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URBAN AGRICULTURE AND SHORTENED SUPPLY CHAIN – DIFFERENT APPROACHES TO LOCAL FOOD PRODUCTION

Rolnictwo miejskie i skrócony łańcuch dostaw – różne podejścia do lokalnej produkcji żywności

Abstract: The aim of this article is to describe the supply chains in which urban agriculture operates in four selected cities – Havana, Kigali, Bissau and Singapore. The analysis based on the results of the fieldwork conducted in 2018–2020 comprises both the spatial dimension of the supply chain as well as the number of actors along the products' route. It is argued here that despite the fact that operating in a shortened supply chain is considered a typical feature of urban agriculture, its benefits depend on local economic, social and spatial conditions, the organization and structure of the supply chain itself, as well as the distance between particular actors and the role they perform. The results of the analysis of diverse cases located in different regions of the world show that the positive effects of bringing food production closer to the place of consumption are indeed not arbitrary and further research regarding the structure of the supply and also value chain is needed.

Key words: urban agriculture, supply chain, local food production, Havana, Kigali, Bissau, Singapore

INTRODUCTION

According to Pacione (2009) cities consume up to 75% of the world's resources despite the fact that they cover only 2% of the world's surface. This means that the majority of resources used by city residents (including food) are produced outside the cities' borders (Wiskerke 2015). One of the biggest challenges faced by contemporary cities that contributes to increased 'urban ecological footprint' is food provisioning, which although that for many decades has not been taken up by scientists, urban planners or policy makers, is currently gaining in attention (*ibid.*). As stated by C. Steel (2008) feeding cities has a great social and physical impact on the planet and its inhabitants. Studying and analysing the existing food systems in terms of their sustainability and resilience is therefore crucial for finding most effective solutions to challenges faced by urban dwellers all around the world. One of the ways to diminish the negative impact that cities have on the natural environment is to bring the process of production closer to the place of consumption and thus enhance urban areas' productivity.

Urban agriculture regarded as 'the growing of plants and the raising of animals for food and other uses within and around cities and towns' (Van Veenhuizen 2006, p. 2) despite being practiced for centuries, only in the last two decades began to be more frequently discussed in the context of the

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benefits it brings for the urban food systems. Multifunctionality is considered a universal attribute of urban agriculture (De Bon et al. 2010). It is therefore important to depict key characteristics of the role this activity might play in the city.

Often treated as a movement that is a grassroots response to perceived market failures (Bellemare, Dusoruth 2021) urban agriculture gives an opportunity to improve the food security of the growing urban population, especially in the times of crisis. It contributes to local food supply, increasing city's food self-sufficiency. Vegetables, cereals and tubers grown in urban areas serve as a basis for the diet of urban dwellers, those with low purchasing power and limited financial resources in particular (De Bon i in. 2010). Furthermore, urban agriculture can also constitute an additional source of income and employment, improving economic situation of many households. Engagement in local food production can therefore lead to social inclusion of most disadvantaged groups of the society (Armar-Klemesu, Maxwell 2000, Bryld 2003, Van Veenhuizen 2006, Dubbeling et al. 2010, Mkwambisi et al. 2011, Górna 2018). The role of urban agriculture in increasing food security and providing livelihood for urban dwellers has been discussed by many authors in different geographical contexts (see for instance: Maxwell 1995, Armar-Klemesu, Maxwell 2000, Zezza and Tasciotti 2010, Mkwambisi 2012, Du et al. 2012, Gallaher et al. 2013, Badami and Ramankutty 2015).

Additionally, being an integral part of city ecosystem, urban agriculture performs several environmental functions. The growing of plants in cities helps to improve air quality, increase air humidity and diminish air temperature in summer months, what can significantly mitigate the urban heat island (Pearson et al. 2010). Moreover, urban agriculture can also enhance water retention, preventing the risk of both floods and droughts (Aubry i in. 2012, Heather 2012, Specht 2014). Increasing the share of green space in the form of urban gardens may also add to the city's biodiversity. Agricultural areas in built urban landscape can serve as new animal, especially birds', habitats. Finally, as local food production frequently involves organic methods and techniques, such as composting, it contributes to sustainable management of household waste (Pearson et al. 2010).

An important feature of urban agriculture is that (compared to rural agriculture) it functions in a shortened supply chain¹ that includes a complex range of activities implemented by various actors (such as input suppliers, producers, vendors etc.) to bring a product to the final consumer (De Bon et al. 2010, Dubbeling et al. 2010). The supply chain in which urban agriculture operates is regarded here in two distinctive ways discussed below.

