of favourite Singapore fare from local eating outlets does not seem imminent. Indeed, the Singapore government’s commitment to support local foods by promoting its consumption in different markets around the world may help to ensure their continued viability back home. Enhancing awareness and expanding market demand make it more economically feasible to continue to produce such foods. In this way, the globalisation of food may contribute not only economically, but also to the longevity of Singapore’s vaunted food heritage, even as the cuisine itself continues to evolve, grow and spread. ●

Urban Agriculture in Disused Spaces

# Growing Food in Unlikely Places

Cities around the world are starting to reintroduce agriculture into their communities. In this photo essay, **Naufal Khan** looks at the ingenuity of urban communities that have used unlikely places in cities to grow food for themselves and to enhance public spaces.



Community Garden Builders partners with other non-profit organisations, who would sponsor these temporary farming spaces. Together, they aim to build communities around agriculture.



## Vancouver, Canada

Temporary farms attuned to growing seasons

Capitalising on vacant land that is changing hands, Community Garden Builders, a registered charity co-founded by Environmental and Resource Studies graduate Chris Reid, transforms vacant spaces into temporary community gardens and growing spaces in British Columbia, Canada.

Community Garden Builders partners with other non-profit organisations to sponsor farming spaces and build communities around growing seasons.

## Tokyo, Japan

### Promoting edible offices

To promote employment in Japan's agricultural sector, the Pasona Group Office greened their façade and converted part of their headquarters into an urban farm. This unique environment was set up to encourage employees and job-seekers' to consider farming as a career, through provoking thought and discussion.



The office farm instills a sense of community among employees centered around gardening, and allows them to grow and harvest their own food. Besides improving air quality, constant interaction with plants enhance employees' mental health, productivity, and relaxation.



## London, United Kingdom

### Converting barren tubes to green shoots

Located 33 m underground, air-raid shelters unused since WWII have been given a new lease of life. Growing Underground uses abandoned tunnels to grow edible greens and fungi.

This underground farm stretches for around 1 km from Clapham North to Stockwell underground tube stations.



Due to shorter farm-to-fork distances, the freshness and high quality of the produce is popular with discerning local restaurants and organic shops in London. This has led to a healthy demand for Growing Underground's microgreens.

Their success has motivated other like-minded individuals to start their own eco-business ventures.

## Berlin, Germany

### Reclaiming barren land

Prinzessinnengarten is an initiative started in 2009 by Nomadic Grün and people within the neighbourhood. A 60-year-old 6,000m<sup>2</sup> barren plot of land at Moritzplatz has been transformed into an ecological and community garden.



## Sao Paulo, Brazil

### Low-cost expansion of green spaces

With the city running out of cultivable garden space, Marcos Victorino, a local agricultural technician, led an initiative to transform concrete urban spaces into green gardens through the use of inverted porous roof tiles as troughs.

The raised farming beds in accessible urban spaces allow everyone in the community, young or old, to be comfortably involved in and exposed to gardening benefits – increasing the project's chances of success.

The garden, run by volunteers and gardening enthusiasts, features spaces for learning about climate action and organic produce, as well as a communal gathering area for members to interact. It also offers gardening sessions and workshops on urban farming.



## Hangzhou, China

### Fertile, flat roofs for food

A collaboration between Pujia Primary School and the Zhejiang Province Agricultural Academy has led to a farm emerging on the rooftop of the primary school. By incorporating the idea of a rooftop farm from the outset, the structure of the school is designed to be able to support a 2,000 m<sup>2</sup> farming plot to bring agriculture closer to students' daily lives.

Produce grown and collected from this rooftop farm are sent to the school's kitchen for the students' consumption.



ESSAY

Safeguarding Food Security with Urban Agriculture

# Cities: The Solution to World Hunger?

Global food output will have to double by 2050 in order to meet the demand of a growing world population. **Max Opray** of Netherlands-based sustainable innovation agency Metabolic explains how cities could embrace and revolutionise agriculture, ensuring food security in the face of resource pressures.

Imagine a new kind of skyscraper rising up to join the apartment blocks, commercial towers and hotels that crowd the skyline of modern cities. Instead of homes or office cubicles, these buildings house row upon row of fruits and vegetables. In the dimly-lit basement and lower levels, mushrooms and bean sprouts thrive in dark conditions. The carbon dioxide the mushrooms emit as they sprout is pumped into artificially lit greenhouses in the floors above to help grow produce like bok choy and tomatoes, all efficiently nourished by circulating water systems. The greenhouses on the rooftop do not need artificial light, as they can bask in the sun. At these heights, robots safely harvest the produce to order for nearby supermarkets and grocery stores in the surrounding neighbourhood.

“A cityscape lined with greenhouse towers ... could be what is needed to feed a booming world population.”

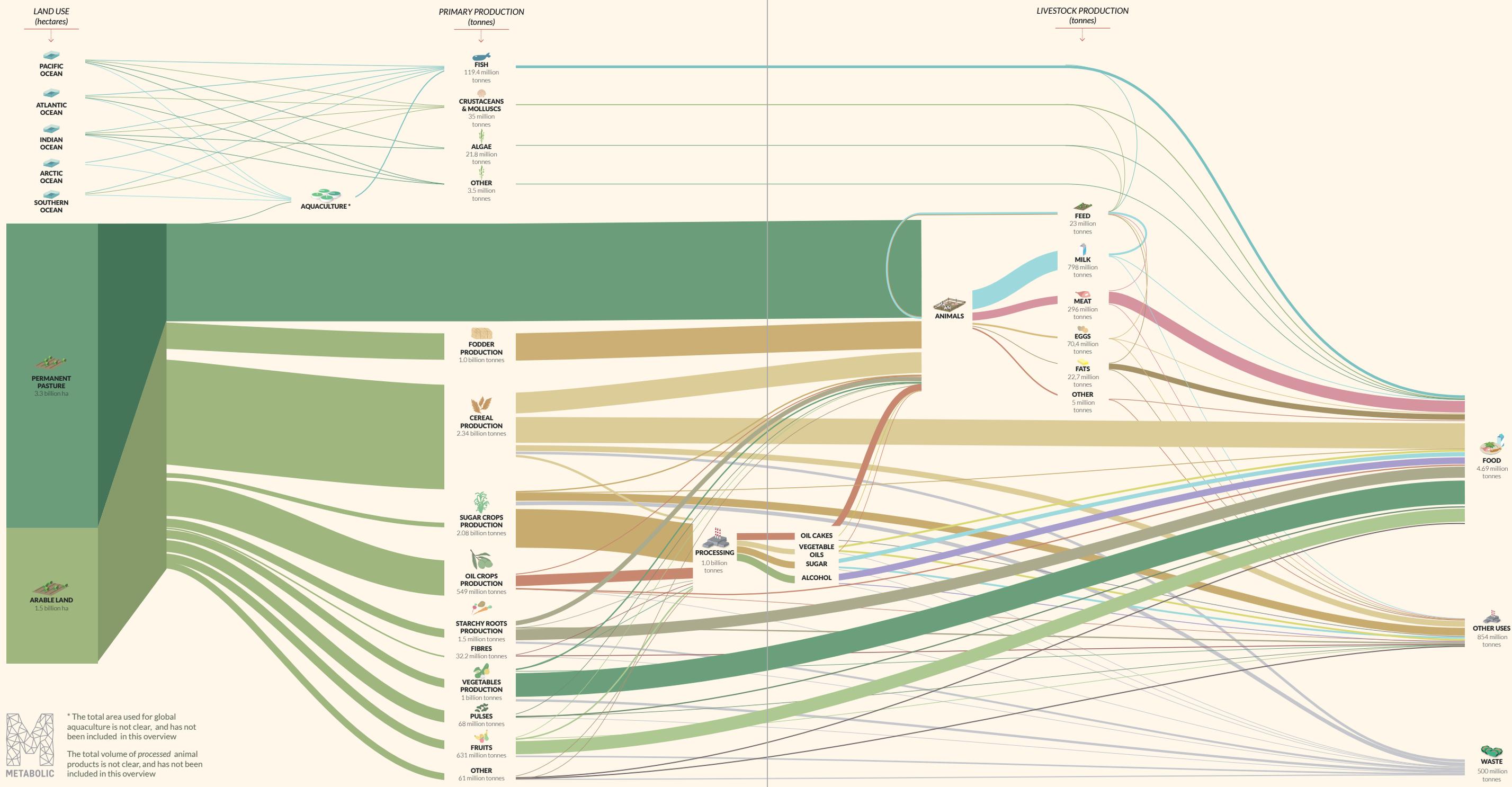
This might sound like science fiction, but for high-density cities with the technical and financial capacity to take the lead, this vision is within reach. Indeed, a cityscape lined with greenhouse towers such as these could be what is needed to feed a booming world population.



**Max Opray** is a content specialist with Metabolic, a consulting and venture-building company that uses systems thinking to tackle global sustainability challenges.



Illustration of a highrise building mixed with office and greenhouse space in Linköping, Sweden.



**M** \* The total area used for global aquaculture is not clear, and has not been included in this overview

The total volume of processed animal products is not clear, and has not been included in this overview

**METABOLIC**

01 Metabolic's sankey diagram shows how land and ocean resources produce different food products, including waste, in 2011.

### Doing More with Less

The case for urban agriculture is clear. Between now and 2050, the world's food output will have to at least double in order to support a global population that, according to 2017 UN estimates, is not only growing in number by an estimated 83 million people every year, but also demanding increasingly more resource-intensive diets.

