



Article

Food for Thought: Addressing Urban Food Security Risks through Urban Agriculture

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Abstract: Food and nutrition security has been neglected in the planning field for reasons of a lack of connection between food and planning and the perception that agricultural activities have no place in the modernizing world. However, considering increasing climate change impacts and implications on industrialized agriculture, there is a clear need to establish shorter, more sustainable agricultural production practices and food supply chains. Urban agriculture is proposed as a potential method of intervention for planners to support sustainable food production and supply chains. The paper utilized a multiple-case study design to analyze four best practice examples of urban agriculture in the Global South to uncover its potential to address food security associated risks and contribute to sustainable development objectives. The results delivered evidence of the potential to harness the multifunctionality of urban agriculture to not only improve the food security of the most at-risk populations, but to also address other urban risks such as unemployment, community decline and food deserts. The recommendations for this paper relate to establishing a food security department, mapping and encouraging more sustainable food supply chains, creating land uses and zonings specific to urban agriculture and to utilize its multifunctionality to address other urban risks.

Keywords: spatial planning; food security; food supply chain; urban agriculture; sustainable development



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1. Introduction

The 2020 State of Food Security and Nutrition in the World Report highlighted that the world is not on track to meet Sustainable Development Goal 2 to “end hunger, achieve food security and improve nutrition, and promote sustainable agriculture” [1] in 2030 [2]. This is partly due to the fact that the number of people experiencing any form of food insecurity steadily increased from 1.63 billion to 2 billion people from 2014 to 2019 [2]. The data also highlights the unequal spread of food insecurity, with the majority (1.9 billion people) of food insecurity being felt in the Global South than in that of the Global North (94 million people) [2].

Complicating the future of food security is the projected impacts that climate change will have on industrialized agriculture. Though the true extent of the impacts can only be speculated, some negative impacts have already started to show. For instance, it is estimated that an annual 15 billion tons of fertile soil is lost due to land degradation [3], while another estimate highlights that there has been a marked 50% increase in extreme flood events over the last 10 years [3]. Industrialized agriculture will also continuously face water scarcity under the impacts of climate change with an expected 129 countries that will face increasing water stress due to droughts [4].

Coupled with the impacts expected due to climate change is the rapid urbanization, which is set to put further strain on the ability of rural environments to support the food demands of growing urban populations. The global population is expected to reach 9.8 billion people by 2050 [5] with an expected 68% of them residing in urban areas [6].

These arguments highlight the need for more policy intervention in the Global South since it is within these contexts that the impacts of rapid urbanization [7], climate change [8], urbanized poverty [9], and food insecurity [2] are most severely felt.

Urban planners have, however, neglected to plan for food, as it is perceived as a rural issue with no connection to the built environment [10]. These arguments do not account for the occurrence of urban agriculture, a method employed by the urban poor since the start of civilizations [11], or the multifunctionality of the food supply chain, whose elements are inherently connected to various fields of planning interest. By neglecting to plan for food, planners are risking the food security of urban residents, whose food security issues are already exacerbated by the very nature of the urban environment. There is thus a need for planning intervention in terms of more sustainable food production methods and supply chains.

This article argues for the adoption of urban agriculture as a means to address urban food security associated risks. Urban agriculture has been utilized in urban environments since the earliest civilizations [12]. The practice is present in both the Global North and South, though with varying degrees of development and primary foci of these initiatives [11]. In the Global North, the focus of urban agriculture tends to be on the potential societal benefits such as encouraging upliftment and community development [13]. In the Global South, on the other hand, urban agriculture is generally practiced to address food security and nutritional needs [14]. There is great potential for urban agriculture to address sustainability issues [15], mitigate the adverse impacts of industrialized agriculture [16] and provide food for urban populations [17]. However, this potential has not been harnessed to its full potential, especially with regards to its potential for integration into urban planning.

Based on all the factors mentioned above, this article positions itself to fill the theoretical gaps between urban planning, urban food security and urban agriculture. Therefore, this article is aimed at reflecting, from a spatial perspective, on why planners need to engage more actively with the food supply chain in order to address the food security associated risks in cities of the Global South. The objectives set to achieve this aim include: (1) reflecting on why food security is a planning issue; (2) investigating the impact of the food supply chain on planning in urban areas; (3) identifying best practice examples of urban food production and (4) providing multiple arguments for the integration of urban agriculture into urban planning practice.

