Chapter 10
Addressing Food Security in Constrained Urban Environments

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Abstract Our research investigates how the issue of food security is addressed through an effective urban planning strategy and legislative agenda in resource-constrained urban environments. As part of our study, we assess the degree to which urban planners have embraced the issue of food security. We also examine the importance of urban agriculture in facilitating narrower supply chains, which enhance food security. Finally, to further our understanding of the field, this study provides urban farming examples from Canada, Brazil, and Singapore to shed light on how a combination of community and NGOs support, public and private sector investments, as well as specific government regulatory provisions can help alleviate most of the food security challenges that resource-constrained environments present.

Keywords Urban environments · Urban planning · Food security · Urban farming · Policy development

10.1 Introduction

The urban landscape is experiencing unprecedented change, with more than half of the world’s population now living in urban areas (Zeng et al. 2016). Since 1950, the urban population has increased from 751 million to 4.2 billion in 2018 (UN 2018). This urban drift is placing significant stresses on key infrastructure and natural resources such as land, water and energy, the likes of which are crucial for the production, transportation and consumption of food (Montgomery 2008; McDonald et al. 2013, 2014). Past research has shown that as urban populations increase, demand for resources like land, water and food also increases (Rashid et al. 2018; Huang et al. 2010). Unsustainable developmental models that attempt to accommodate urban
populations have resulted in damaged ecosystems and environmental degradation (Heshmati et al. 2019).

One of the most important factors that has emerged from constrained urban environments has been the issue of food security. Defined as a person’s ability to have physical and economic access to sufficient, safe, and nutritious food, food security is an important means supporting the dietary needs for an active and healthy life (FAO 2006). Food security research has shown that strong supply chains help to improve the physical health of people, while a lack of food security has been positively related to lifestyle disorders such as diabetes and obesity (Yau et al. 2018). However, the need to have secure access to food goes beyond simply ensuring that everyone has a safe supply of food to eat. The issue has been a prominent feature within the United Nations Sustainable Development Goals (SDGs) for the year 2030 initiative (Breene 2016). Its inclusion highlights the important role that food security plays within other socio, economic and environmental factors such as urbanization, growing population, climate change and poverty. Any challenging circumstances or constraints caused by these factors limit an area’s ability to achieve food security. In order to address such concerns, innovative approaches are needed (Anderson and Kolko 2011).

One important innovative approach to secure food security is through the development of well-structured urban planning initiatives that drive urban agricultural production. Defined as ‘growing and raising food crops and animals in an urban setting for the purpose of feeding local populations’ (Pfeiffer et al. 2013, p. 79), urban farming has grown to be an important feature of the modern urban planning. Over the past decade, urban agriculture has evolved from a leisure or personal activity to that of an economic activity on the cutting edge of technological innovation. Its growing appeal around the world (Yuan et al. 2019) also reflects government attempts to overcome food safety and land resource issues, while also providing sustainable urban living environments that manage the food security threats posed by rapid urbanization (Shamshiri et al. 2018). However, in order to better support urban agricultural activities, urban planners need to do more to accommodate the issue of food accessibility in cities (Slade et al. 2016). Despite some progress being made, many urban areas still experience so-called ‘food deserts’ in which access to healthy food outlets is limited (Slade et al. 2016).

Appropriate urban planning can therefore go a long way to preventing the presence of these deserts by increasing the level of connectivity that exists between urban areas and rural agro-industries. Given this context, our research seeks to understand the important role that urban planning initiatives, such as urban agriculture, can play in alleviating food security concerns in cities. In order to do so, we adopt a qualitative informative approach by exploring the following research questions (RQ):

RQ1: How can urban planning facilitate urban agricultural opportunities?
RQ2: What role does urban agriculture play in addressing food security concerns?
RQ3: What policy and legislative frameworks have been developed to enhance food security efforts in urban areas?
This food security study differs from earlier works in several ways. Firstly, it examines the role of urban planners within the urban agricultural landscape. Secondly, we assess the important role that urban agriculture plays in alleviating urban food insecurities. Finally, our study highlights urban farming examples from Canada, Brazil, and Singapore to illustrate how government regulatory provisions can help alleviate some of the food security challenges that urban environments present.