According to our WWF-commissioned 2017 study *The Global Food System: An Analysis*, this massive new demand has to be met by a system already straining at the limits of what our planet can support. Humans use 38% of the world's land surface for agriculture, including nearly half of the land capable of supporting plant life. Most of the remaining space is not suitable for food production. Land degradation is also on the increase, thanks to intensive agricultural practices responsible for rising salinity and declining soil health. Current food production is water intensive, using 69% of the world's extracted fresh water. On top of all this, the enormous shift of human populations from rural areas to cities means that urban centres are expanding and paving over some of the world's best farmland. With all these extra mouths to feed, cities are particularly vulnerable to global shocks, and will need to devise innovative solutions in order to safeguard their food security.

### Closing the Loop

In the current food system, cities are primarily consumers: one of the endpoints in a linear process. At every stage of this process, there are huge losses of finite resources: be it fertiliser ingredients mined from the ground, land used up and degraded by exploitative agricultural practices, fossil fuels consumed in the process of transporting food, which also generates carbon emissions, or nutrient loss through food wastage and disposal.

Urban agriculture could serve as a panacea for many of these concerns. Clearly, food miles would be reduced by growing the food where it is consumed. The benefits could go further however: urban farming operations can potentially close resource cycles locally, reusing phosphorus and nitrogen in nearby production systems rather than let them go to waste.

### Deciding what to Farm

While urban farming can help reduce food miles, spoilage, packaging demand and land use, it also poses challenges. In order to make the business case work, there needs to be extremely high output per m<sup>2</sup>, since land in cities is typically much more expensive than in rural areas. Cereal crops are generally not viable, although Japan once had an underground rice paddy in what was previously a bank vault. The problem is that cereal crops require too much space, and do not enjoy the profit margins needed to justify its use of urban space. Likewise, meat, milk, and other produce sourced from animals are usually too space-intensive to work in cities.



01

The Netherlands features extremely high population densities, yet the country is not a net food importer—in fact, the Dutch are the second largest food exporters by value in the world.

The key here is “value”. The Dutch grow produce—such as tomatoes, capsicums, eggplants, and zucchinis—that can be cultivated within confined spaces in short growth cycles and at a lucrative premium. This approach is now being applied all over the world, including in Singapore, where the pioneering Sky Greens project grows a variety of vegetables in 120 slender four-storey towers.

### Looking Up: Vertical Farming

To integrate agriculture into a high-density urban environment, one solution is to look to the skies. Vertical farms could work in layers like a forest ecosystem, harnessing synergies between produce that grows in darkness and crops with fast growth cycles that thrive off natural or artificial light. As a closed system, water and nutrients can be cycled over and over with less external inputs than a conventional farming system. Waste biomass could be used for other purposes, such as chemical production or biofuel.

There are trade-offs, however. Although hydroponic growing operations use up to 90% less water, they require increased energy for artificial lighting, so renewable power sources would be needed to ensure that reduced carbon dioxide emissions from reduced food miles are not outweighed by the carbon emissions from greater electricity consumption. Farm 360 in Indianapolis is an example of how this could work: it grows lettuce in a warehouse using energy-efficient LED lighting and 100% renewable energy.

To deal with the significant logistics of urban agriculture, a hub and spoke collection model could minimise disruption to urban traffic



02

flows. A highly automated system might see robots deployed to harvest produce in response to specific requests by nearby supermarkets and restaurants, based on current needs. By leaving produce on the vine until needed, some fruits and vegetables stay fresh for longer without the need for refrigeration, minimising wastage and energy use.

There are technical challenges, of course, particularly in terms of automation. Developing robots that can grip produce without crushing it is one difficulty. However, some highly automated systems are already at work, including a Dutch mushroom production tower that automatically harvests, slices, cleans and packages mushrooms for sale.

- 01 A rice paddy in what used to be an underground bank vault.  
02 Vertical farms enable us to farm upwards instead of outwards.



01

New buildings designed specifically for urban farming are the ideal option, but it is possible to retrofit existing buildings or even integrate food production into residential towers, with dedicated shafts for horticulture. One challenge of this approach is how to build greenhouses on rooftops not designed to carry such heavy weight. A more practical solution might be peri-urban farming just outside the city core, in warehouses two to four storeys tall.

### Look to the Seas

Building up is not the only option available to cities: there are also the rivers, lakes and seas near which most cities are built. Our research has found wild fisheries under increasing strain, with 90% either collapsed, overexploited or at capacity. Fish or seafood supplies 15% of total protein demand globally, and this demand is set to rise.

Aquaculture could help meet humanity's growing appetite for seafood, and contribute to the cultivation of alternative food sources such as algae. Although wild capture fisheries still dominate the seafood market, aquaculture has more than doubled since the start of the millennium: it is positioned to become the primary contributor to seafood production in the near future.

The principles of vertical farming can be applied to aquatic farming as well, by building down rather than up, using layers of nets. However, precautions would have to be observed to avoid the risk of disease from overcrowded conditions and genetic problems from inbreeding. Another challenge is in sourcing feed for the fish. Much feed for aquaculture operations is sourced from the wild fish stocks currently under so much strain. More sustainable options include farming black fly larvae, which can be fed food waste and then processed into capsules to feed aquaculture operations. By thinking outside the box, human populations may continue enjoying the fruits of the sea for centuries to come.

### Wasted Opportunity

One of the easiest ways to improve food security is to reduce wastage. Globally, about a third of food is currently wasted: some 1.3 billion tonnes a year. Reducing this would represent a quick win in the race to feed the world's growing population.

**“Aquaculture... is positioned to become the primary contributor to seafood production in the near future.”**

In urban environments, food waste has another consequence: it takes up precious space. As the population and economy continue to grow, further increases in food waste could pose a challenge in terms of competition for limited land.

A range of things can be done to reduce food waste: from apps like Spoiler Alert that help food businesses manage their unsold inventory more effectively, to education programmes that teach people how to better use their food, as well as new regulations. France recently became the first country in the world to ban supermarkets from throwing away unsold food; it must now be donated to charities. US-based project DC Central Kitchen recovers food that might otherwise go to waste, turning it into meals which are provided to other non-profit organisations to feed their clients.

Between 20-40% of produce never makes it off the farm, because it does not meet the aesthetic requirements of supermarkets and other retailers. In the United Kingdom, retailers are forced by law to sell these “ugly” foods, with others in other countries voluntarily choosing to sell these.

“...the greater the share of the world that lives within cities, the more cities become a useful leverage point for change.”



01

“Globally, about a third of food is currently wasted: some 1.3 billion tonnes a year.”

02



### What Comes Next

In our case study analysis of the European food system, we argue that reforming the EU's Central Agricultural Policy (CAP) could be a powerful lever to encourage the growth of urban farming. A range of CAP subsidies incentivise large-scale farming more suited to rural areas. By shifting the focus of these subsidies away from larger farmers towards small-scale operations and urban agriculture innovations, systemic change could be realised.

The EU is the top layer of a sprawling, complex set of governments that administer 28 countries across Europe, each with several layers of bureaucracy. Municipal governments, however, are directly connected to their urban populations. The rapid urbanisation of the global population means that the greater the share of the world that lives within cities, the more cities become a useful leverage point for change. In cities with centralised authority, small policy changes can have a potentially massive impact on how large urban populations relate to the food system. For instance, urban authorities could encourage the identification of underused

warehouses and other suitable space for farming. They could also foster relevant connections between stakeholders responsible for water, energy use, and food production.

An extensive urban food system could not only help cities shore up their own food security—it could also serve as an example for others. By making better use of limited space, reducing food miles, and cutting back wastage, cities could show the world how to feed growing populations in a sustainable way while generating new industries and intellectual property. Approached the right way, urban land constraints could shift from a challenge to a strategic advantage. ○

01 DC Central Kitchen has turned 827,247 pounds of otherwise wasted food into meals.

02 Recognising that ugly food may not necessarily be bad food, grocers are starting to sell “ugly” produce at discounted prices to minimise food waste.



ESSAY

Town Planning and Food Accessibility in Singapore

# It's No Mirage, It's A Food Oasis!

Access to fresh produce and other nourishing food can often be limited geographically in cities and can disadvantage some social groups. CLC Researcher **Thinesh Kumar** explains how good town planning prevents the formation of such “food deserts” in Singapore, with the integration of supermarkets, markets and hawker centres in the development of new housing towns.

With the advent of climate change, urbanisation and increasing demand for meat-based diets, food security and resilience have become key concerns globally in the last few decades. Beyond the supply and demand of food, access to food has emerged as a significant issue.

One particular phenomenon has been the formation of food deserts in some cities. Food deserts refer to neighbourhoods or communities where residential populations lack access to fresh, nutritious and affordable produce. This could be due to a lack of proximity to shops and markets, limited transportation links, or even lifestyle or cultural factors such as a preference for convenient processed or fast foods.

This problem is not limited to developing countries. Research shows that food deserts have appeared in low-income areas of certain cities in the United Kingdom and the United States. While limited accessibility to food supply could contribute to food insecurity, food deserts have been on the radar of researchers mainly because of their adverse impact on nutrition. Food deserts epitomise how complex issues of health inequality, undernutrition, social exclusion and differential access to amenities can overlap, making it both a social and planning challenge for policymakers.



**Thinesh Kumar** is a researcher at the Centre for Liveable Cities and the co-author of *Food and the City: Overcoming Challenges for Food Security* (Centre for Liveable Cities, 2016).



Fishmongers at the Marine Parade Market and Hawker Centre supply local residents with fresh and affordable seafood.