Section 2 of this article includes the theoretical investigation into food security, the food supply chain, urban agriculture and ecosystem services. The literature study is structured to systematically introduce the argument of this article, by highlighting how food security has been ignored in urban planning practice, and how detrimental a lack of planning is to the food security of urban residents. Thereafter, the inherent vulnerabilities and negative externalities of the globalized food supply chain and industrialized agriculture are emphasized as motivation for the adoption of urban agriculture to potentially counteract and alleviate these issues. Urban agriculture is then investigated to emphasize the potential benefits it may entail for food security, shorter food supply chains and sustainable development. Lastly, urban agriculture is motivated in terms of ecosystem services to highlight the multifunctionality that can potentially be harnessed to address other urban issues (such as waste management).

Section 3 is used to highlight best practice examples of urban agriculture in order to provide empirical evidence to the theoretical potential benefits that urban agriculture might entail for food security, the food supply chain, ecosystem services and sustainable development. The multiple-case study design includes cases from Belo Horizonte, Brazil; Rosario, Argentina and Cape Town and Johannesburg in South Africa.

Section 4 concludes on the main lessons learnt from both the theoretical and empirical investigations. Section 5, lastly, introduces several recommendations on how planners can: incorporate food security into the urban agenda; enable the establishment and support of shorter supply chains; include urban agriculture into urban planning practice and harness the multifunctionality of urban agriculture to address other urban issues besides food security.

2. Literature Study

The literature study serves to identify and define the theoretical background of food security, the food supply chain, urban agriculture and ecosystems services. The investigation into these concepts was then used to formulate the criteria for the empirical investigation.

2.1. Food Security and Planning

This section will introduce food security in relation to urban planning and risk. It will highlight the rural bias dominating global discourse on food security, and how this bias results in a neglect of planning for food. This section will lastly highlight how risks associated with the elements of food security manifest in urban environments.

2.1.1. Understanding Food Security and the Associated Global Discourse

Food security has been evident in development research since the late 1900s, with the original focus on national self-sufficiency in terms of producing food within their own borders [18]. Increased production, however, did nothing to ensure that everyone had enough to eat, and hunger persisted throughout the world, especially in the Global South [18]. The seminal work from Sen (1982) on “food entitlements” affirmed this, highlighting that hunger had more to do with distribution and access than the mere physical presence of food in the area [19]. The modernization of diets also resulted in the manifestation of the “triple-burden”, with malnutrition, micronutrient deficiency and obesity occurring within the same region [20]. There came a realization that although food may be physically, socially and economically available, those foodstuffs may not be of proper dietary quality to ensure adequate nutrition.

These realizations inevitably resulted in the rephrasing of food security from the “ability to meet aggregate food needs in a consistent way” [21] to “when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meet their dietary preferences for an active and healthy life” [22]. This definition originally only encompassed the elements of availability, access, utilization and stability [10], but recently (June 2020) the High Level Panel of Experts [23] added the elements of agency and sustainability.

Even with the recognition that food security encompasses numerous elements, global discourse on food security is still dominated by the ideal that food security issues can be solved through increasing production and support for rural producers [24]. The first iteration of an international response to food security was the Rome Declaration and the 1996 Plan for Action [25], which had the primary goal of halving the number of undernourished people by 2015 [26]. The formulated interventions, however, delivered “zero progress” and the number of undernourished people increased rapidly [27].

The Committee on World Food Security responded to this issue by narrowing the broad commitments of the Plan for Action and focused on a twin-track approach, which entailed that “social protection systems be strengthened, and smallholder agriculture be supported” [7].

Numerous subsequent policies and plans followed this twin-track bias to rural development and smallholder agricultural production [7], including the Comprehensive Framework for Action (2008) and State of Food Security and Nutrition in the World Report (2008) [7]. Thus, reiterating that food insecurity largely impacts rural populations, and this issue can only be mitigated by increasing rural and smallholder production [28].

The latest iteration on the development agenda, the UN Sustainable Development Goals (SDG), still presents this rural bias. The goal on ending hunger (SDG2) highlights the importance of ensuring food and nutrition security [1] yet ignores the increasing incidence of obesity as a nutritional issue, and wholly neglects to include urban environments as part of the food security debate [29]. Having a goal exclusively dedicated to addressing the problems facing urban areas (SDG11) [1], and not highlighting food security as one of the primary issues, further enshrines the ideal that food insecurity only impacts rural areas.