The remainder of our study is as follows, Sect. 10.2 addresses the role that urban planners play in addressing urban agricultural opportunities (RQ1). Section 10.3 examining the role that urban agriculture plays in addressing food security concerns (RQ2). Section 10.4 provides examples of various policy and legislative frameworks that have been developed to enhance food security efforts in urban areas (RQ3). Finally, Section 10.5 documents the key results and provides a series of concluding remarks.

### 10.2 The Role of Urban Planners Within the Urban Agriculture Landscape

Urban planning links health outcomes and place at a local level (Slade et al. 2016) with urban planners playing a pivotal role in creating the types of healthy living environments that provide sustainable and equitable access to secure and healthy sources of food (Morgan 2009). However, as Pothukuchi and Kaufman (2000) note, while urban planners have done much to improve land use, housing, transportation and a range of environmental factors, little interest has been given to addressing the issue of food security (Cassidy and Patterson 2008). Moreover, within the context of urban agriculture, Thibert (2012) states that local government urban planners are ill-equipped to deal with the practical and policy aspects of the role. However, Clancy (2004) provides an alternative perspective, by suggesting that more needs to be done by food advocates to convince planners of the benefits of their involvement in developing agricultural opportunities. An Australian study by Allender et al. (2009), found that local governments can feel powerless to make a change, noting evidence of multiple urban planning barriers when endeavouring to address the complex challenge of food security. In other research, Morgan (2009) notes that planners go to great lengths to plan for water access without considering a community’s need for secure food supplies. While others note that it was not until the academic community and several international organizations criticized many urban planning practices that more of an emphasis was given to the issue of food security (Raja et al. 2008).

In recent years, the literature on urban planners has evolved, with the identification of three key interfaces between urban planning and the improvement of food security outcomes, these include: strategic planning and policy development, land use regulation and infrastructure development (Slade et al. 2016). Research highlights the ways in which urban planning can influence the location and establishment of urban farming activities, like community gardens and fresh food stalls (Slade et al. 2016).
These initiatives provide a range of social, environmental, and economic benefits, including the productive use of vacant spaces, enhanced liveability, alternative income sources, the alleviation of poverty, and better health outcomes (Mougeot 2006; Thompson et al. 2007). In order to develop and grow these urban farming initiatives, urban planners must work with local governments to plan, zone, and design appropriate guidelines and living environments to be successful (Castillo et al. 2013). The advent of the urban farming era has enabled a smoother integration of food into urban planning agendas. With growing worldwide interest in urban farming and the efforts of local governments to improve local food security, land is being zoned for agriculture and allied activities in urban areas. However, some researchers are still sceptical about the benefits of urban farming with some noting that it may even escalate food inaccessibility by benefitting privileged communities who prefer fresh food (Horst et al. 2017). Furthermore, urban farming only addresses the food availability aspect of food security. Some academics suggest that planners can play a proactive role in improving food access by strategically locating supermarkets, farmers markets, corner stores and other food destinations (Raja et al. 2008). Also in communities where a lack of access to food is prevalent, due to poor public transportation and low economic status, planners can empower these communities with better connectivity to the food systems. For example, studies in the US have shown that low-income communities have to travel for 19.5 minutes to reach a supermarket, whereas in high-income neighbourhoods, the commute time was only 15 minutes (Hodgson 2012).

Planners can also address the poor rural–urban linkages, which play an important part in increasing ‘food miles’ and the carbon footprint of the food itself, while also making the food system vulnerable to supply chain disruptions. Improving market access, building urban infrastructure for transport as well as food storage facilities are some of the steps that planners can take to address such concerns. The City Region Food Systems (CRFS) planning concept is one that allows for holistic planning right across the rural–urban food system landscape (American Planning Association 2007; Brinkley 2012). The CRFS programme deals with a wide array of areas, ranging from food production to food waste, in which the focus is on managing not only land use concerns but also resources such as transport and water (American Planning Association 2007; Brinkley 2012). While planning for food security, urban planning must also take into consideration informal food systems such as street food vendors, which are common in developing countries. Furthermore, effective urban planning also helps to make sure that resources are utilized in the most sustainable manner possible (Cabannes and Marocchino 2018). The concept of the circular economy can also be applied successfully if planners channel food waste into agricultural producing regions and efforts are made to reduce landfill usage (American Planning Association 2007).