### Singapore, A Food Oasis

Despite being a city-state that imports 90% of its food, Singapore has been relatively food secure, topping the Global Food Security Index in 2018. Guided by a Food Security Roadmap overseen by the Agri-Food and Veterinary Authority (AVA), Singapore has worked to diversify its food sources. Over the years, it has securitised its food supply as its dependence on imports increased, in order to mitigate potential supply disruptions. This became especially important after the global food crisis of 2008, when prices of staple foods soared worldwide. To prevent history from repeating itself, key food items were sourced from different geographical regions. Today, less than 50% of Singapore's needs for most key food items are imported from any one country.

Sourcing for food at competitive prices from all over world, Singapore spreads the risk of shortages, shoring up its food system against global price fluctuations. Although the city-state's government does not interfere with the market pricing of food, it does offer welfare measures, such as food vouchers, to ensure that low-income groups can afford food.

Food deserts in the conventional sense do not exist in Singapore. In particular, Singapore's holistic town planning framework has prevented the formation of these spaces of exclusion, by ensuring the availability of food sources such as supermarkets, wet markets and hawker centres in its residential towns. This gives Singaporeans from all walks of life ready access to fresh and safe produce and affordable, safe cooked food. Over 85% of Singapore's populace live in these self-contained public housing towns, which are well-provisioned with facilities and

“Food deserts epitomise how complex issues of health inequality, undernutrition, social exclusion and differential access to amenities can overlap...”

amenities at both the town centre and local neighbourhood levels. The result: not food deserts, but food oases.

### Town Planning and Food Accessibility

Itinerant hawkers and street peddlers were once common on Singapore's streets. By 1966, it was estimated that there were some 40,000 of them in the city, both licensed and unlicensed. They were an important means of livelihood for many, and made cheap food and produce available to city residents. However, a burgeoning population brought concerns over traffic obstruction and unsanitary conditions. From the 1960s to 1980s, hawkers islandwide were registered, and eventually relocated into purpose-built markets and hawker centres. These were sited near both places of employment (such as industrial estates) and residential areas—where they continue to cater to food demand from local workers and residents to this day.

With the 1971 Concept Plan seeking to shift the population away from the city centre, Singapore came to develop self-contained housing estate towns, each big enough to sustain its own commercial, institutional and recreational facilities. As part of this effort, hawker centres (selling cooked food) and wet markets (selling produce) were constructed—often as a single structure—in the new housing estates, within walking distance

01 A dry goods stall at the Marine Parade Market and Hawker Centre.

02 Fresh fruit can be bought at this stall in the Bugis Street market as late as 9pm.



01

of residents. These centres were usually built and owned by the Housing and Development Board (HDB) as part of the development of new towns. They were managed by the Ministry of Environment—and later by the National Environment Agency (NEA).

As a rule of thumb, each new town had at least one hawker centre and wet market, with these numbers increasing depending on population size. HDB guidelines stipulated that market and hawker centres were to be provided for every 4,000 to 6,000 units of flats in most public housing estates. Small provision shops, relocated from kampongs to the ground floors of housing flats, would provide food as well as daily necessities for the community. The new towns were also designed to allow for a variety of retail outlets including pop-up convenience stores, supermarkets and dry grocery shops in the town and neighbourhood centres—ensuring convenient access to food throughout each housing estate and making the new towns liveable and convenient.

As of 2018, there are 104 wet markets and hawker centres managed by NEA, with plans to build 20 more hawker centres and wet markets.

#### Building a Food Oasis

Hawkers centres have become a mainstay in Singapore's urban landscape, offering a variety of cooked fare at affordable prices islandwide, and preserving Singapore's distinctive food heritage. Moreover, hawker centres are designed to be inclusive spaces, reflecting the multicultural makeup of Singapore by ensuring that a variety of food types is provided. For example, each hawker centre has a set number of stalls offering Malay and Indian food alongside Chinese cuisine. Provisions have also been made to ensure that cutlery for halal and non-halal food stalls are separated.

While the initial planning of physical infrastructure for hawker centres played a crucial role in enabling access, they have also continued to be maintained and developed to meet evolving needs.

“Hawkers centres have become a mainstay in Singapore’s urban landscape, offering a variety of cooked fare at affordable prices islandwide...”



02

01 A street in Chinatown in the 1970s, congested with street hawkers and peddlers.

02 Affordable prices at hawker centres allow people to have meals out regularly.



01

In 2001, the Hawker Centre Upgrading Programme (HUP) was introduced to upgrade the conditions and facilities of aging hawker centres. These included such works as retailing and reroofing, upgrading wiring, plumbing and ventilation, and improving tables and seats to make dining more comfortable. Moreover, recent upgrading work has seen the improvement of wheelchair access with the table designs being tweaked to allow wheelchair bound people to dine comfortably at hawker centres. By 2013, 106 hawker centres had been refurbished under the HUP.

With Singaporeans spending an average of 37% of their food budget on hawker fare, these hawker centres have become convenient primary sources of food. This is particularly significant for lower-income groups, underlining the need to keep hawker centre food prices affordable. The Singapore government does this by ensuring that stalls are personally operated and not sublet, and by abolishing the practice of reserve rent to keep stall rental costs down. Today, a full meal at a hawker centre stall typically costs S\$3 to S\$6.



02

Wet markets follow the same principles, providing fresh produce at affordable prices. Even with the phasing out of the live slaughter of poultry at wet markets, these market centres have remained relevant as a key source of safe produce for sale. The Cold Chain System was introduced in 1999; it requires meat to be kept chilled throughout the entire preparation process, ensuring the safety of meat sold in wet markets.

#### The Way Forward

Singapore has done well in developing its urban environment while ensuring that its people continue to enjoy ready access to food. Even as new towns were built away from the city centre, no food deserts formed. Adaptability is key, with the government continuously evolving its policies and programmes to suit the changing food needs of the people. More recent initiatives have even addressed the nutritional value of available food, by promoting healthier food options in hawker centres to help address the prevalence of lifestyle-related conditions such as obesity and diabetes.



03

However, physical access to food is only part of the story. While successful town planning policy has ensured that food deserts have not formed in Singapore, there is a need to acknowledge that access to food could still remain a challenge for some communities.

Despite a ready supply of produce or cooked food options available, some groups such as the elderly or low income households may still be affected by such factors as physical constraints or the rising cost of food. Currently, welfare measures are in place to help vulnerable groups afford food. Lower-income groups—who spend a larger proportion of their income on food and

may thus be affected by the volatility of food spikes—are given government assistance in the form of supermarket vouchers. In 2012, the NTUC FairPrice Foundation handed out approximately S\$1 million worth of food vouchers to 20,000 low income families and individuals.

Singapore has done much at the national and local levels to ensure that good food sources are readily accessible, available and affordable. To keep Singapore a food oasis, it will be important to be vigilant about how food deserts could emerge in new and different forms in future. ●

01 Toa Payoh town centre houses eateries, provision shops and supermarkets within easy access to residential areas.

02 From young to old, the hawker centre caters to different dietary needs and socioeconomic groups.

03 Fresh meat, fish and vegetables are on display at bustling Tekka Market.



Novel Technologies for Food Production

# Producing More with Less

Cities around the world are incubating innovative modes and types of food production, promising sustainable new ways to supply the nutritional needs of our societies.

Historically, cities have often sprung from agricultural settlements. However, many farms in cities have relocated or diminished over time due to urban development, zoning changes or stricter environmental standards. Today, only between 5–10% of food is grown in cities.

Yet farms in urban centres offer many important and unique benefits. They contribute to local nutrition and food security in cities, and promote social integration and economic diversification. They also contribute to environmental sustainability by saving energy, mitigating heat island effects, and supporting ecosystem services such as pollination or capturing surface runoff.

Recently, there has been a resurgence of interest in urban farming around the world. Demand for high quality fresh vegetables, herbs and fruits has risen in cities. At the same time, increasingly cheap and available technology has enabled the development of novel foods and efficient new farming methods better suited to urban centres.

### Finding New Spaces for Farming

However, the lack of affordable land continues to constrain farming in cities. Today's urban farms have adapted to this challenge by using technology to overcome physical limitations, maximise available space and create suitable conditions for food production.



Elyssa Ludher is co-author of Food and the City: Overcoming Challenges for Food Security (Centre for Liveable Cities, 2016).

Tan Poh Hong is a Fellow with the Centre for Liveable Cities and former CEO of Singapore's Agri-Food & Veterinary Authority.



# What if a city could produce all of its own food?

Farm skyscrapers

Greenwall, incl. Vertical farms

Insect Farm

Floating Farm

Farming in marginal spaces

Recirculating Aquaculture Systems (indoor farming)

Underground farming

Edible Landscaping

Herb Garden

Fruit Trees

Rooftop Greenhouse and intensive farms

Lab Grown Meat

Automated cleaning, processing and packaging plants



**Global vertical farming market that is projected to grow to US\$3.88 billion (S\$5.3 billion) by 2020.**

On the land-scarce island of Singapore, local firm Sky Greens has developed 9-m towers with rotatable racks, each of which can grow up to 2500 plants. The new method produces 10 times the farm yield for the same area of land used, without requiring arable land. Each rack also consumes only 40WH of electricity (equivalent to a small light bulb), and uses up to 95% less water than conventional land-based farming. This is just one of many forms of vertical farming to emerge in recent years, fuelling a global vertical farming market that is projected to grow to US\$3.88 billion (S\$5.3 billion) by 2020.



Many urban farms are installed within enclosed, non-landed spaces, thanks to technologies that replicate the natural conditions needed for growth, indoors. This has several advantages.