The first one is spatial, measured by the so called 'food miles' which represent the distance food travels from the location where it is produced to the location where it will eventually be consumed (Hill 2008, Weber, Matthews 2008). Frequently a broader approach is adopted. It can be summarized by a popular expression 'from seed to table'², where instead of the place of a production of food being the starting point of the distance measurement, it is the place of production (or often provision) of agricultural inputs, such as seeds or fertilizers (Dubbeling i in. 2010). As in the case of urban agriculture food is produced close to local markets, it does not have to be transported long distances. This leads to lower transport costs and thus decreased price of the final product (De Bon et al. 2010). In turn, smaller number of delivery trucks entering cities results in reduced vehicle exhaust emissions, and hence reduced smog (Specht et al. 2014) and improved public health in urban areas.

The second way food supply chains can be regarded is the number of actors on the product's route. Urban farmers and gardeners frequently sell their products locally what allows direct contact between the producer and the consumer (De Bon et al. 2010). In addition to the economic benefits for both, resulting from the reduction in the number of middlemen (lower production costs for the

¹ Supply chain is very often analysed along with value chain, thus apart from the number of actors and the distance travelled by food, also the flow of money is taken into consideration (Dubbeling i in. 2010).

² A strategy "farm to fork" was included in the EU Green Deal, what shows that the shortening as well as thorough analysis of the supply chain has gained in attention of key decision makers and is considered necessary to reduce the negative impact of food production on the natural environment and increase the sustainability of food systems (https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/agriculture-and-green-deal_en, accessed 21.12.2021).

producer and lower prices for the consumer), a shortened supply chain also increases the level of control over the production process, which often leads to consistence in the quality of goods (*ibid.*). According to the food sovereignty concept, the possibility for citizens to control the way food is produced should be considered a legitimate right (Koc et al., 1999, Pimbert 2009), especially in the face of the development of international, globalized trade that increases the risks of growing distance between producers and consumers (De Bon et al. 2010). Distribution of products is an issue of particular importance in the context of shaping local food systems. Indicating the places where local agricultural products are sold and mapping the paths they travel from the place of production to the place of consumption contributes to a better understanding of the role urban agriculture plays in the spatial and functional structure of cities. Moreover, as stated by K. Benis et al. (2018, 2020) the assessment of the sustainability of alternative local food supply practices requires the analysis of existing supply chains. For this purpose the authors propose the concept of ‘Urban Foodprints’ that expresses the consumption of resources and environmental impacts associated with the urban food system from agricultural production through distribution to consumption (Benis et al. 2018). Other authors that, propose different frameworks of sustainability assessment of local food supply chain, also those based on urban agriculture, are for instance A. Ramaswami et al. (2017), D. Boyer et al. (2019), as well as Y. Hu et al. (2020).

The aim of this article is to describe and compare the supply chains in which urban agriculture operates in four cities – Havana, Kigali, Bissau and Singapore – taking into account the spatial dimension as well as the number of actors along the products’ routes. It is argued here that despite the fact that operating in a shortened supply chain is considered a typical feature of urban agriculture, its benefits are not arbitrary and depend on local economic, social and spatial conditions. The organization of the supply chain, the distance between particular actors, as well as the roles they perform have a significant impact on the profits secured by each of them. The choice of the above cities was deliberate, and is justified by the attempt to present the widest possible spectrum of cases that differ in respect of organization of local food production. Havana is the capital of Cuba and one of the largest metropolises in the Caribbean, Kigali is the capital of Rwanda located in East Africa, Bissau is the capital of Guinea Bissau located in West Africa and finally Singapore is a city-state of Southeast Asia. The four cities differ in terms of land area³, population⁴ and level of socio-economic development⁵. What is more, in chosen metropolises, the scale of agricultural activity, both the area under cultivation and the share of inhabitants involved in agriculture, varies significantly. The selection of differing case studies enables the comparison of how supply chains are shaped under diverse conditions. The text is based on a descriptive and predominantly qualitative approach and aims to present one, particular aspect (namely the structure of food supply chains) of a wider research topic studied by the author in the four cities in 2018–2020. The research, regarding the role of urban agriculture in the spatial and functional structure of the cities selected, was based on the fieldwork carried out in all four cities, and was preceded by the analysis (visual interpretation) of satellite images available in Google Earth programme which in each case enabled the locating of urban agriculture in urbanized areas and the estimation of the total area it occupies. During the fieldwork, the identified urban agriculture sites (urban gardens and farms as well as agricultural areas) and their surroundings were