In summary, the recent literature suggests that urban planning plays an important role in advancing food security in urban areas. It is particularly important in identifying patterns of inequitable access, facilitating urban food supply and embedding food security principles into policies and plans (Slade et al. 2016). The role that
urban planners play, can be significantly enhanced through the implementation of integrated and consistent food security policies at all levels of government.

10.3 Urban Agriculture and Its Impact on Urban Food Security

As the world becomes increasingly urban, cities will face higher demand for natural resources and the potential for unsustainable levels of economic development (Bentham 2012; Thomaier et al. 2015; Dodman et al. 2017). In order to address these concerns, much research has focused on the important role that urban agriculture can play in achieving food sovereignty and improving local economic development opportunities, while at the same time reducing the size of the carbon footprint across the urban landscape. Urban agriculture represents an industry which makes, processes, and sells food in response to the daily needs for urban consumers, using urban and peri-urban buildings and land (Pölling 2016; Benis and Ferrão 2017). A key aspect of urban agriculture is vertical farming, a technique that features prominently in the urban farming literature. In principle, it is a simple concept; farm up rather than out (Despommier 2013, 2014). An assessment of the literature shows that vertical farming occurs in two main types (Despommier 2014). The first consists of tall structures in which several layers of growing beds are stacked on top of each other, all of which utilize artificial LED lights. This is the most common form of vertical farming, with many cities having implemented this model in old and new buildings as well as warehouses that have been repurposed for agricultural activities (Despommier 2013; Al-Kodmany 2018). The other major form of vertical farming takes place on the rooftops of commercial and residential structures as well as on restaurants and grocery stores (Despommier 2014; Touliatos et al. 2016). In both instances, the logic of vertical farming is simple: produce more food on less land (Muller et al. 2017). Moreover, the same rationale used in Singapore, in which homes and offices are stacked into limited and expensive land, can be applied to farming. The technologies used in vertical farming include hydroponics, aeroponics and aquaponics (see Table 10.1).

Several studies also highlight the important role that urban agriculture plays in improving urban food security (Kalantari et al. 2020), increasing fruit and vegetable consumption (Taylor and Lovell 2012; Mansfield and Mendes 2013), facilitating community interactions (Armstrong 2000; Morgan 2014) and providing access to fresh food in food deserts (Segal 2010). Moreover, from a specific vertical farming perspective, other works highlight its role in growing produce in a more efficient and sustainable manner than traditional forms of farming (Al-Kodmany 2018). In terms of food security, Despommier (2010) estimates that a 30-floor building spanning one square block, utilized for vertical farming purposes, can provide the calorific intake for 10,000 people (based on 2,000 calories a day per person diet). Furthermore, as the food would be produced inside city boundaries, the distance it would have to travel
| Type/technology                                      | Farming example                                      |
|-----------------------------------------------------|------------------------------------------------------|
| Hydroponics                                         | Oh Chin Huat Hydroponic Farms: Singapore             |
|                                                     | Nuvege Plant Factory: Kyoto, Japan                    |
| Aeroponics                                          | AeroFarms: USA                                       |
|                                                     | Ky Greens Farms: Singapore                           |
| Aquaponics                                          | Ecoponics: Iceland                                   |
|                                                     | The Plant Vertical Farm: Chicago, IL                  |
| Greenhouses (Controlled Environment Agriculture)     | Green Sense Farms: Portage, Indiana and Shenzhen, China |
|                                                     | AeroFarms: Newark, New Jersey                         |

*Sources: Kalantari et al. (2017, 2018)*

is also drastically reduced (Suparwoko and Taufani 2017). This shrinking of the supply chain would also greatly enhance food security. Other studies highlight urban farming’s ability to save water and energy use while also reducing pollution emissions (Healy and Rosenberg 2013), and provide new employment opportunities. In addition to this, other studies have highlighted ecological benefits through the ‘greening’ of urban environments, decreasing urban heat-island effects and providing wastewater diversion (Chen and Wong 2005; Grewal and Grewal 2012; Haberman et al. 2014; Johnson et al. 2015). Nonetheless, despite these benefits, Despommier (2010) notes that vertical farming is not a panacea for overcoming all food security issues. A key criticism of vertical farming approaches is the energy costs associated with helping the plants to grow (Al-Chalabi 2015; Specht et al. 2014). Such costs greatly impact the sustainability gains that are often touted as an important benefit of urban agriculture (The Economist 2010). There are also water issues surrounding vertical farming businesses that can profoundly influence the success of the venture (Perez 2014). In order to overcome this issue, aeroponics and hydroponics technologies have been used that help to save up to 95% of total water used (Kalantari et al. 2018). They can also help to remove wastewater, which is potentially hazardous to the environment and to human health (Voss 2013). However, these technologies are still expensive to set up and require significant expertise in terms of their monitoring and upkeep. Despite its various advantages and disadvantages, many cities around the world have pioneered their own approaches to urban farming as a means of achieving food security. The most notable examples of which include Singapore, Hong Kong, New York and Dubai.