Despite the mounting evidence of the impact of urbanization on food security, the urban dimension of food security is still neglected [7]. Increasing urbanization rates in low-income countries [6] and the accompanying urbanization of poverty and hunger [30] means that the food security debate will increasingly take on an urban dimension. Towns and cities in low-income countries will thus be at the forefront of food security issues in the coming years [9].

Recently, however, key actors in food policy discourse have started to acknowledge the importance of the urban dimension of food security. The FAO State of Food Security and Nutrition of the World Report (2020) has acknowledged the importance of affordability of nutritious food and how food prices have a significant impact on urban food and nutrition security [2]. A direct focus on urban food security by the FAO Framework for the Urban Food Security Agenda saw to the acknowledgement of unique urban constraints to food security such as a lack of regulatory frameworks, limited capacities and resource and financial constraints [31]. These constraints require significant attention in order to counteract the rural bias still present in the SDGs as highlighted earlier. A shift from this rural bias and productionist paradigm thus needs to take place, in order for planners to acknowledge their role in addressing food security associated risks in urban environments.

2.1.2. The Lack of Planning for Urban Food Security

In order to sustain life, cities need to provide food, shelter, water and air. Planners have traditionally engaged with all the essentials, except for food [32]. Morgan [9] emphasized this by stating that the food system is a “stranger to the planning field” and traditional planning omits food when planning for basic essentials [33]. The reasons for this may vary, but some of the most prominent reasons are because there is a lack of connection between food and the built environment, food is beyond the scope of the urban agenda and is seen as a rural issue, and a lack of knowledge and expertise to address food security through planning [9,10].

This omission might be justified by claiming that food security is a rural issue [9], as echoed in global food security discourse, or that it lacks connection to the built environment [10]. However, these arguments neglect to recognize the multifunctional character of the food system, and how the elements thereof influence energy, water, land, transport, economic development and many other sectors in which planners have genuine interests [32].

Another reason for the planners’ lack of addressing food security in urban environments is the perception of modernization, which aimed to remove the dualism present in cities by establishing agriculture in rural areas and keeping urban areas exclusively for economic growth and development [34]. As a result of modernist perceptions, urban planners become part of the food security issues in cities by making it their professional obligation to rid the city of agricultural production [9]. Armar-Klemesu [35] argued that the only difference between rural and urban food security is that in rural areas people are often able to produce their own food. Toth et al. [15] agreed and added that a large portion for urban populations is dependent on wage labor, and only a few can make a living from agriculture. Urban residents are also more dependent on purchasing food [30], and the ability to earn a monetary income is thus an important factor in achieving urban food security [15].

2.1.3. Urban Risks Associated with the Lack of Planning for Food

The incidence of extreme poverty and hunger and obesity and overconsumption occurring within the same urban region complicates the process of designing effective food strategies to address these issues [18]. Food insecurity manifests in various ways in the urban environment. It might be the case that people are completely insecure—or might only exhibit some aspects of insecurity. Crush and Frayne [24] emphasized this by stating that supermarkets might be bursting with fresh produce, while on their doorsteps there are people who are unable to feed themselves more than once a day.

This statement illustrates the fact that the availability of food within an area does not mean that food is universally accessible. Additionally, even with food available and accessible, those foodstuffs might not have the necessary dietary quality to ensure adequate nutrition [20].

Planners are primarily concerned with ensuring the *availability* of food through planning complex supermarket models [35]. Battersby and Haysom [20] emphasized how availability of food refers to the physical presence of food in an area, and the mix of food types made available in different socioeconomic regions. Since planners have no real power to dictate where supermarkets are allowed to open, they can develop wherever they maximize profits and minimize risks [36]. The result thereof is the formation of food deserts—areas with limited access to healthy food outlets and easy access to convenience and fast food shops [10]. With supermarkets more commonly located in wealthier neighborhoods, low-income groups have to rely on other sources to ensure food access [30].

Access according to Thompson et al. [8] is the ability to obtain food. Toth et al. [15], however, stated that access in urban areas largely concern the relationship between income and food prices, and the ability to earn a monetary income is thus a prerequisite to ensure food security [35]. Though city dwellers might be frequenting supermarkets more, the informal market remains a dominant means to access food [37]. Warshawsky [30] emphasized this by stating that city dwellers often make use of non-monetary means to secure food, such as sharing food within the community or growing their own food. Sharing food is, however, only possible when there is a surplus, making this social network inaccessible in times of hardship [20]. When considering access, it is important to think about the physical and economic access to food [38]. It is also necessary to consider that purchasing food is not the only expense urban households face, and households might sacrifice their food security in order to pay for other costs of urban living [20].