³ Area covered by the cities is as follows: Havana – 728.3 km², Kigali – 730 km², Bissau – 77 km², Singapore – 728.3 km². Although Havana, Kigali and Singapore are very similar in terms of area covered, Bissau is an almost ten times smaller city. As the article focuses mainly on intra-urban agriculture, in the case of Havana, Kigali and Bissau, the scope of the research (fieldwork included) was limited to contiguously built-up area. This results from the fact that the administrative boundaries of the three cities encompass vast rural areas that were to be excluded from the analysis. Delimited research areas are as follows: Havana – 76.7 km², Kigali – 91.8 km², Bissau – 52.9 km².

⁴ Population of the cities in 2020 was as follows: Havana – 2.14 mln, Kigali – 1.13 mln, Bissau – 0.6 mln and Singapore – 5.9 mln (<https://worldpopulationreview.com/world-cities>, accessed 10.07.2021).

⁵ In the Human Development Index 2020, Singapore is ranked 11th, Havana 70th, Rwanda 160th and Guinea-Bissau 175th. The cases chosen represent both countries of very high, high, and low HDI (<http://hdr.undp.org/en/content/latest-human-development-index-ranking>, accessed 10.07.2021).

subjected to standardized observations. They were also supported by semi-structured (in the case of Havana, Singapore and Kigali) and informal (in the case of Bissau) interviews with producers and vendors, providing detailed information on how local food production and distribution system functions. In this paper, the results concerning the structure of the food supply chains in the four cities have been extracted from the above research. They were then described, juxtaposed and compared, allowing general conclusions to be drawn about the relationship between urban farming and the food supply chain.

HAVANA

Havana, the capital of Cuba, is an example of a city where urban agriculture plays an important role in the urban tissue. Although urban gardens developed relatively recently, only in the 1990s, they are particularly important for the shaping of the city's alternative food system (Altieri et al. 1999, Murphy 1999). The emergence of urban agriculture in the Cuban capital resulted directly from the economic crisis following the collapse of the Eastern Bloc. As the country lost its main trading partner – the USSR, the inhabitants of the island experienced severe food shortages as a result of limited imports, as well as insufficient productivity of rural areas. City dwellers in order to increase food security of their households were therefore forced to produce food locally with use of generally available recourses (Altieri et al. 1999, Murphy 1999, Novo, Murphy 2000). Thus, an alternative food system based on local, organic production was created. Urban agriculture movement, primarily of a grassroots character, was quickly subjected to institutionalisation and drawn into complex administrative structures (Altieri et al. 1999, Herrera Sorzano 2009). According to A. Herrera Sorzano (2009) in 2005 the number of people working in urban agriculture in Cuba reached almost 400,000 and was maintained until 2009. In Havana, the number of agricultural workers in 2006 was 44,000 (Koont 2009). The estimation of the current share of employment in agriculture in the Cuban capital is however difficult due to the lack of up-to-date data. The research included in this article comprised 43 urban gardens of a total area 32.3 ha⁶ (0.4% of the research area), where 21 semi-structured interviews were conducted.

The description of the food supply chain in the Cuban capital should commence with an overview of the methods of provision of agricultural inputs such as plant seeds and compost. Most urban gardens either have their own seed nurseries or use the assistance of the state 'seed houses' (Spanish: *Casas de Semillas*). They are located within the city and provide support to urban farmers. As for compost – in the late 1990s, it was still imported from rural areas (Murphy 1999). However, due to received training in the field of organic farming, urban gardeners increased their competences and were able to start its production on site. Currently most of the urban gardens in Havana have their own composters, what may serve as proof of the effectiveness of government assistance in this matter (Gónna, Gónny 2020). The use of locally produced inputs increases self-sufficiency of gardens and reduces the length of the supply chain, by eliminating one of its actors, namely the inputs' suppliers.

Despite far-reaching institutionalization and government control, Havana's urban agriculture is largely commercialized. The products from the gardens are mostly intended for sale and supply the local food market. There are two most common ways to distribute products from urban gardens in the city. The first, and prevailing at the same time, is direct selling. In most of the gardens analysed here, fruit and vegetables were sold at small points of sale (Spanish: *puntos de venta*), usually located within the gardens (Photo 1a), or at markets (Spanish: *agromercados*) situated in their immediate vicinity. On-site sales reduce the costs of transport and help avoid the risk of unsold products being wasted, as producers can adjust the amount of fruits and vegetables harvested to daily demand.