In order to ramp up its local food production, the Singapore government implemented the ‘30 by 30’ policy agenda, which seeks to raise local production from less than 10% today to meet 30% of Singapore’s nutritional needs locally by 2030 (CNA, 7 March 2019a). This policy platform has also coincided with a tremendous increase in the uptake of vertical farming initiatives across the island. The most significant of
which is the Sky Greens project, a world leader in this area. In 2019, the Singaporean Sky Greens urban farming enterprise received the world’s first national certification standard for organic vegetables grown in urban environments. In other developments, Hong Kong now has over 60 urban farming enthusiasts who farm terraces actively (Robson 2017), while Dubai has invested US$40 million in urban farming initiatives so as to ensure as much fresh food as possible is served for its national airline Emirates (Gray 2018). New York is also an active player in urban farming with its Aero Farms supplying leafy greens to Singapore Airlines (Slotnick 2019). It is also home to various other large players such as Bowery and Brooklyn Garage, while smaller urban centres like Detroit have also adopted urban farming practices, with the movement now being embraced by some 800 million urban residents globally (FAO, n. d).

### 10.4 Policy Frameworks and Case Study Analyses

Establishing shorter supply chains that enhance food security in urban areas has received more attention in recent times. More specifically, the World Health Organization (WHO) and the United Nations Food and Agricultural Organization (FAO) have launched programmes like ‘Healthy Cities’ and ‘Food for the Cities’ to endorse the importance of urban food security (WHO, n.d.; FAO, n.d.). In order to achieve greater food security, the FAO has created guidelines for integrating food security mechanisms within urban planning frameworks (Cabannes and Marocchino 2018). One such example has been the establishment of the Milan Food Policy Pact, which was signed in 2015 by more than 160 cities from around the world. The Milan Urban Food Policy Pact forms the first international protocol that calls for the development of more sustainable and resilient urban food systems. The aim of this pact is to reduce the impact of food loss and waste (FLW) on natural resources, the environment and sustainable food production in urban centres (FAO 2015). In association with this, an e-book titled ‘Milan Urban Food Policy Pact. Selected Good Practices from Cities’ containing 49 good practices was published along with this Pact (FAO 2015).

While analysing the legislative aspects of planning food systems and security, it must be stressed that the local government’s role in planning is as vital as that of state or federal governments. Local governments are often in control of how land is used, where residents are housed, how commercial activities take place and establish necessary local socio-economic linkages (Hodgson 2012). The local community, NGOs, and investments from both the private and public sector are also critical in helping to shape urban planning developments and the implementation of effective food security initiatives. The remainder of this section provides a number of case studies which outline how effect policy frameworks have been implemented.
10.4.1 The Case of the Greater Golden Horseshoe (GGH) Region, Toronto

The GGH region is one of Canada’s most populated and fastest growing regions. With a current population of 9 million, the area is projected to grow to 13.5 million people by 2041 (Ontario Government, n.d.). The GGH City Region includes the City of Toronto and 15 surrounding counties. It is Canada’s most important economic engine, generating two thirds of Ontario’s and one-quarter of Canada’s Gross Domestic Product (Ministry of Municipal Affairs and Housing, n.d.). Its farmland represents one of the most important economic sectors of the region, contributing $11 billion and 38,000 jobs to Ontario’s economy (Ontario Federation of Agriculture 2015). How growth is accommodated in these areas will determine the future of agricultural lands and the agricultural economy in the GGH.