Utilization refers to a persons' ability to derive biological benefits from food based on its nutritional value [8]. The changing diets might be motivated by a range of food and non-food factors impeding on the nutrition security of households. Modernization of diets as a result of decreased time to cook food, water and energy costs, and a greater distance between home and work [20], highlights how food preferences might also impact food and nutrition security. The increasing incidence of the "triple-burden" of malnutrition, micronutrient deficiency and obesity [10], and the insecurity-obesity paradox (obesity occurring amongst the most food insecure due to the consumption of calorie-dense food) [10,18] make planning for effective food strategies more complex. This dimension also considers non-food retailers, and the mix of food types made available in urban areas [20].

Stability of food security refers to the ability to access adequate food at all times and not being at risk of losing access due to shocks or cyclical events [20,35]. Cyclical events have been noted by Thompson et al. [8] as the distinct "hungry seasons" occurring in periods where household incomes are strained, such as holiday seasons, when seasonal work ends or during times when living costs are high [20]. Shocks refer to sudden onset events such as the 2007/8 global food crisis and the recent COVID-19 pandemic [18,39].

The HLPE [23] highlighted that stability refers to the ability of the food system to handle shorter-term shocks and cyclical events, whereas sustainability refers to the ability of the food system to withstand longer-term disruptions. *Sustainability* thus refers to the ability of the food system to ensure current and future generations with food and nutrition security that is considerate of the ecological, economic and social systems on which it is based HLPE [23]. The longer-term disruptions that might impact this dimension relate to climate change impacts and natural resource depletion. Climate change is set to have a negative impact on the sustainability of food security, not only as a result of increased warming and decreased rainfall, but also when considering the vulnerability of populations [8]. Decreased productivity of crops will influence not only the stability and sustainability of food security but also the availability of those foodstuffs within the market [40]. The current method of agricultural production has numerous negative

externalities, such as soil erosion, water shortages, ecosystem disruption and biodiversity loss, all of which further the impacts of climate change [41].

Agency, according to the HLPE (23), refers to the ability of individuals to affect change in the food system. It emphasizes the rights of people to adequate food and nutrition, and to decide on what they want to eat, how and where those foodstuffs are produced, processed and distributed [23]. Even though the concept of agency might only have recently been made a part of the food security definition elements, the presence of this concept in food security discourse goes as far back as the work from Sen on food entitlements [42]. This work highlighted that food insecurity had less to do with natural causes, and more to do with social, economic and political causes of vulnerabilities [20]. Agency thus involves issues of gender roles [36], empowerment of marginalized groups such as women and low-income citizens [11], transparency of food production, processing, distribution, retailing and waste [20] and democratization of public policy formulation processes [23].

The risks highlighted in this section emphasizes that a global focus on increasing agricultural productivity in rural areas might be more detrimental to the environment and does little to address the urban dimension of food security. Agriculture's role in climate change and the methods to mitigate this should be considered in the wider food system perspective [43]. Battersby and Watson [37] emphasized this by stating that a food systems approach is necessary to solve the food security challenges. The only real influence planners can have on food security is in addressing the elements of the food supply chain, which relates to the sectors of land-use management, transportation planning, place-making, land, waste, basic infrastructure provision, economic development, public health and social justice [9,32].

2.2. The Food Supply Chain

This section will focus on the food supply chain and will thus start off with an analysis of the current status quo with regards to food systems planning, and the inherent risks associated with the global food supply chain.

Status Quo of the Global Food Supply Chain

The present model for agricultural production sees food being produced outside of cities, brought into cities to be processed, retailed and consumed, where after the generated waste is moved outside the city again [18]. This is known as the food supply chain and is defined by Battersby and Watson [37] as "the system that gathers all the elements and activities that relate to the production, processing, distribution, preparation and consumption of food, and the outputs of these activities, including socio-economic and environmental outcomes". The food supply chain is thus interdisciplinary and highly complex and requires expert analysis in order to be adequately managed. Toth et al. [15] echoed this and highlighted that the food supply chain includes production, processing, retailing, distribution and consumption. Waste will be discussed as another aspect of the food supply chain since it is present and generated in every step and is thus an important element that needs considerable attention.