First, it means that dead or underutilised spaces in the city can be put to better use. While industrial buildings are popular for commercial indoor farming, other enclosed spaces have also been equipped for food production. Alesca Life, a Beijing-based start-up, refits shipping containers with hydroponic systems, lighting and integrated software

to maximise productivity while minimising energy and water use. Such containers can be set up in small underutilised spaces, and also stacked up to expand the farm.

Farming indoors is viable even in climates that do not allow for year-round growing. Warehouses can be converted into growing spaces with LED lights, atmospheric control, substrate mimicry, hydroponic systems and sensors, allowing crops like tomatoes, leafy greens and microgreens to be produced 365 days a year.

01 Aerofarms deploys aeroponics as a means of farming vegetables indoors efficiently.

02 The container farm in Dubai run by Alesca Life provides fresh, pesticide-free produce to nearby restaurants and hotels.

In addition, yields are generally higher in indoor farms. This is due to stacking, as well as better control of seeds, pests, water and carbon dioxide levels. Indoor crops are also less exposed to weather elements or pest invasions. Japan's Mirai Co enjoys 50–100 times more production efficiency, and uses no pesticides or genetically modified organisms (GMO). Within a year of operation, they were supplying 10,000 heads of lettuce annually from a small footprint of approximately 2,300 m<sup>2</sup>. In the US, large indoor farms can produce up to 26.6 kg per m<sup>2</sup> of greens annually, compared to only 3.4 kg per m<sup>2</sup> from conventional farms.

Finally, being able to farm indoors means that more than just vegetables can be grown. In Netherlands, Seafarm BV uses a Recirculating Aquaculture System (RAS) to farm fish indoors in multi-storey layers. The process—from feeding, harvesting to packing—is fully automated and requires only one operator; thus reducing labour requirements. Apollo, a fully-automated aquaculture farm in Singapore, uses RAS technology to grow 12 popular food fish in an 8-tier system. Once at full capacity, the farm is expected to yield 2000 tonnes each year. In Rotterdam, the world's first floating dairy farm is being built: it is expected to produce approximately 800 L of milk a day.



01



02



03



04

### Expanding Our Diets to Alternative Foods

Cities often attract entrepreneurs and talent. The gathering of bright and curious minds have made cities hotbeds for the creation of new, innovative food types. One new food that is gaining traction is insects: some crickets, locusts, ants, and grubs offer high quality protein, amino acids and vitamins, requiring less feed to produce compared to fish, chicken or other meats. Edible insects have been part of the diets of some Asian, African and South American cultures for centuries. As global protein demand grows, fast-growing insects could supplement food supply. More than 300 entomophagy (insects for human food) companies worldwide are now taking this food mainstream, producing protein bars, pasta, cookies, snacks, shakes and more.

Farming insects is more sustainable: it needs less space than typical livestock, emits lower levels of greenhouse gases and produces yield at much faster rates. It is thus suitable to farm even in large cities. Insects are also useful for animal feeds: Enterra Feed farms black soldier flies in a warehouse outside of Vancouver; they

are about to establish three new mega facilities, following tens of millions of dollars' worth of investments to fund expansion.

Algae is also becoming popular as an alternative food: both as macroalgae, such as seaweed, and microalgae, such as spirulina and chlorella. While most large algae farms are located in deserts, some are finding their way into cities. EnerGaia, for example, has set up farms on rooftops in Bangkok to produce high quality, unadulterated spirulina for health bars, restaurants and nutrition stores in the city. Besides having no smell, algae has the benefit of absorbing carbon dioxide from the environment for photosynthesis and producing oxygen when it is grown.

**“Lab grown “meats” are another emerging food trend ... being taken seriously by major food industry players.”**

- 01 Food like these burgers made from buffalo worms may one day become prevalent.
- 02 When completed, Floating Farm will be three storeys high and fully mechanised.
- 03 EnerGaia harvests algae on building rooftops in Bangkok.
- 04 The “Impossible Burger” is now sold in burger restaurants, including the popular American fastfood chain White Castle.

“Like any industry, the food industry benefits from clear, transparent and supportive municipal policies and regulations.”

01



Lab grown “meats” are another emerging food trend. Typically developed in city labs with access to research talent and facilities, these “meats” may be grown from cells (cultured or in-vitro), or are plant-based but synthesised to replicate the look, texture and taste of meat. A number of companies—including *JUST*, *Beyond Meat* and *Memphis Meat*—are producing what they dub “clean meat” grown from cells. They are being taken seriously by major food industry players. *Future Meat Technologies* has partnered with *Tyson*, the world’s largest poultry and pig farming company. *Impossible Foods*, located in the San Francisco area, has created a plant-based beef-like burger patty made out of heme, textured wheat protein and coconut oil, which is now being sold throughout the US.

#### Encouraging Food Production in Cities through Policies and Incentives.

Food companies are increasingly interested in setting up in cities to be closer to markets. Like any industry, the food industry benefits from clear, transparent and supportive municipal policies and regulations. Some cities are adapting their urban policies to make more of opportunities in the growing field of urban food production and encourage its advancement.

For example, the city of Chicago, through its “Growing for Chicago” initiative, has amended zoning plans and introduced economic incentives to encourage the establishment of urban farms all over the city. Its commercial farms, such as *Gotham Greens*, intensively produce food for local markets and double as catalysts for urban regeneration.

The city-state of Singapore produces less than 10% of its food needs, yet its food industry adds S\$4.3 billion to its GDP

and provides 48,000 jobs. To spur their growth, urban farms and food producers benefit from multi-agency public sector support, which includes a range of incentives, facilities and other schemes, to advance their development.

For instance, Singapore’s JTC has facilitated the use of industrial spaces for food clusters, including the JTC Food Hub @ Senoko. Within this development, a 1,130 m<sup>2</sup> small batch production facility will help strengthen the food innovation and R&D ecosystem in Singapore. Through a pay-per-use model, companies will gain access to a range of cutting edge equipment, such as a Pulse Electric Field and Microwave Assisted Thermal Steriliser, to carry out small batch production of their newly developed food products for market validation.

#### Conclusion

While staple foods such as rice, wheat and maize are unlikely to be grown at scale in cities, other food types are clearly moving into urban settings. These can be grown more intensively, producing less waste and with reduced time and distance from farm to table. Novel foods and innovations are more likely to be incubated and to take off in cities, which have better access to talent, resources and markets.

Major cities around the world, including London, New York, Shanghai, Beijing and Tokyo, are looking at incentives and policies to facilitate urban food production, helping ensure that there is a measure of food resilience and innovation in local industries.

Cities are thus natural settings to facilitate producing more food with less, while contributing to national resilience, sustainability and economic diversity. ○

01 Food manufacturers can validate new products and test their commercial viability at JTC Food Hub @ Senoko’s small batch production facility.



CITY FOCUS

Seattle

# Growing Food, Cultivating Communities



Seattle's Beacon Hill Food Forest.

Access to food intersects with a complex range of other issues faced by urban centres worldwide. Adopting a multi-faceted food strategy, the city of Seattle is drawing together partners from across government, businesses and the community to nurture an urban food system that is secure, sustainable and accessible to all.

Not everyone living in a city enjoys the same access to safe, nutritious food. This may be compounded with effects such as hunger, malnutrition and obesity, with dire consequences across individual lives and communities. The challenge of ensuring equitable and secure access to food is further complicated by the many issues cities face, from climate change to social inequality.

This intersection of concerns means that cities must take a multi-faceted approach to food access. One urban centre that has adopted this approach is Seattle, a North American city of more than 700,000 people. As a rapidly growing city, Seattle seeks to balance a limited land base, a burgeoning population and rising costs of living with a strong commitment to environmental sustainability and local food production.

In 2013, Seattle adopted a Food Action Plan, with the aims of securing affordable, healthy, local and culturally appropriate food for Seattle residents, removing barriers to urban food production, strengthening the local food

economy and cutting food waste. Each of the Food Action Plan's goals is supported by a range of initiatives and programmes.

“Our food security strategies span safety net programmes, access and affordability programmes, urban agriculture and community gardening programmes, as well as supporting state and federal policy that strengthens the hunger safety net,” says Sharon Lerman, a food policy manager at Seattle’s Office of Sustainability & Environment. She adds that the city’s approach allows for “multiple access points for healthy food—whether people are visiting a food bank, growing their own, or shopping at a farmers’ market”.

To realise its Food Action Plan, the city works with a diverse array of non-profit and educational organisations, businesses and other partners. For example, the Farm to Table initiative, the Good Food Program and the Fresh Bucks to Go Program provide healthy local food through educational and community institutions, as well as subsidies for fruits and vegetables.



Besides supermarket chains, Seattle also works with neighbourhood grocers and informal farmers markets to ensure multiple avenues of affordable fresh produce for the Fresh Bucks to Go programme.

Participants of the Seattle Department of Neighborhoods P Patch Community Gardening Program can also earn an income by selling their produce at markets.



Alvin Chua is a writer and researcher in the fields of sustainability, urbanism and heritage.

“Partnerships can greatly increase our impact and allow us to do things we couldn’t do alone as a government.”

“Partnerships can greatly increase our impact and allow us to do things we couldn’t do alone as a government,” explains Lerman. For the Fresh Bucks food access programme, the city partners with Seattle’s farmers’ markets, small neighbourhood grocers, a large supermarket chain, as well as many community-based organisations, to improve access to affordable food.

Lerman believes that food security is intertwined with social inclusion and environmental sustainability. “Our food system intersects with so many other issues. Our many community gardens build connections and promote inclusivity. Our urban agriculture projects intersect with wetlands and foster biodiversity,” she adds. A dedicated group of policy and programme staff from across different City departments meets regularly, bringing together a broad range of expertise to work on different aspects of food policy. This has led to collaborative initiatives, such as between Solid Waste and Human Services to increase recovery of wasted food, and between Human Services and Education to increase healthy, local food served in preschools.