The core problem of the GGH region, is the competing demands between housing, infrastructure needs, and preservation of prime agricultural land. Food insecurity is another significant challenge for Toronto as some communities face difficulties in accessing healthy food, particularly low-income households and individuals and families reliant on social assistance (Toronto ca, n.d.). It is reported that in 2017, almost one in five (18.5%) Toronto households experienced marginal, moderate, or severe food insecurity, which is significantly higher than the provincial average of 14.1% in Ontario, excluding Toronto (Toronto ca, n.d.). The 2015 ‘Cultivating Food Connections’ study for Toronto shows that insufficient funding is going to local farmers or local communities (FAO, n.d.).

To tackle these constrained urban challenges, a review was conducted with various stakeholders, which resulted in Toronto adopting a range of food security policies that facilitated more sustainable lifestyles and better access to fresh food for its residents. Eight key policy recommendations emerged through the CRFS project. Each of which were assessed and then grouped in order to identify appropriate priorities. The top policy recommendation was to create mid-scale infrastructure and provide financial, regulatory, public food procurement and educational supports, such as food hubs, to further develop regional food flows (FAO, n.d.). Associated recommendations include providing financial resources, developing appropriate regulations and increasing related educational and research support to foster mid-scale infrastructure (FAO, n.d.).

The above policy recommendations demonstrate that the City Region Food System (CRFS) approach facilitated a more integrated, just, and efficient food system in the Toronto Region as linkages between existing networks deepened, including the Toronto Food Policy Council, Greater Golden Horseshoe Food and Farming Alliance, Toronto City Council, Toronto Public Health and Economic Development (Miller and Blay-Palmer 2018). As a result, several initiatives were rolled out, including the Urban Agriculture tours for rural members and the region/peri urban tours for urban practitioners, the Food, Farming and Health professional development measures, as well as the data sharing and collaboration strategies to increase the procurement of local food in City institutions (Miller and Blay-Palmer 2018).
The GGH planning framework is undoubtedly a major step forward in the direction of managing growth and preserving farmland in the region. However, there are major challenges linked directly or indirectly to land-use planning which have policy and legislative implications. One of the challenges arises due to expanding urban developments, which have been encroaching on agricultural lands. These changes reflect a new planning framework that encourages new urban development opportunities (Ontario Federation of Agriculture 2015).

In line with smart growth planning principles and global climate change, there is a need to integrate agriculture as a permanent feature of the regional landscape and farming as an essential component of the economy and cultural heritage (Ontario Federation of Agriculture 2015). This is consistent with the principles of ecological planning, which are becoming increasingly important as communities seek to provide a more holistic approach to environment conservation (Ontario Federation of Agriculture 2015).

### 10.4.2 The Case of Belo Horizonte in Brazil

Belo Horizonte, the capital city of Minas Gerais state, is the fourth largest city in Brazil with a population of 6.08 million in 2020 (Macrotrends, n.d.). In the early 1990s, the city suffered high rates of poverty and hunger. Figures from the time estimated some 38% of families were living below the poverty line, while 18% of children aged less than three years were found to be malnourished (FAO, n.d.).

In 1993, the newly elected municipal government of Belo Horizonte initiated a new policy agenda, which included changes to land use legislation and the development of the Belo Horizonte Food Security Program, which sought to combat poverty-related food inaccessibility issues (Deldago 2018; Rocha and Lessa 2010). A core component of the programme is the Municipal Secretariat of Supplies (Secretaria Municipal de Abastecimento—SMAB), an agency created by the City Government to prevent and reduce malnutrition among vulnerable groups (FAO, n.d.).

The SMAB’s programmes have been quite successful, reaching close to 35% of Belo Horizonte’s population (Pessoa and Machado 1999), mostly low-income families and individuals. The programme not only significantly improved food security, its urban planning initiatives also made the city a pioneer in urban food security. Besides food security, Belo Horizonte’s efforts also focused on equitable access to food and social justice (Rocha and Lessa 2010). The programme assisted those in need, addressing partnerships with private food players as well as a focus on urban agriculture. The main partners include other government departments (Public Health, Education and Environment), the private sector (small farmers, food manufacturers and store operators), NGOs (the Citizens’ Action Campaign, the Network for Exchange in Alternative Technologies and others), philanthropic groups (running day-care centres, community centres and nursing homes), community associations, and the University of Minas Gerais. The city also introduced comprehensive food waste management practices and a highly effective food and nutrition education
programme, as well as an outreach restaurant-based food supply initiative that provided meals to the homeless and destitute (FAO 2018).