Features of the food supply chain include perishability, seasonality, long production cycles and variability with regards to quantity and quality [44]. The global supply chain, as highlighted by Gold et al. [44], has the added features of variability in logistical costs due to fuel price volatility and unstable political environments that impact prices. Aiello et al. [45] further supported this by arguing that the conventional supply chain is fraught with numerous inefficiencies and drawbacks, some of which include longer food miles [46], price volatility [19] and considerable food losses [47]. These are just some examples of the inefficiency present in the conventional, globalized food chain that adds to the ecological unsustainability of the system [48].

Chappell and LaValle [49] emphasized that traditional agriculture practices are some of the greatest challenges for biodiversity both in terms of the conversion of natural areas to crop lands, and the environmental impacts of intensification. The FAO [50] agreed on

and highlighted the impacts of high-intensity agriculture on the environment, as being deforestation, soil depletion, high levels of greenhouse gas emissions and water scarcity and biodiversity loss amongst others. Not only is agriculture a contributor to environmental problems, but it also will increasingly fall victim to the impacts of climate change [38], in the form of increased temperatures, decreases and more variability in precipitation events and increased storm surges and the increased incidence of floods and droughts [19]. Not only does this model of agricultural production incur environmental inefficiencies but it also creates a multidimensional rural–urban divide [32], incurring both economic and social costs in the process. The FAO [43] therefore concluded that the agriculture’s role in climate change should be analyzed in the wider food systems perspective, focusing on areas of production, processing, retail, consumption, distribution and waste. Table 1 contains further detail on the risks within every step of the food supply chain with regards to its contribution to and the impacts expected thereon due to climate change. These risks are highlighted to emphasize how the global supply chain model and industrialized agriculture contribute and fall victim to climate change. No consideration in this article has been made in the event of advancements in technology, dissemination of new agricultural production methods or the adoption of climate resilient crops, which are all mitigation measures adopted in light of the climate change impacts highlighted in Table 1.

Table 1. Elements of the food supply chain in relation to their climate change contributions and the impact of climate change associated risks [19,37,46,49,51–58].

Element	Definition	Contribution to Climate Change and Environmental Degradation	Climate Change Impact
Production	Farmers delivering food in its raw form into the supply chain	<ul style="list-style-type: none"> - Larger foodsheds leading to higher fossil fuel usage to import food - Downstream contamination due to runoff - Biodiversity loss - Anthropogenic greenhouse gas emissions - Increased soil infertility 	<ul style="list-style-type: none"> - Variable precipitation events - Decreased crop productivity - Altered growing seasons - Desertification - Groundwater depletion - Soil erosion - Increased and extended hungry seasons
Processing	Value-adding processes to transform raw food into products that meet consumer needs	<ul style="list-style-type: none"> - High incidence of food contamination results in unnecessary waste - Anthropogenic greenhouse gas emissions 	<ul style="list-style-type: none"> - Increased temperatures accelerate spoilage, increasing dependence on rapid processing reducing nutritional value - Food shortages as a result of reduced crop productivity - Input resource shortages
Retail	Where consumers interact with food products	<ul style="list-style-type: none"> - Food deserts as a result of poor retail placement increases food miles - Globalized retail supply chain increases food miles - Sourcing from industrialized food producers and processors mean that the retail sector actively contributes to all the other climate change contributions incurred at the previous steps - The “just-in-time” nature of sourcing fresh produce contributes significantly to waste and losses 	<ul style="list-style-type: none"> - Decreased product availability - Need to sell produce faster due to increased food quality deterioration - May result in reduced stocking of fresh produce - Rising food product sourcing prices

Table 1. Cont.

Element	Definition	Contribution to Climate Change and Environmental Degradation	Climate Change Impact
Consumption	Consumption is the main determinant of what is produced, how it is produced and in what quality and quantity it is marketed. Therefore, consumption can be seen as the single most important step in the supply chain in terms of the impact in changing consumption patterns can have on wider sustainable agricultural practices	<ul style="list-style-type: none"> - Higher demand for animal-based products and limited dietary diversity contributes to the conversion of more natural habitats to crop and pastoral lands - Current consumption of highly processed food supports the industrialized global food system, adding to all the climate change contributions occurring in the previous steps 	<ul style="list-style-type: none"> - Decreased product availability - Higher food prices due to scarcity of certain products - Reduced nutrition - Increased dependence on highly processed foods, resulting in more diet-related disease and illnesses - Diminishing purchasing power
Distribution	Links all actors of the supply chain, transporting food between them	<ul style="list-style-type: none"> - Increased food miles due to multiple actors - Large greenhouse gas emissions due to longer food miles 	<ul style="list-style-type: none"> - Increased transportation cost due to the dependence on diminishing fossil fuel resources - Increased fuel cost, increases distribution cost - Increased temperatures increase the dependence in refrigeration to keep produce fresh during transport - Lack of refrigeration may result in even more waste and losses