⁶ For further reading on spatial dimension of urban agriculture in Havana see Gónna, Gónny 2020. The total area of urban agriculture in all four cities was estimated using the measuring tools available in Google Earth.

Moreover, the direct sale also helps diminish the final price of products. According to M. G. Novo (2002) the prices of tomato, onion as well as fruits diminished threefold between 1994 and 1999 after the launch of the urban agriculture program in the country.

Moreover, due to the on-site location of the points of sale, direct contact between the producer and the consumer is facilitated, with the latter having the opportunity to observe the process of production of purchased goods. This is a privilege that the vast majority of city dwellers around the world do not have. It should also be emphasized that the distance between the place of production and the place of consumption is also shortened in this case. Consumers are, first of all, local residents living nearby who do not have to travel long distances to purchase food.

Another form of food distribution is the direct supply of state institutions typical of gardens called *autoconsumos estatales*, what can be translated to ‘self-provisioning state gardens’ (Altieri et al. 1999, Murphy 1999, Murphy, Novo 2000, Premat 2005). The food produced here is intended almost exclusively for the employees of a given workplace. In the case of this research, these were, inter alia, offices of ministries and other government institutions, schools, as well as nursing homes for the elderly or the disabled. Only in some cases could the surplus of the produced food be sold to garden workers or on the local market, while contributing to the extension of the supply chain. In most gardens of this type, however, similar to subsistence gardens, the food did not leave the place where it was produced and was not available to a wider group of consumers. Such gardens therefore created small, closed food systems, where the place of production was also the place of consumption.



(a)

(b)

Photo 1 a and b. Point of sale located directly in front of the garden Organopónico “La Sazón” in Havana (a). Conversation between the producer and the middleman on one of the cultivated plots in Kigali (b)

Source: phot. K. Górny, Havana 2018, Kigali 2019

Fot. 1 a i b. Punkt sprzedaży zlokalizowany bezpośrednio przy ogrodzie Organopónico “La Sazón” w Hawanie (a). Rozmowa między producentką i pośrednikiem na jednym z poletek uprawnych w Kigali (b)

Źródło: fot. K. Górny, Hawana 2018, Kigali 2019

In addition, subsistence gardens, in which all production is intended solely for the needs of producers, are very common in Havana. They usually take up limited space and are located on patios and balconies (Premat 2003). In their case, the supply chain is therefore virtually non-existent, as the food producer is also its consumer, and the food produced does not leave the place of production, as it is consumed on site.

Taking into account urban gardens analyzed in Havana, the supply chain is much shortened, both in spatial terms and with regard to the number of actors it consists of. The capital of Cuba can therefore be considered a model city that fully benefits from the positive outcomes of the abridgement of the supply chain. Firstly, due to the proximity of the places of production and consumption, food miles are reduced what leads to the eradication of transport costs and car emissions. Secondly, the decrease in the number of actors involved in the process of production, distribution and consump-

tion of food leads to the reduction of both production costs (producers' benefit) and the final price of the product (consumers' benefit). Moreover, direct contact between the producer and the consumer increases the level of control over the production process of the latter, what may help increase the quality of the food produced.