This case study provides a good example of successful food security policy. The establishment of the Municipal Secretariat of Supplies (Secretaria Municipal de Abastecimento—SMAB) has played a pivotal role in significantly reducing the levels of hunger and malnutrition in Belo Horizonte, while at the same time driving economic growth through small-scale agricultural holdings in the region (Future Policy Organisation, n.d.). Nonetheless, the question remains as to whether this kind of success can be replicated in other parts of Brazil?

### 10.4.3 The Case of Singapore

Singapore is an interesting case when it comes to food security policy and legislative frameworks. As a densely populated metropolis of 5.703 million in 2019 (Department of Statistics, Singapore 2020) the country is largely devoid of any natural resources and as such is highly dependent on food imports from around the world. Given this backdrop, it is perhaps surprising that Singapore has topped the Economist Intelligence Unit’s Global Food Security Index of 113 countries in 2018 and 2019 (The Straits Times, 10 December 2019). Prior to 2018, of the countries recorded, Singapore had been in the top three positions of the index’s measures of affordability, availability, quality, and safety of food source.

Researchers such as Dr Cecilia Tortajada, a Senior Research Fellow at the Lee Kuan Yew School of Public Policy’s Institute of Water Policy attributed Singapore’s high ranking in food security to its planning and ability to ensure a safe, accessible and affordable supply of food (The Straits Times, 10 December 2019). With agricultural land, only making up 1% of Singapore’s total land area (Choo 2019) it is little wonder that it imports more than 90% of the food consumed in the country. Its need for foreign sourced food has seen Singapore develop strong trading ties with more than 160 countries around the world (SFA 2016/2017). Given this reliance, any disruption to its food supply chains through the impact of climate change, rising sea levels and temperatures or an outbreak of diseases could prove extremely damaging for Singapore. Given such concerns, the Singaporean Government and the private sector have made significant investments to secure strong and effective food supplies.

The early adoption of urban farming in Singapore has been aided by innovative research technologies (Teng and Escaler 2010) as well as strong support through the launching of initiatives such as the Environment and Water Resource Ministry’s ambitious ‘30 by 30’ goal, which as mentioned earlier, seeks to produce 30% of Singapore’s nutritional needs locally by 2030 (Ai-Lien 2019). In order to achieve this, the Environment and Water Resources Ministry (MEWR) detailed four ways in which food security can be achieved. These included the use of technology to grow more with less, unlocking physical spaces for farming, developing local talent and getting consumers to support locally produced food (Mahmud 2019). These announcements have in turn led to significant investments in indoor agricultural innovations and
the establishment of business accelerators and incubators that provide investment opportunities and grants to start-ups working in the urban farming industry. More specifically, the Singapore Government has partnered/co-invested with seven accelerators to invest further in food and agriculture technology start-ups (Chong 2019). These efforts have resulted in significant growth in vertical and rooftop farming, in particular the successful Skygreens, and Oh Chin Huat operations, which has seen Singapore now produce 13% of the total amount of leafy greens consumed locally (Choo 2019).

The Government initiatives also came in the form of funding for R&D investment in the agriculture and food production sector. In line with the newly announced target to produce 30% of the nation’s nutritional needs by 2030, the Government will invest $144 million (SGD) from its Research, Innovation and Enterprise 2020 (RIE 2020) plan to ramp up research and development activities in the agri-food industry (Tang 2019). To upskill local farming capabilities, institutes of higher learning, such as Temasek Polytechnic have launched new institutions like the Aquaculture Innovation Centre (AIC), which opened in June 2019. The AIC is the first ever Centre of Innovation (COI) funded by Enterprise Singapore (a statutory board under the Ministry of Trade and Industry in Singapore) that adopts an inclusive and collaborative approach involving a consortium of 9 research institutes, agencies, universities, and polytechnics in Singapore (Temasek Polytechnic, n.d.).