One of Seattle’s priorities is to make it easy for residents to grow food within the city, and to provide opportunities for residents to engage with nature and food systems. An initiative that supports this goal is the community-stewarded Seattle Department of Neighborhoods P Patch Community Gardening Program, which has more than 6,800 P-Patch gardeners producing food on urban allotments (“P-Patches”) for their families and food banks. People from disadvantaged backgrounds can earn an income by selling this produce in the city’s markets. The Program’s Beacon Food Forest, a seven-acre free food commons initiated and managed by the community, has some 200 types of edible plants, boosting the city’s biodiversity, nurturing community cooperation and providing a sustainable food source.

“P-Patches provide so much more than food ... P-Patches are sites of learning, education, hands on exploration, and community building.”





01

“P-Patches provide so much more than food. They connect people to their neighbours, preserve cultural traditions, spark connections to nature, provide a different form of public open space and recreation, and make people feel connected with their food and the food system,” says Lerman, adding that “P-Patches are sites of learning, education, hands on exploration, and community building”.

With a growing population, competing demands for land has become a challenge for the city. Seattle remains committed to

maintaining space for urban agriculture and community use. Programmes such as the Seattle Department of Neighbourhoods P Patch Community Gardening Program, the Orchard Steward Program and the city’s urban farms help safeguard green space for urban agriculture and community use. “We think about them as an extension of our park land,” says Lerman.

The city is also encouraging its residents to be creative about where they can grow food. For instance, the Transportation office led the



02

Planting in the Right of Way programme to show residents where and how they can use the planting strips in front of their homes. The Seattle Public Utilities also led a multi-agency collaboration to produce the guide Growing Food in the City, a comprehensive resource on growing food in the urban environment. The guide is now available in 19 languages.

Seattle’s local food scene and its attractive proximity to nature have long been core to the city’s identity and culture. Building on

its strengths, the city’s institutions, businesses and communities have come together to create innovative urban food production and food access programmes that address the intersections between urban concerns. Its multi-pronged strategy grows the city’s food, economic, environmental and social resilience, ensuring that Seattle’s abundance can continue to be enjoyed by all. ●

01 Urban farming programmes do not compete for land space, but provide green places for people to gather.

02 Leafy collards, broccoli and squash are grown on the roadside of this Seattle neighbourhood.



CASE STUDY

Singapore | Food Waste Management

# Cooking Food Once, Using It Twice

**H**igh-traffic mixed development Our Tampines Hub (OTH) has pioneered a new system for more sustainable, efficient and cost-effective food waste management, by collecting food waste and recycling it into useful products.

## Challenge

Eating out is a quintessential part of Singaporean culture. But this thriving food scene also generates substantial waste. In 2017, the island of 5.6 million people generated 809,800 tonnes of food waste, of which only 16% was recycled. The rest—some 700,000 tonnes of discarded and expired food—was incinerated, incurring significant economic, environmental and energy costs. The incineration ash also goes to landfill, which space-constrained Singapore can ill-afford.

In 2015, Singapore announced a vision to become a Zero Waste nation as part of its Sustainable Singapore Blueprint. The goal: an economy where unsustainable

waste generation and landfill disposal are no longer standard practices. Instead of incineration, new solutions are being sought to reduce, treat and recycle food waste.

Our Tampines Hub (OTH) is a mixed-use development providing integrated community, government and lifestyle services. Featuring a 24-hour supermarket, 30 eateries, and a hawker centre with 42 stalls, OTH serves an average of 1.5 million visitors each month and generates a significant amount of food waste daily. This presented an opportunity to put innovative waste management approaches into practice.



OTH's multiple F&B establishments generate 1.4 tonnes of food waste daily.



Alvin Chua is a writer and researcher in the fields of sustainability, urbanism and heritage.

Each day, up to 1.4 tonnes of food waste is taken to two digesters ... yielding useful by-products such as organic fertiliser.

### Solution

OTH serves Tampines, a town of more than 250,000 people with a strong municipal focus on being green. With support from OTH's stakeholders, including the National Environment Agency (NEA), a new food waste management programme was born. OTH implemented a system that collects and channels leftovers from the hawker centre and eateries, as well as expired foods from the supermarket, to food waste digesters.

"Eco-sustainability was always a key focus of the Hub from its inception," explains OTH Director Suhaimi Rafdi. "We realised OTH had an opportunity to not only contribute towards being a Zero Waste nation, but also to serve as a platform to educate and to nurture a culture that would continually engage in practices to reduce food waste in Singapore for the longer term."

Each day, up to 1.4 tonnes of food waste is taken to two digesters in the OTH basement. These break down food waste through natural decomposition within a controlled environment, using a sludge management system consisting of a grease separator, microbial treatment and an ultra-fine filter. Microbes accelerate decomposition, yielding useful by-products such as organic fertiliser, liquid plant nutrients and non-potable water. The fertiliser is used in OTH's community gardens and landscaping, and also distributed in 180g packets to residents, community clubs and schools. The non-potable water is used to clean OTH facilities.

Beyond engineering solutions, food waste control also requires waste to be segregated and sorted, which is a matter of social practice. All F&B tenants operating within the Hub, including the supermarket and hawker centre, have to undergo comprehensive training to learn how to separate their food waste from other general waste. To ensure commitment, food segregation to support the food waste management programme is incorporated into their tenancy agreements.



01

02

## Innovative food waste management at Our Tampines Hub

A look at OTH's eco-digester system

### 1 Food waste collection

At the **Hawker Centre**, cleaners or patrons deposit used utensils and unfinished food at the **tray return station**.



Food waste from **eateries** and the **supermarket** is manually sorted. Organic materials are collected in bins.

Non-biodegradable food waste joins the rest of the **non-food waste**.

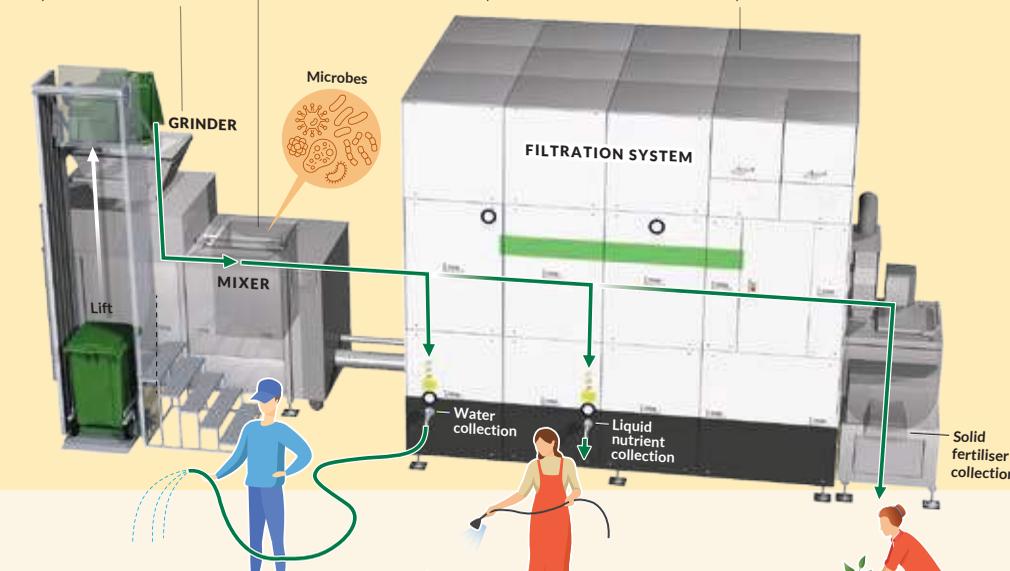
### 2 Eco-digester

Bins are taken to the digester twice a day.

**a.** Bins of food waste are emptied into a **grinder** by a mechanical lift.

**b.** The ground-up food waste is mixed within a drum with **microbes** to hasten decomposition.

**c.** The slurry is channelled to a filtration system and processed into:



### 3 Three useful by-products

**Non-potable water** used to clean the machine and the bin centre

**Liquid plant nutrients** for OTH's gardens and landscaping

**Organic fertiliser** packed and given to residents, community clubs and school

### Benefits

up to **1.4 tonnes** of food waste recycled daily

**1** garbage truck needed daily instead of 3



01 OTH's hawker centre boasts 42 stalls, 800 seats and 24-hour dining.

02 Eateries receive a steady stream of patrons throughout the day.

“Beyond engineering solutions, food waste control also requires waste to be segregated and sorted, which is a matter of social practice.”

01



The People's Association (PA), the local government agency for community development which manages OTH, also runs programmes to foster community participation and education. Students, OTH staff and volunteers help to pack and distribute the fertiliser packets. Regular learning tours to the Eco-Digester Centre are held so that corporate and community partners can appreciate how waste is managed at OTH and how everyone can play a part by making it easier to segregate food waste.

“As a pioneer in food waste recycling, OTH faced an uphill task in convincing tenants, partners and stakeholders that this was not only the better option environmentally but commercially also,” the OTH Director recalls. He adds that OTH continues to engage closely with vendors and tenants so that the programme can be further improved.

### Outcome

Today, the OTH system serves as a “living lab” for public education and an example to other developments on how to reduce food waste. After implementing the food waste control system, the number of garbage trucks needed to haul away waste each day was reduced from three to just one.

The financial, energy and labour savings have been apparent, along with reduced vehicular carbon emissions and improved traffic flow. Also, food waste no longer sits in facility bin centres awaiting disposal: this improves hygiene and reduces infestation by rats and other pests.