Food waste and losses are a significant part of the supply chain with an estimated 1.3 billion tons of waste and losses incurred globally each year [23]. Figure 1 highlights the process of waste and loss accumulation in the various steps of the food supply chain that inevitably result in a third of the food produced globally being lost [23]. Wiskerke [59] highlighted that at the global level, enough food is produced to feed 10 billion people. A focus on increasing agricultural production (in a business as usual format) is thus irrational, considering the fact that food waste and losses occurring at various steps of the supply chain is not being addressed as a major outcome of the inefficiency of the supply chain.

2.3. Urban Agriculture

This section will further the argument for the spatial integration of urban agriculture (UA) into cities of the Global South. This section will highlight how UA manifests in urban environments and the benefits, constraints and concerns thereof.

2.3.1. Defining UA

UA is the “production of crops and livestock within cities and towns” [60]. Rezai et al. [61] also added that UA includes activities such as processing and distribution of agricultural produce, not just the production thereof. Van Veenhuizen [62] highlighted that UA is often utilized by urban residents as a response to different urban dynamics: as a way to stave off hunger and malnutrition; as a method of harnessing the advantages that urban environments have for agricultural production; or as a way to further sustainable development (through urban greening, social inclusion and waste recycling). There is great diversity in the range of UA interventions available, and initiatives can be tailor made to fit any purpose. It will thus be important that the local contexts be analyzed in depth, to ensure that the chosen UA initiative will be viable in the area.

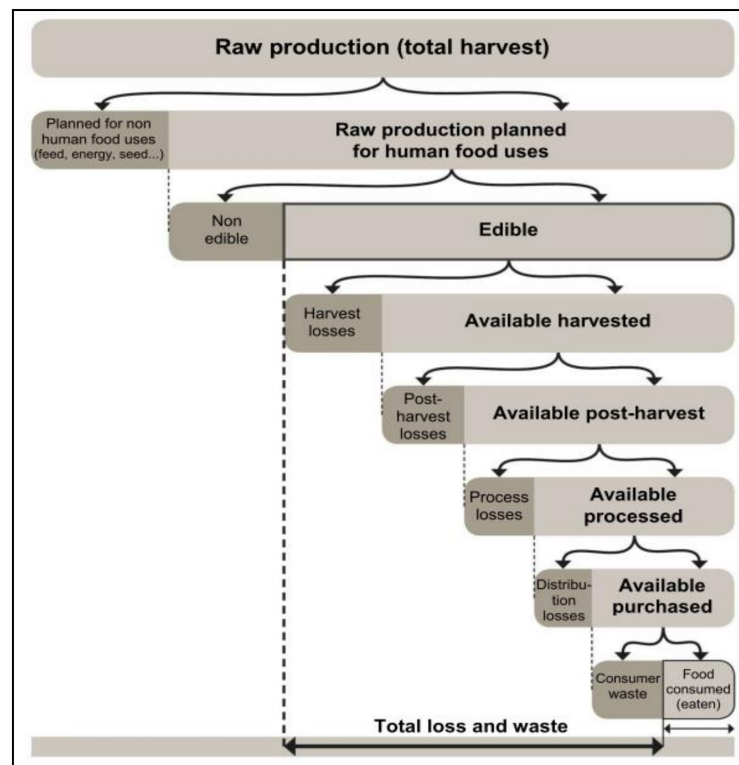


Figure 1. Diagram of food waste and losses generated along the food supply chain [23].

UA not only has the potential to provide more food within urban environments but can also aid in reconnecting people and the city with the environment [63]. In the next section, the potential for UA to shorten food supply chains will be highlighted, and the overarching benefits of UA discussed with specific reference to sustainable development.