KIGALI

Similar to Havana, Kigali is also an example of a city where agriculture developed in the face of a crisis. Immediately after the 1994 genocide against the Tutsi group, the capital of Rwanda began to experience a dynamic and uncontrolled population growth, which resulted, on the one hand, from the demographic explosion characteristic of the countries of the continent, and from President Paul Kagame's decision on forced repatriation of the Hutu refugees on the other (Goodfellow, Smith 2013, Manikariza 2014). As a consequence, in the late 1990s, Kigali encountered serious development problems, one of which were the severe food shortages, particularly important in the context of this paper. The urban dwellers, in order to secure their existence began to occupy wastelands to produce food. They received the support of the city authorities as well as FAO which advised the inclusion of urban agriculture, concerned as a strategic activity, in spatial planning. The grassroots actions of residents supported by the state led to a significant improvement in the food security of Kigali's households (MINAGRI 2016). According to the estimations of the Ministry of Agriculture of Rwanda, around 12% of the households in the city are involved in agriculture (*ibid.*). The research included in this article comprised 98 urban agriculture areas of total area 1170.4 ha (12.7% of the research area)⁷. Fieldwork conducted in Kigali was mainly based on standardized observations and complemented by 3 semi-structured interviews with producers and sellers. Cultivation in the city takes place in large-scale agricultural areas located in vast valley bottoms, or in small-scale 'kitchen gardens' situated on steep slopes. In Kigali subsistence agriculture of low productivity, limited capital expenditure and restricted resources, is clearly prevalent. It is primarily aimed at increasing the food security and supporting livelihoods of urban households. Thus, most of the food produced is intended to meet the needs of the producers with surpluses being sold at local markets. This applies to both 'kitchen gardens' in the immediate vicinity of households and extensive agricultural areas in the valley bottoms, divided into smaller plots cultivated by individual farmers. Typically the producer is at the same time the consumer and the vendor of the produced goods. In the case of urban agriculture sites in the valley bottoms frequently whole families are involved in both production and distribution of food. Nevertheless, a characteristic feature of the food supply chain in Kigali is a developed network of middlemen enjoying a substantial position (Photo 1b). They are involved in transporting and delivering food from producers to sellers at local markets or to restaurants and hotels (Van Dijk, Elings 2014). Using the services of a middleman is particularly relevant in the case of agricultural areas remote from the market, where direct selling of crops is challenging or impossible. Middlemen's position gives them bargaining power that enables them to force the farmers to sell their produce at lower prices and those, having no other options, must agree to it. Hence, middlemen have a significant influence on the food prices in the city, while securing the largest share of the profit (*ibid.*). They constitute an additional and at the same time best-earning actors of the supply chain, while reducing the profits of the producers.

Unlike Havana, in Kigali inputs are not produced on site, the supply chain is therefore extended to include input suppliers. Artificial fertilizers are used in Rwanda's capital and the main importers are based in the city. In spite of that, due to elevated prices the lowest-income farmers cannot afford to purchase them. The seeds, on the other hand, are generally available and are sold in local shops. They are mainly imported from rural areas, as well as from other East African countries such as Kenya.

⁷ For further reading on spatial dimension of urban agriculture in Kigali see Górna, Górný 2020, 2021.

Among the analysed agricultural areas, only in the minority of cases the point of sale was located in their immediate vicinity. Usually, crops are transported to bigger, formal food markets in the city centre or smaller vegetable stores nearby. The largest markets in Kigali are the Kimironko, Kimisagara and Nyabugogo. Kigali's inhabitants are able to rent stands here for 20,000 Rwandan francs (approximately 20 USD) per month (ibid). Usually, each vendor distributes the same products every day. Interestingly, within Kigali, the prices of fruit and vegetables are determined by speculation by sellers at the Nyabugogo Market, which are held daily between 3:00 and 6:00 am. According to the report by N. Van Dijk and A. Elings (2014), the majority of sellers at trade markets are women.

In addition to the main markets, the city also has informal stalls set up by residents along major streets in various locations. Furthermore, part of the production from the studied plots goes to supermarkets, where they are sold at higher prices than at the markets. High-end large-stores are gaining in importance in Kigali, which is mainly due to the increasing wealth of Rwandan society. Agricultural areas within the city limits also supply local restaurants and hotels, which typically purchase products directly from farmers, bypassing any middlemen, to have more control over the quality of the fruit and vegetables they buy (ibid.).

An example that perfectly illustrates the food supply chain typical of Kigali is the urban agriculture site examined during fieldwork, presented in Photo 1b. A small cultivated plot of 0.13 ha is located on the slope of Nyarugenge Hill along KN 1 Avenue in the Muhima sector between the existing ONOMO hotel and the new facility under construction. The plot was temporarily leased, and the plants grown within its boundaries were intended primarily for sale. During fieldwork the women in the photo were in the course of harvesting of sweet potatoes. They were later joined by two middlemen, who after a short conversation, packed the harvested tubers into bags and transported them by bicycle to the point of sale located 700 m away. While the distance the food was transported was short, the number of actors of this particular supply chain was increased. Thus it comprised input suppliers, producers, middlemen, vendors and ultimately consumers.

Spatially, urban agriculture in Kigali operates in a shortened supply chain. The distance the food products are transported is usually short. However, in terms of the number of actors involved, especially when middlemen are concerned, the supply chain can be considered extended, what may significantly increase the final price of the products sold, while diminishing the producers' profit, simultaneously limiting the benefits resulting from the local food production.