After more than a year of operation, OTH is still continuing to learn from its experiences with food waste management,

02



03

and growing the programme. More educational initiatives will be included, as well as more measures to segregate food waste and prevent non-recyclable elements—such as sugar cane stalks, hard shells, coffee powder, and non-organic materials such as plastic packaging—from entering the system. ○

01 To facilitate waste food collection, a points rewards system encourages patrons to return their trays.

02 Students from schools in the vicinity help to pack the fertiliser.

03 Fertiliser produced from recycled food waste are used in OTH's gardens.



CASE STUDY

New Taipei City | Eat with Love

# Free Meal Society

One measure of a society's inclusivity is how it cares for its most vulnerable members. New Taipei City's Eat with Love programme addresses food insecurity among children and teens at risk in the city of four million—and is completely funded by private donations.

## The challenge

In 2012, a 13-year-old child in New Taipei City's was prosecuted for stealing a box of salad. The well-publicised episode highlighted the city's systemic inability to spot and help children and teens at risk.

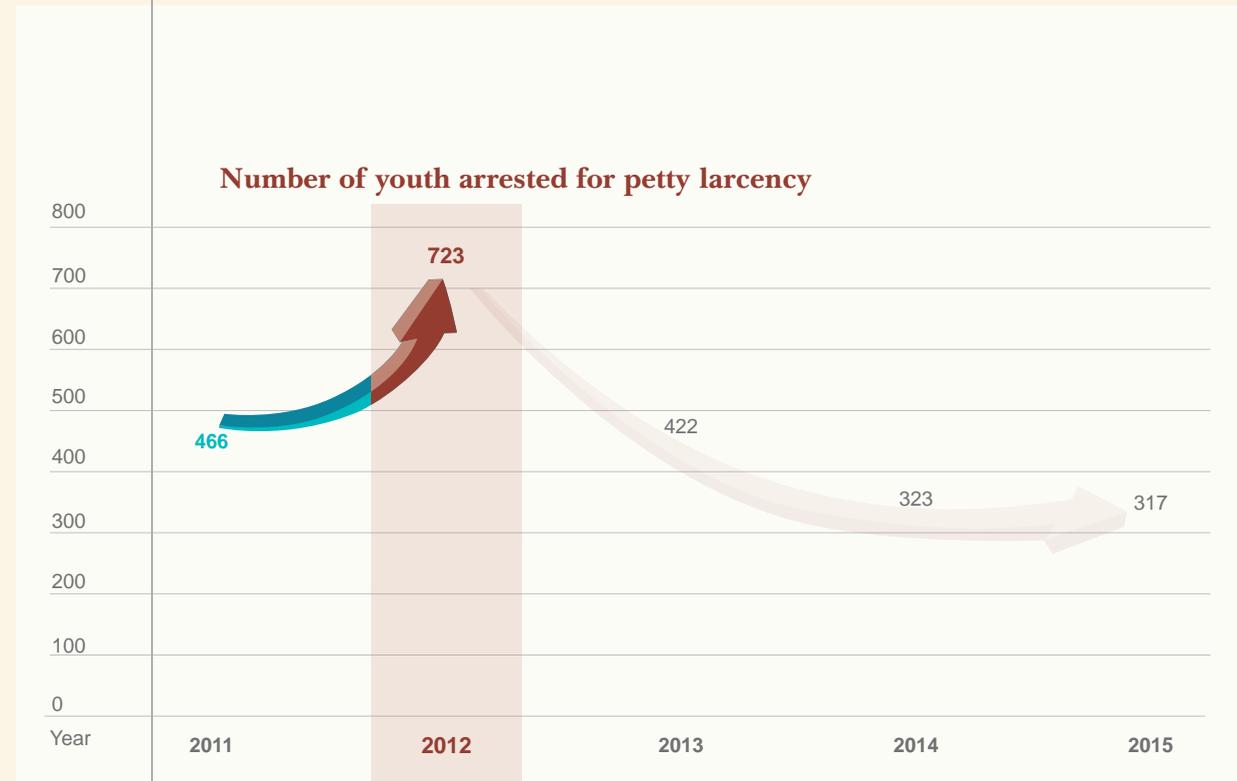
Household disruptions can cause children to go hungry; to feed themselves, some resort to petty crime, which could result in juvenile records. In one case, two siblings were left to fend for themselves when their grandmother and main care-giver was suddenly warded in hospital. Their

single-parent father was unable to care for them due to work commitments. In another case, the father of a schoolchild lost his business but was unwilling to seek financial help, and became unable to provide food for his family.

Even though welfare systems are in place to address vulnerable households, they do not readily cater to sudden, short term or unreported vulnerabilities in cases such as these.



Elyssa Ludher is co-author of *Food and the City: Overcoming Challenges for Food Security* (Centre for Liveable Cities, 2016).



Shortly after being promoted to Special Municipality status in 2011, New Taipei City saw an alarming spike in the number of youth arrested for petty larceny.



“Eat with Love is aligned with New Taipei City’s social welfare principles of ‘rescuing when at risk, not when poor.’”

### The Solution

Due to public outcry over how the 13-year-old child was treated, City Councillor Chen Mingyi challenged the city government to find better ways to address hunger in high risk households, and prevent children from having to resort to crime for food.

In December 2012, the City Council launched the Eat with Love programme as a pilot. Four partnering convenience chain stores —7-eleven, Family Mart, Hi-Life, and OK —were designated “Guardian Stations” (Xìngfú bǎowèi zhàn). Initially funded by the government, these stations offer meals to all under 18-year-olds, capped at NT\$80 (S\$3.60) per meal. The city worked closely with school principals to persuade nearby convenient stores to participate, and ran campaigns to raise awareness of the programme.

Convenience stores were chosen as they serve fresh meals and snacks, are open 24/7, and are accessibly located on nearly every major street corner. Bright and airy, they lack the stigma of welfare services—

unlike government facilities, schools or police stations. Since the stores are open all year round, children in need can get support even during school holidays or winter months.

The programme means that vulnerable children and teens can get three meals a day without disrupting their health or education. Children and teens are registered when they come in for the first time. They are then provided with meal coupons and their details are forwarded to the Service Centre for High Risk Families. The Centre follows up within 24 hours, through school counsellors or social workers, and additional assistance is provided if needed.

Eat with Love is aligned with New Taipei’s social welfare principles of “rescuing when at risk, not when poor” (Jiùjí bù jiù qióng). Vulnerabilities are addressed at the point of emergency, before they spiral and become entrenched in long term welfare dependency, which is disempowering. At heart, such policies aim to create a more just, resilient and caring community.



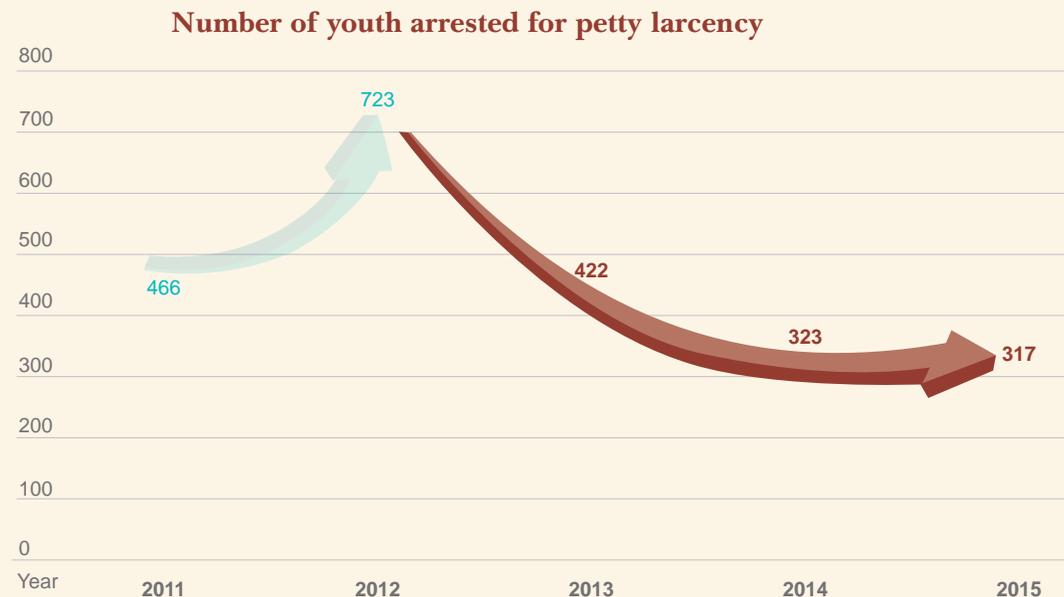
01



02

01 All youth under 18 can approach any convenience store that carries the “Guardian Station” sticker, and ask for a meal.  
 02 Children and youth who come in for a meal are requested to register so that social services can follow up with them.

“Once the public became aware of the programme, they began to donate actively ... The funds raised have more than covered the NT\$2,942,863 spent.”



**The outcome**

When Eat with Love was first introduced, the public was sceptical: many believed the system would be exploited for free meals. Labelled “crazy” by the media, New Taipei’s Mayor, Eric Chu, argued: “I know we are a mature society. We are a well-educated society. Our students will know it’s only for the students [in] need.”

Indeed, since the formal launch of the programme in January 2013, some 2,000 convenience stores have dispatched meal sets to only 23,422 children (both one-off and repeat cases). In 2017 alone, 1,691 children and youth benefited from the programme. Over the years, 2,028 new cases of “high risk” families have been identified and provided with assistance.