2.3.2. The Benefits of UA

The benefits of UA are numerous and diverse. Van Veenhuizen [62] highlighted how UA is an integral part of urban symbiosis in that it benefits from the close proximity to markets, input resources and information, and in turn mitigates the climate impacts of cities and aids in creating circular resource flows [64]. Krikster et al. [65] emphasized how UA leads to agricultural production methods that can produce food independent of on-site variables such as climatic conditions, soil fertility and temperature. These benefits are attributed to the diverse range of production methods such as hydroponics (which replaces soil with nutrient rich water as the growing medium [66]) or indoor farming (which utilizes growing lights to supplement natural sunlight, allowing for accelerated growth and year-round production [67]). UA will thus be able to function within the climatic impacts projected to have adverse effects on agricultural production.

Shorter Food Supply Chains

Moving production into cities through the use of UA has the potential of shortening supply chains and thus reducing the dependency on fossil fuels [68]. Short food supply chains, as described by Charatsari et al. [69] is an alternative form of distributing agricultural products that promotes new production and consumption patterns and brings farmers and consumers closer together. Aiello et al. [45] agreed and emphasized how higher quality standards, ecofriendly production and healthy eating is associated with shorter supply chains. Shorter supply chains also have the added benefit of reducing urban footprints [70], increasing urban resilience in the event of shocks [15] and improving access to nutritious food [70].

Sustainable Development

UA is embedded in the economic, social and environmental systems of the urban environment [60], and thus has the potential to further sustainable development objectives. The socioeconomic benefits of UA entail environmental education, productive use of vacant lots [71], stimulating microenterprise development [62], poverty alleviation [70], improved health and social and community development [10], reducing the incidence of non-communicable diseases [72] and potentially establishing new businesses to support the local economy and job creation [65]. UA can also be facilitated as part of urban greening [59] and green infrastructure [73] support in urban environments and can aid planners in preserving green open spaces and green corridors.

The disposal of waste is becoming a more pressing issue in urban environments [62], and UA has the potential to absorb urban organic waste and wastewater and utilize it productively as compost or irrigation for soil fertility improvement [64,74].

This also has the added benefits of reducing the pressure on rapidly filling landfills [75] and reducing greenhouse gas emissions generated from inadequately treated organic waste [76]. Figure 2 highlights more potential benefits that UA offers for sustainable development. It is, however, necessary to understand the concerns and constraints of UA before integration into urban planning practice can take place.

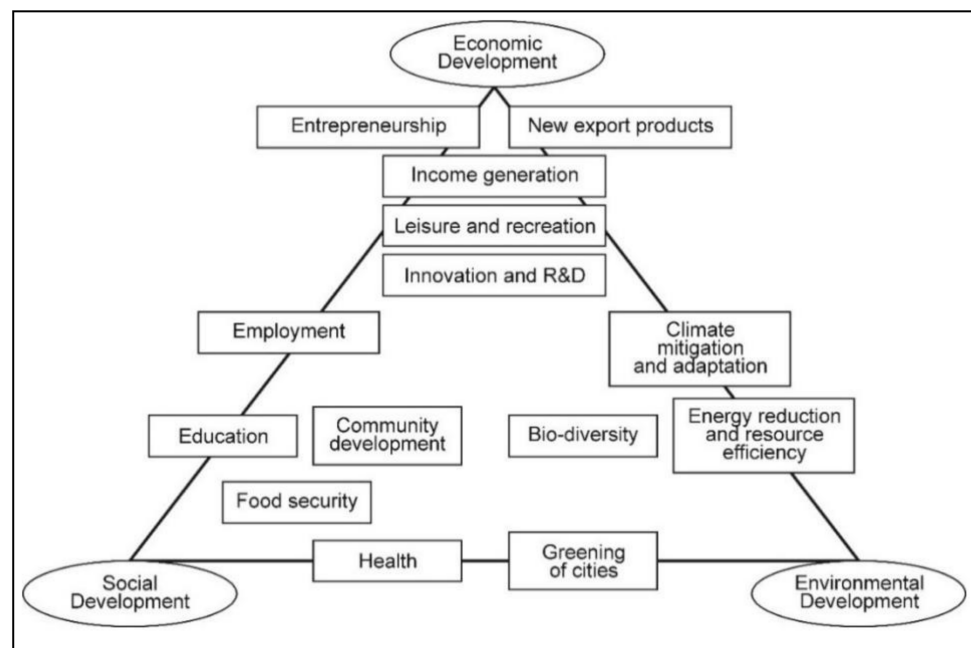


Figure 2. Potential benefits urban agriculture (UA) entails for sustainable development [77].