BISSAU

The next case study is Bissau, the capital of Guinea Bissau. Given this West African country's agricultural sector is based on the production of cash crops such as cashew, urban farming is the basis for the livelihood of urban households, while being an essential component of the urban food system. Similar to Kigali, the food produced locally contributes to the food security of the inhabitants, whereas surplus sales serve as an additional source of income for producers. Moreover, alike in the Rwandan capital and other African cities, such as Gitega, Yaounde, Kampala or Asmara, crops concentrate here in vast valley bottoms, which, due to the high humidity, cannot be used for development (Górna, Górný 2020).

The research included in this article comprised 18 urban agriculture areas of total area 610.3 ha (11.5% of research area)⁸. During the fieldwork one of the valleys located on the north-east of the city was subject to complex observations. What is more, several informal interviews with the producers (in a presence of local interpreter) were also conducted. The valley serves as an example of a well-coordinated system of food production, distribution and consumption. Due to the high level of social self-organization, as well as the multitude of actors involved in its functioning, it differs from other

⁸ For further reading on spatial dimension of urban agriculture in Bissau see Górna, Górný2020.

case studies included in this paper. Importantly, urban agriculture is based here on extensive assistance networks, determined by cultural codes. It is the solidarity of the inhabitants that constitutes a particularly important livelihood strategy that also improves the level of food security of households engaged in it (Lourenço-Lindell 1996).

According to O. David and P. Mousier (1993), Bissau is a city where in 70% of the cases the producer is directly involved in the distribution of agricultural products. It is not typical of other cities of the Global South, as usually producers sell their produce to retailers (De Bon 2010), as it was featured in Kigali. Field observations and interviews conducted in the valley analysed also attest to the producers selling their products themselves. Habitually, after the workday is over, they transport harvested fruit and vegetables on foot and sell them at the local market located 550 meters away. Considering that the sales take place daily, the risk of not selling part of the harvest is considerably reduced. What distinguishes Bissau from Kigali is the minor role of middlemen in the supply chain. Producers are at the same times vendors and they secure the largest share of profit. Moreover, in Bissau, the multitude of other actors in the supply chain is notable. Their engagement in the value chain however does not result in a significant increase in the final price of the product. In the valley analysed, the production process is based on the clear division of labour between individuals. Each person is involved in a specific activity, such as growing, watering and finally harvesting plants. Moreover, the system also comprises actors whose role, although contributing to the efficiency of the production process, should be considered secondary. These are mainly people that transport water, as well as heavier products within the valley, prepare and serve meals for farmers, and protect the rice plots from birds (Photo 2a). Children are often involved in the last-mentioned activity (Górna, Górný 2020). What's more, there are also input suppliers within the valley who sell fertilizers and seeds, usually imported from abroad. Similar to Kigali, in Bissau most of those engaged in production and distribution of food are women.



(a)

(b)

Photo 2 a and b. Woman watering plants in the analysed valley in Bissau and a point of serving meals visible in the distance (a). Salad wrapped in plastic, produced by Comcrop in one of the NTUC Fair Price supermarkets (b)

Source: phot. K. Górný, Bissau 2020, Singapore 2019

Fot. 2 a i b. Kobieta podlewająca rośliny w analizowanej dolinie w Bissau oraz punkt serwowania posiłków widoczny w oddali (a). Sałata zapakowana w plastik, produkt Comcrop w jednym z supermarketów sieci NTUC Fair Price (b)

Źródło: fot. K. Górný, Bissau 2020, Singapur 2019

The presented supply chain is not of a typical hierarchical nature, as it is extended by horizontal relationships. In addition to primary actors such as input suppliers and producers-vendors and consumers it is supported by secondary actors such as those preparing meals, transporting water, taking care of crops. Its distinctive feature is, above all, that it is based on a network of interpersonal relations and cooperation between the city's inhabitants. They constitute a strategy in which people respond to scarce resources by work and income division rather than competition for them. Such ap-

proach is intended to improve the situation of individual households through the cooperation of their members.

Due to the fact that producers usually sell their products themselves and there are no middlemen between producers and vendors, the former gain largest share of the profit. In spatial terms, the chain is significantly extended between inputs suppliers and producers, as fertilizers and seeds are imported from abroad. It is however considerably shortened between the producer and the consumer, whose direct contact is enabled.