The programme has also harnessed public goodwill. Once the public became aware of the programme, they began to donate actively to it through the city government’s charity account. The funds

raised have more than covered the NT\$2,942,863 (S\$131,325) spent since the programme’s inception. This unusual collaboration with four large food chain businesses also represents a new approach to public-private partnership towards social goals. Mayor Chu shared: “After this [programme] was accomplished, the leader of the convenience store [came] to my office. I gave them a prize and said ‘thank you’, and everybody was happy. We should pay [them] back, not with money, but [with] respect.”

Locally, the programme has won the “Health and Equity” award from Taiwan’s Ministry of Health and Welfare, and the Outstanding Government Public Relations award. The programme is also being expanded to include more convenience stores in New Taipei. A similar programme of “Safeguarding Stations” was adopted in Taichung City in 2016, with approximately 1,220 convenience store outlets. ○

01 Extensive publicity campaigns for the Guardian Station programme meant that more youth and children knew where to go, if caught in difficult circumstances.  
 02 The number of youth arrested for petty larceny, which includes stealing of food, has fallen rapidly since the induction of the programme.



CASE STUDY

Singapore | Citizen Farm

# Farming for the Common Good

A passionate, ground-up group of urban farmers have jumpstarted a new model of community farming with a social mission—in the heart of Singapore’s densely built-up cityscape.

## Challenge

It is easy to take food for granted in Singapore, where food is readily available 24 hours a day, seven days a week. Yet a staggering 90% of Singapore’s food is imported, and food choices are largely constrained and influenced by market supply.

A growing number of urban farmers in Singapore are exploring ways to increase domestic production to supplement food imports. They want to produce what is good for consumers, instead of what is merely good for trade. They also believe that the process of growing food can be made more inclusive.

To pursue these goals, Edible Garden City was set up in 2012, with the aim to use edible gardens for residential, educational and recreational purposes. As it gained traction, it sought to have its own farm. A farm would not only provide fresh produce daily, but bring the community together, provide access to nature, allow people to learn about food sources and offer respite from urban sprawl.

However, few in Singapore knew how to design, build and operate an urban farm. The high cost of manpower in Singapore also meant a thin profit margin for small-scale farmers, making it hard for urban farms to be viable. A lack of space and complex regulatory rules relating to land use also made it difficult to find a suitable place for the farm in the city.



Darren Ho is the Head and co-founder of Citizen Farm.



After being demolished in 2010, the land that used to house the Queenstown Remand Prison lay unused.





01

## The Solution

An interagency urban farming task force, led by the Ministry of National Development, was set up to study how technological innovation has improved the viability of domestic food production, especially in limited land space, and how regulations could encourage more urban farming. Working together, stakeholders such as the Edible Garden City and the task force identified factors that obstructed the growth of urban farming. For example, existing regulations had not kept pace with technology and the economy. Traditional farms needed long leases to be viable, while modern farming systems, enabled by technology, could now be portable, allowing some flexibility in where they can be set up. In addition, urban farming as a social enterprise, which combined land uses, had not been accounted for.

**Waste from the flies is used as fertiliser for the farm's other crops, creating a closed loop.**

There were no sites that permitted urban farming for social purposes—land use for farming purposes is restricted, while land set aside for community purposes (e.g. a park or a community centre) is limited to specific uses which did not include farming.

The task force helped Edible Garden City navigate the regulations to set up an urban farm in Singapore. It played a crucial role in persuading government agencies to allow unutilised spaces for community farming and commercial farming on short leases.



02

The task force identified an unused plot of land in the housing estate of Queenstown, and worked with the Singapore Land Authority for leasing of the land, and with the Agri-Food & Veterinary Authority of Singapore for regulating agriculture produce.

With this help, Edible Garden City managed to site its new farm. The site, a former prison, was ideal as the land was disused, yet it was close to the city centre as well as to residents with a diverse range of backgrounds: local and foreign, young and old. Their farm initiative and social enterprise, Citizen Farm, officially opened in June 2017.

Darren Ho, Citizen Farm's head, had worked in various farms in Australia. Bringing his experience to bear, Citizen Farm started out by growing a combination of crops that were healthy, high in value and easy to grow. The farm was also designed to be a closed-loop setup that integrates natural systems with modern technology. Citizen Farm features Singapore's first urban black soldier fly farm, which can process food waste up to four times their weight a day. Because of this, the farm does not require any external energy to process organic material. Waste from the flies is used as fertiliser for the farm's other crops, creating a closed loop. Citizen Farm also incorporates elements of agro-tourism and education. Workshops and farm tours are held regularly for schools, corporations and other interest groups to raise awareness about urban farming.

01 Black Soldier Fly larvae break down waste into fertiliser, and allow Citizen Farm to close its production loop.

02 A farm that could grow different species for food and connect people to nature was envisioned.

“More young graduates have also been attracted to urban farming, despite the reputation of farming as a sunset industry.”



01



02

## The Outcome

Today, Citizen Farm grows up to 20 varieties of pesticide-free leafy salad greens, microgreens, edible flowers and mushrooms. The farm produces 50–80 kg of produce monthly, some of which is used in 50 restaurants island-wide, including Michelin-star restaurants run by world-renowned chefs. It is also host to an indoor hydroponics and aquaponics farm.

Further introducing people to local produce, the farm also feeds 50 families weekly with their community-supported vegetable box. This “Citizen Box” comes as an eight or twelve-week subscription of fresh produce.

Over the past two years, the farm has grown from five to 20 farmers, 10 of whom are individuals with special needs. The farm collaborates with organisations such as the Autism Resource Centre, Employment for People with Intellectual Disabilities and the Singapore Prison Service to equip people with autism,

mental disabilities, as well as inmates, with farming skills. More young graduates have also been attracted to urban farming, despite the reputation of farming as a sunset industry. To date, Citizen Farm has about 40 staff who are aged 22–65, with nine fresh graduates joining in 2018 alone.

The social entrepreneurship of a group of passionate urban farmers, supported by a responsive government task force, has opened doors for innovative new business models, and put Singapore on the path to growing a viable urban farming community in the city. Citizen Farm’s success showcases the potential of harnessing underused, marginal land for temporary use. These farming models are designed to be mobile and easily adapted to various spaces. Such setups supplement local food production, provide much-needed space for start-ups to explore agrotechnology innovations, and offer a much-needed platform to activate communities and get people involved. 

01 Citizen Farm officially opened in June 2017.

02 Tours and workshops for visitors such as this foreign minister from India are regularly held at the farm.



CASE STUDY

Wageningen | Foodvalley

# The Silicon Valley of Food

Small and medium enterprises, academic and research institutions, technology partners and government agencies have come together in the Netherlands to create Foodvalley, a multi-organisation ecosystem to develop innovative solutions for sustainable agriculture practice and the production of healthier food.

## Challenge

With a population of 17 million in a small, low-lying delta region of 41,500 km<sup>2</sup>, the Netherlands is the most densely populated country in Europe. Given that land and water is in limited supply, the Dutch have traditionally relied on intensive farming techniques. Over time, such techniques have placed increasing pressure on the environment and on living conditions. New methods of farming that could be both productive and environmentally sustainable were sorely needed.

However, while academic institutions such as the Wageningen University and Research at the Wageningen municipality had been generating a wealth of relevant scientific research and technological advancements, these were not easily accessible by the small and medium enterprises (SMEs) that form the mainstay of the Dutch agricultural industry. At the same time, SMEs lacked resources to carry out their own research and development.

There was a clear need to foster ties among the different stakeholders in the Dutch agricultural sector, so that they can share relevant knowledge and collaborate to improve the industry.



A Dutch greenhouse.



Krishna Udayasankar is a researcher, novelist and poet.



01

## Solution

In the early 1990s, attempts were made to systematically connect queries from agrifood companies with those with the knowledge to address them. Initially, this role was carried out by Kennisstad (Knowledge City) Wageningen.

Then in 2004, Foodvalley was set up in the Metropolitan Food Cluster in Wageningen. A unique, industry-led ecosystem to further the creation of healthier and more delicious food using sustainable production methods, Foodvalley comprises food companies, Wageningen University, the local government and the Regional Development Agency Oost NL. Its aim is to connect Dutch food companies with industry-relevant knowledge from the private and public sectors, and other parties abroad. It also supports SMEs with schemes that had previously been available mainly to government, research institutions or larger corporations.

**Foodvalley offers a comprehensive slate of programmes to systematically accelerate innovation and market outreach.**

Foodvalley is incorporated as a not-for-profit organisation. Financed by membership fees, the Dutch government, and the European Union, its membership base is a mix of smaller and larger companies, with a majority being SMEs. Taking what its Chief Executive Officer Roger Van Hoesel calls a “company-driven approach”, with the organisation’s decisions made from the bottom up, results in an environment conducive to technological collaboration as well as business-oriented alliances, such as marketing partnerships. Indeed, the Foodvalley initiative first arose from a spontaneous collaboration of research institutions, corporations and government agencies.



02



03

To pursue its goals, Foodvalley leverages on agricultural value chains already in place in Wageningen. Cutting-edge research and solutions relevant for the industry are generated by the local Wageningen University and Research, as well as by private contract research companies. One of these, NIZO, provides a demonstration centre that helps translate research insights into commercially viable technology that SMEs can use. Other firms, such as the HAN BioCentre, offers shared laboratories and research facilities to make it more cost-effective for SMEs to engage in their own R&D.

To support its member companies, Foodvalley offers a comprehensive slate of programmes

to systematically accelerate innovation and market outreach. These range from topic- or company- specific platforms (e.g. “The Protein Cluster”), to training sessions, breakfast networking sessions, trade show contingents under the Foodvalley umbrella to enter international markets, and more. Online portal worldfoodinnovations.com showcases Dutch agrifood innovations to the world.