From a local community perspective, Singapore’s public housing environment provides the perfect platform from which local food production can be increased. A Singapore-based study by Astee and Kishnani (2010), showed that if the rooftops of public housing estates in Singapore (HDB’s) are used for food production, local production can be increased to 35.5% from its current 5.5% level; while at the same time, reducing carbon emissions, and enhancing new biofuel production opportunities. In addition, when compared with other cities globally, Singapore’s unique tropical climate means that rooftop-farming operations are very feasible. Instead of using expensive lighting for growing crops, Singapore can harvest natural sources of light to grow vertically farmed produce (Wilson 2005).

The current COVID-19 situation in 2020 underscores the importance of local food production as part of Singapore’s strategies to ensure food security. In recent times, the Singapore Government has offered local farming ventures various grants and incentives which seek to increase local production capabilities. This includes providing a $30 million (SGD) grant to support the production of eggs, leafy vegetables and fish, while also identifying alternative farming spaces, such as industrial areas and vacant sites (The Straits Times, 8 April 2020).

However, for a small city-state like Singapore, there are challenges relating to urban farming, which it needs to surmount. For example, land scarcity remains a challenge, exacerbated by a complex and restrictive regulatory framework related to land use (Low 2019). Building human capacity is another challenge that relates to many cities with most of the farm’s employees being brought up as urban dwellers (Low 2019). Many lack the experience and training to manage urban farms. Skilled-labour to service these farms is also of concern, for although the vertical farming system is automated, the harvesting and packing of vegetables is carried out manually
by foreign workers. There is also a general lack of awareness about and support for more sustainable consumption patterns among the Singapore community, which further hinders the advancement of vertical farming opportunities. Moreover, how much will consumers be willing to pay in order to purchase organic vertically farmed vegetables over traditionally farmed ones? (Khoo 2020).

The case of Singapore illustrates the significant role played by government in supporting initiatives for food security in a highly constrained urban environment. Its ability to accelerate the development of a tech-savvy workforce in agriculture and food processing, backed by appropriate investments in research and development, through its higher education institutes and ASEAN centres of expertise in food production and processing (CNA, 10 March 2019b) have helped Singapore scale the constraints of its urban environment. Moreover, unlike the Bel Horizonte case study in Brazil, in which civil society participation, NGOs and community groups were instrumental in leading change. The success of Singapore’s urban environment is very much driven by strategic urban planning initiatives and specific government regulatory provisions that help alleviate some of the food security challenges faced by the city-state.

10.5 Conclusion

In the coming decades, climate change, urbanization and an expanding global population with growing income inequalities will make food security even more challenging. Coupled with the interdependency of the global economies, any disruption in supply chains wrought about by unforeseen global events such as the COVID-19 pandemic in early 2020 will only serve to exacerbate the food security issue further. In an attempt to better understand how the issue of food security can be overcome our study addressed three research questions: (1) How can urban planning facilitate urban agricultural opportunities? (2) What role does urban agriculture play in addressing food security concerns? (3) What policy and legislative frameworks have been developed to enhance food security efforts in urban areas?

Firstly, our study identified the important role that urban planners in creating an environment that facilitates the establishment of urban farming activities, like community gardens and fresh food stalls. Such initiatives provide a range of social, environmental, and economic benefits which are instrumental in helping to not only alleviate poverty but also provide better health outcomes for some of the most vulnerable members of society. In order to develop and grow these urban farming initiatives, urban planners must work with local governments to plan, zone and design appropriate guidelines and living environments to be successful. Secondly, our research showed the important role that urban agriculture can play in alleviating food security concerns in constrained urban environments. In particular, its ability to shrink the length of the supply chain, conserve water and energy use while also reducing pollution emissions, green urban environments, and decrease urban heat-island effects. Nonetheless, despite such benefits, some forms of urban farming have been critically
assessed by scholars, in particular, vertical farming which has been criticized due to its high energy and start-up costs. Thirdly, by providing a series of case study examples, this study outlines the important role that civil society participation, NGOs, and community groups play in driving policy change, particularly in the Brazilian City of Bel Horizonte. While the success of Singapore’s urban environment has been driven by strategic urban planning initiatives and the development of effective government regulations, the likes of which, have been instrumental in alleviating the food security challenges faced by country.

In summary, the development of urban infrastructure with rural–urban linkages is essential for food security. Moreover, governments and urban planners must work together to ensure that food retail establishments, zoning land for urban farming activities, improving urban transport infrastructure, market linkages, and efficient resource management practices are conducted in ways so as to ensure the creation of urban environments that have high levels of food security.

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