SINGAPORE

The last case study is Singapore – a city-state that is considered one of the most developed urban centres in the world. In contrast to the above cases, Singapore's problem is not food shortages, but limited local production. The inhabitants of the city have unrestricted access to food products, but over 90% of them are imported from abroad, which is associated with an increased carbon footprint and the raise of the final food prices⁹. Due to the lack of extensive agricultural land, Singapore is particularly vulnerable to shocks in foreign food markets. In order to increase food self-sufficiency the city-state authorities have begun to support local agriculture. However, as the Asian city-state faces challenges resulting from limited land resources as well as increasing population, the farms that obtain the state's approval are those based on modern and innovative production methods and efficient use of space. The number of farms operating in Singapore in 2019 was 220, only half of which is land-based. The research included in this article comprised 36 urban farms of total area 188,8 ha (which merely constitute 0,26% of the Singapore's total area)¹⁰. According to the estimations of the World Bank the value added of agriculture (along forestry and fishing) in the Asian city-state in 2019 accounted for 0,03% of its GDP¹¹. The marginal role of agricultural activity, despite government's alleged support, is also evidenced by the low share of employment in this sector, which in 2019 did not exceed 0.03%¹².

Unquestionably, the operation of urban farms within the city limits results in a significant shortening of the traditional food supply chain based on imports, it is therefore beneficial for the urban system. Nevertheless, the description of the supply chains that evolve around urban agriculture itself is necessary in order to identify those systems of production, distribution and consumption of food that most favourable for the city and its inhabitants.

In Singapore, similar to Kigali and Bissau, the use of chemical fertilizers is not prohibited. However, in none of the farms analysed here the use of artificial fertilizers was confirmed. Nevertheless, according to responders those farms in Singapore that do not produce compost locally purchase fertilizers from local or foreign suppliers. It also applies to seeds, which are often imported to Singapore from abroad – China, Malaysia and even European countries. The supply chain, as in the two analysed African cities, might therefore be extended to include suppliers of agricultural inputs.

Most of the urban farms analysed are private companies that sell all their produce on the local market. Community, allotment or subsistence gardens, where food is intended for the producers are much less common, as they are not economically viable enough to be supported by the state and consequently to persevere in the urban space.

A typical feature of the farms analysed in Singapore is the diversification of forms of food distribution. In the majority of cases products were sold in more than one way. In addition to supplying local supermarkets (most frequently NTUC Fair Price or PRIME), farms provided on-site or online sales. Moreover, some of the farms visited also sold their produce to local restaurants. By the diver-

⁹ <https://www.sfa.gov.sg/food-farming/singapore-food-supply/the-food-we-eat> (accessed 12.01.2021).

¹⁰ For further reading on spatial dimension of urban agriculture in Singapore see Góna, Górný 2021.

¹¹ <https://databank.worldbank.org/reports.aspx?source=2&country=SGP#> (accessed 22.12.2021).

¹² Ibid.

sification of forms of distribution, producers expanded the possibilities of reaching a larger group of consumers, including those, who apart from buying food products stationary want to take part in recreational activities provided by the farm.

It is worthwhile to describe in more detail the system of products distribution of one of the farms analysed – Comcrop. In 2019, at the time of the fieldwork, the farm operated in two locations – on the rooftop of *SCAPE Mall, less than 200 metres away from *Orchard Road* in downtown, and on the rooftop of *Woodlands East Industrial Estate* situated on the north of the island. While all of the produce (mainly herbs) from the former was sold exclusively in the RedMart online store with a small amount also purchased by restaurants located nearby, in the case of the latter vegetables were distributed in NTUC FairPrice supermarkets in 4 locations: Woodlands, Woodgrove, Upper Thomson and Bishan Junction 8 (Photo 2b). They are located 4.7 km, 5.1 km, 18 km. and 20.8 km away from the Woodlands farm respectively. Although the four supermarkets listed are located in the northern part of the Central Region and, like the farm itself, in the North Region, the distance the products are transported is extended. It is however important to emphasise that Comcrop is one of the few farms in Singapore that are located in the central parts of the city, as most agricultural areas are located on the periphery within *Kranji Countryside* on the north-west of the island. In their cases the distance between the place of production and the place of distribution and consumption of food (farms offering online sales included) is therefore even further elongated.