Such schemes benefit companies on different scales. Smaller companies enjoy better access to knowledge, overseas markets, capital and partners. Larger firms are connected with promising start-up companies and research talent from the university.

- 01 Wageningen University & Research conducts world-class agricultural research.
- 02 Foodvalley organises the biannual Foodvalley Summit to help accelerate innovation and business.
- 03 The annual Foodvalley Expo showcases innovations from the Dutch agrifood industry.

“Foodvalley has led to the formation of the largest food and nutrition research and development cluster in the world.”



01



02

### Outcomes

Today, Foodvalley farmers deploy a wealth of new approaches to farm sustainably and productively. They use LED lighting to grow crops round the clock in climate-controlled greenhouses, and a range of automated systems: from driverless tractors to drones that monitor soil quality, irrigation levels and individual plant growth. Some Foodvalley farmers have reduced their water dependence by up to 90%; many have almost completely eliminated their use of chemical pesticides. Antibiotic use for livestock has also diminished.

Foodvalley’s focus on collaborative innovation has also opened doors for members further up the chain of production. For example, in 2012, local SME and Foodvalley member Solynta was conferred the Foodvalley Award for their innovation, which significantly

reduces breeding times for new potato varieties—from 10 to 50 years to as little as three to five years. The prestigious annual Award enables companies to gain recognition and attract investments for their innovative products. According to Pim Lindhout, Head of Solynta Research & Research Development, such accolades “help tremendously” as the company looks to future growth. Two years later in 2014, Solynta was further honoured as a Dutch National Icon for its breakthrough discovery.

Foodvalley has led to the formation of the largest food and nutrition research and development cluster in the world. The Wageningen region has benefited from a virtuous cycle of development, as more producers and support services choose to locate the facilities there. This ecosystem has been instrumental in making the Dutch agrifood industry more sustainable, connected, and innovative. ●

01 Foodvalley member Q-Point won the Foodvalley Award in 2016 for their food waste solution.

02 Local SME Solynta developed an innovation that drastically shortened potato breeding times.



CASE STUDY

New York City | Rooftop Farming

# Top of the Crops

High above New York City's densely populated skyline, lush farms full of fresh herbs, tomatoes and greens flourish on rooftops. **Toh Ee Ming** investigates the Big Apple's exciting urban farming boom in the sky and how it contributes to a more sustainable food system for the city.

## The Challenge

While New York City has had a local guerrilla gardening movement since the 1970s, there had been no comprehensive city-wide plan for urban agriculture. Up till the late 2000s, only a disparate assortment of programmes existed.

In 2009 and 2010, Manhattan Borough President Scott M. Stringer produced two reports that put forth policy recommendations to make the city's food system more sustainable, inclusive and resilient. A key area highlighted by the reports was to prioritise urban food production in the city.

Among its many recommendations, Stringer's reports advocated that underutilised spaces like rooftops be

used to develop agricultural greenhouses in land-scarce New York. But they also highlighted significant regulatory obstacles in the way. Many of the city's private and communal roof gardens lacked proper permits. Logistical, legal and other barriers remained high. Poor coordination among different public agencies sparked tensions between gardeners and property developers.

The challenge was thus to overcome policy hurdles so that urban farming, including on rooftops, could blossom in New York City. Doing so would help improve health for citizens, create commercial opportunities, bring communities together and mitigate the city's climate impact.



Gardens and greenery were limited and grew haphazardly on New York City's rooftops up till the late 2000s.



Toh Ee Ming is a journalist who has reported for Today, Xinhua News Agency and Nepali Times.



01

## The Solution

New York City is primed for successful urban agriculture. It has a well-developed transport and distribution network, and a lively, eco-conscious restaurant scene that supports locally grown produce.

The city's highly dense urban environment and expensive rent prices mean that spaces available and economically sustainable for farming are hard to come by—except on top of its many high-rise buildings. An estimated 14,000 acres of space on New York City's rooftops suitable for urban gardening and farming lie unused, with clusters of promising rooftops in Brooklyn, the Long Island City neighbourhoods of Queens and Mott Haven in the Bronx.

Stringer's reports recommended the systemic review of legislation and the identification

of unused spaces, particularly rooftops, in order to promote urban food production. This opened the path for greater ease of farming and gardening on top of the city's tower blocks.

In 2008, tax breaks were given to developers and building owners who installed green roofs from 2008. Later, the New York City Department of City Planning (DCP) launched a citywide initiative, called "Zone Green", which would revise zoning regulations, removing certain height, floor-area and use restrictions that once served as major barriers to constructing rooftop farms. Equipment necessary for rooftop farms' operations like solar panels and wastewater management equipment became permitted.

Such amendments became crucial in "creating more places for urban agriculture to take root in a dense, built-up

01 Regulation changes supported the growth of soil-based rooftop farming, such as those at Brooklyn Grange.

02 Gotham Greens' rooftop greenhouse, which utilises a hydroponic system, supplies fresh produce directly to the Whole Foods Market below.



02

environment", according to city planning commissioner Amanda M. Burden. This initiative later earned the national award for environmental planning.

Funding support for urban farmers was also improved. They were offered more financial support through loans provided by the government such as the Farm Service Agency under the US Department of Agriculture, or the Agriculture Loan Fund Program launched recently by the New York Job Development Authority. Aspiring farmers were given a chance to learn how to expand small-scale ventures, manage finances and market products, and to be mentored by experienced entrepreneurs, through initiatives such as the FARMroots' Beginning Farmer Program run by non-profit GrowNYC.

Dialogues between the authorities and farmers were held to keep relevant improvements ongoing. In 2016, the Brooklyn Borough President hosted a

**“An estimated 14,000 acres of space on New York City's rooftops suitable for urban gardening and farming lie unused...”**

roundtable with municipal agencies and the New York City Agriculture Collective (a group of businesses that grow food or produce technologies for urban agriculture) to discuss how to better support the growing sector.

More recently in December 2017, the New York City Council unanimously passed the city's first-ever urban agriculture policy bill. It called for a centralised digital database of agricultural organisations, businesses, and public land parcels suitable for farming to be established. Guidelines would also be provided to help would-be urban farmers navigate the complex system of starting an urban farm.

“Today, New York is the world’s leading city in urban farming.”

01



02

## The Outcome

Today, New York is the world’s leading city in urban farming. A plethora of farms and gardens have taken over its rooftops, including housing complexes, convention centres, public schools and even a church in Hell’s Kitchen. Their activities range from hobby community gardens and roof-to-table restaurants to high-tech indoor vertical farms and commercial rooftop farms. In 2014, some 900 gardens and farms grew food in the city, up from 700 in 2012.

Rooftop farms like Brooklyn Grange, a rooftop farm founded in 2010, harvest over 22,000 kg of fresh produce annually, supplying local restaurants and farmers’ markets. Ben Flanner, President and Director of Agriculture at Brooklyn Grange, told CLC he expects production to grow to over 36,000 kg per year within the next two years.

Flanner credits the farm’s success to its “multi-faceted appeal” in addressing environmental, health and education

issues, and the municipal government’s support. Some of the farm’s green roof installations were partially funded by the city’s Green Infrastructure Stormwater Grant.

The increasing presence of successful commercial urban agriculture ventures has sparked a growing consciousness and appreciation about the origins of local food. This has even led to new business models for sustainability, such as tipping fees for collecting compostable waste.

The rise of urban farming in disadvantaged communities, in places like Harlem, have also helped provide affordable, nutritious and fresh food to neighbourhoods where such foods are harder to come by.

Nevertheless, hurdles remain, especially for new entrants. Prospective farmers continue to face bureaucratic hurdles, limited investor funding, and lack of understanding over zoning, permits and regulations. Appropriately trained urban farm workers are also in short supply. ○

01 Brooklyn Grange runs numerous citizen engagement activities, including free public tours of its farm, to raise awareness.

02 A rooftop garden in Hell’s Kitchen.

The **SINGAPORE URBAN SYSTEMS STUDIES SERIES**

draws on original research to document Singapore's transformation into a liveable and sustainable city.

Taking reference from the Singapore Liveability Framework, the Urban Systems Studies series aims to answer two key questions: how Singapore has transformed itself into a highly liveable city within the last five decades, and how Singapore can build on its urban development experience to create knowledge and urban solutions for current and future challenges relevant to Singapore and other cities, through applied research.

The Urban Systems Studies series is available for free download from the CLC website.

Discover the USS series and other CLC publications via our digital channels:

[www.clc.gov.sg](http://www.clc.gov.sg)

[CLCsg](#)

[CLCotSG](#)



download  
*free*  
copies online

[www.clc.gov.sg/research-publications/publications/urban-solutions](http://www.clc.gov.sg/research-publications/publications/urban-solutions)



CENTRE for  
**LiveableCities**  
SINGAPORE



The Centre for Liveable Cities seeks to distil, create and share knowledge on liveable and sustainable cities. Our work spans four main areas, namely Research, Capability Development, Knowledge Platforms and Advisory. Through these efforts, we aim to inspire and give urban leaders and practitioners the knowledge and support they need to make cities more liveable and sustainable.

*Discover what CLC does on our digital channels.*

**EXPLORE**



[clc.gov.sg](http://clc.gov.sg)



**CONNECT**



[CLCsg](https://www.facebook.com/CLCsg)



**IMMERSE**



[CLC01SG](https://www.youtube.com/CLC01SG)



**Contact**

[MND\\_CLC\\_enquiries@mnd.gov.sg](mailto:MND_CLC_enquiries@mnd.gov.sg)