On-site sales should ensure a significant shortening of the supply chain as the production site is also the place of distribution and the direct contact between the producer and the consumer is enabled. Nevertheless, in the case of Singapore the benefits resulting from entirely eliminating the distance between the former and the latter are somewhat limited. In contrast to Havana, Kigali and Bissau, urban agriculture here rarely adjoins residential areas. Due to the peripheral location of most of the farms, inhabitants have to travel long distances in order to buy food on site. Moreover, as the *Kranji Countryside* is not well connected to the public transport network, it is necessary to use private cars to reach most of the urban farms. Consequently, although the distance between the place of production and the place of distribution of agricultural products is indeed shortened and the number of actors of the supply chain is limited, the distance between the place of distribution and the place of consumption is still significant, what results in increased car traffic as well as transport costs on the part of the consumer.

CONCLUSIONS

The research described in this text confirms the thesis proposed by M. Dubbeling et al. (2010) that even in the case of subsistence agriculture, where most products are intended for the needs of producers themselves, local farmers tend to sell surpluses and hence become part of the supply chain. A situation where producers are solely consumers is rare, as most frequently they simultaneously contribute part of their produce to local markets. Furthermore, the above examples show how diverse the supply chains within which urban agriculture operates can be. They include a number of actors from input suppliers, producers, middlemen, vendors to consumers, and might also be extended, as featured in Bissau, with secondary actors who support the production process.

Havana is an example of a city where, not only is the distance between the producer and the consumer kept to a minimum, but also agricultural inputs are produced within particular gardens or provided by Seed Banks located within the city. As a consequence the city's residents can fully benefit from the positive aspects of local food production such as reduced prices, limited transport from rural areas, and producers enjoying the possibility to observe the production process on site. In Kigali, compared to Havana, the supply chain is extended to include input suppliers as well as middlemen delivering agricultural products from producer to seller. Moreover, as direct sales are rare, the contact between the producer and the consumer is limited. Such organization of the supply chain is associated with an increase in the final price of the product, a reduction in producers' profits for the benefit

of middlemen, as well as limited control over the production process by consumers. In Bissau, due to the fact that the producer is usually at the same time the seller and the distance between the place of production and the place of distribution is short, the chain should be considered shortened in its final part. However, the chain in Bissau, like in Kigali and Singapore, also includes input suppliers, frequently based abroad. It is worth emphasizing that in this West African city, the production and distribution process is organized into a network of horizontal connections based on mutual support of the inhabitants. The research carried out in Bissau demonstrates that expanding the supply chain with additional secondary actors and creation of horizontal grid, is not a disadvantageous phenomenon and does not contribute to reducing producers' profits, but is rather a strategy developed by the local community that improves the functioning of the chain and hence the situation of actors involved in its operation.

The last case analysed – Singapore – proves that although the distance between the place of production and the place of distribution may be shortened in the case of farms offering on-site sales, at the same time the distance between the place of distribution and the place of consumption may be extended due to the peripheral location of agricultural areas. The benefits of shortened distance between the producer and the consumer are therefore significantly limited. Moreover, such a spatial arrangement of the production, distribution and consumption processes enhances car traffic, which is detrimental to the urban ecosystem.

The comparison of the four case studies leads to a conclusion that when agriculture functions in a situation of food security being threatened, it usually occupies areas in the vicinity of markets and residential areas inhabited by potential consumers. That results in the shortening of the supply chain in spatial terms. This is the case in Havana, Kigali as well as Bissau. On the other hand, in Singapore, where almost all of urban households are food secure, urban agriculture is not crucial for the livelihood of the inhabitants. For this reason, farms are located in more peripheral parts of the city and thus the distance between the place of production and the place where food is distributed or consumed is increased. Although in all the cases analysed the supply chain is significantly shortened as compared to traditional food systems based on production limited to rural areas or, as in the case of Singapore, import from abroad, a more detailed analysis at the level of individual actors confirms the thesis that the benefits of reduced distance between the place of production and the place of distribution and consumption of food, as well as limited number of people involved in the entire process, varies. Moreover, an important conclusion of the research conducted is the necessity of extending the analysis of the supply chains. In addition to comparing and contrasting conventional supply chains with the local ones, it is also crucial to thoroughly examine and juxtapose various supply chains shaped at the city level. The studied cases prove that supply chains within cities may differ from each other, and the benefits of them being shortened are not arbitrary. What is more, the examples examined show that the advantages of local food production depend on the organization and structure of the supply chain, as well as the role played by its various actors. It is therefore important to broaden the research on urban agriculture to include food route mapping and the flow of money between particular actors, in order to present the forms of organization of production and distribution of food within cities, that are most profitable for inhabitants and indeed effectively more sustainable than existing supply chains (Benis et al. 2018).

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