2.3.3. UA Constraints and Concerns

Land tenure tends to be the main operational constraint to the establishment of UA initiatives [78]. As Mubvami and Mushamba [79] highlighted, land tenure is a determining factor to the level of investment into UA and with no legal land rights, farmers are unable to use the property as collateral for financial loans, and are thus unable to access the necessary funds with which to set up an urban farm. The high cost and demand for urban land is also a challenge for the implementation of UA [78]. This can, however, be mitigated by considering under-utilized spaces such as rooftops, alongside roadways or between buildings as potential sites for UA [63]. As previously mentioned, UA is able to function independently of the natural resources required for conventional agriculture (such as sunlight and fertile soil), making it versatile in application and adaptable to various growing environments [63,65].

Critics such as Warshawsky [30] have, however, critiqued the promotion of UA as a “cure-all” method for food security, since there is no real evidence that UA will be able to enhance the food security of all who live within the city. UA is, however, not promoted as a method to replace conventional agriculture, but rather as a means to supplement diets and make people less reliant on monetary incomes to access nutritious food. Others have also argued that UA is hardly accessible by the poorest of the poor since the establishment of an UA farm requires capital inputs often not possessed by the poor [28,80]. These critiques, however, do not acknowledge the other forms of UA such as community farming whereby multiple farmers will be able to pool their combined resources to establish UA farms, thus sharing the costs of the initial investment. There are also considerable concerns with regards to the use of organic waste as input sources, questioning how safe these products will be for consumption [35]. Contaminated urban soils and polluted air is also a concern for food safety [81].

These health concerns require considerable investigation and illustrate the need to formalize UA in order to establish health and safety standards and ensure that food produced in urban environments is safe for consumption. The multifunctionality of UA, however, means that its application extends well beyond mere food provision, and these other functions also have numerous other benefits, concerns and constraints, which need to be considered before plans and policies are formulated.

2.4. UA and Ecosystem Services

Ecosystem services according to The Economics of Ecosystems & Biodiversity [82] refer to the benefits that humans derive from functioning ecosystems. These services are divided into provisioning, regulating, habitat and supporting and cultural services, the components of which can be found in Figure 3. Provisioning services describe the material and/or energy output from ecosystems; regulating services are provided through the regulation of air and soil quality as well as flood and disease control; habitat or supporting services provide habitats and diversity of plants and animals and cultural services are non-material benefits that humans derive from ecosystems [82].

UA has the potential to support ecosystems and biodiversity [15], and Goldstein et al. [74] highlighted how if UA played a bigger role in food production, it may reduce the necessity to transform more natural ecosystems into croplands. UA can aid in establishing more urban green spaces, which as highlighted by Lin et al. [83] brings diverse green infrastructure into cities and connects fragmented habitats. Clinton et al. [72] also highlighted how UA facilitates ecosystem services through the cultivation of diverse crops, supporting pollinator and animal movement, absorbing urban wastewater and organic waste and regulating the local microclimate.

UA is thus not only reserved for food production, and the wide range of vegetation structures and management goals mean that it is highly heterogeneous and can be adapted to suit any need [83]. It is this adaptability and the inherent multifunctionality of UA that makes it an ideal method to contribute to the food security and sustainable development of urban environments. The arguments highlighted in the literature study coincide with the purpose thereof for generating criteria with which the best practice examples in the empirical investigation will be analyzed. The next section will thus describe the methodology utilized in the empirical investigation and analyze the selected best practice examples of UA.



Figure 3. Ecosystem services [82].

3. Materials and Methods

The purpose of the empirical investigation is to analyze best practice examples of urban agriculture (UA) in cities of the Global South, in order to better motivate the integration into urban planning practices. Considering the nature of this paper, a qualitative approach in the form of case study research will be followed. This section will serve to introduce the methods utilized for the empirical investigation, highlighting the criteria used to sample and analyze the chosen cases. Thereafter, the chosen Global South cases are analyzed, and the spatial and urban planning implications thereof discussed.

3.1. Method of Analysis

As previously stated, the nature of this paper lent itself particularly well to qualitative research since it is often used to build meaning from rich descriptions of phenomena [84]. Chawla and Sondhi [85] highlighted how the qualitative approach can be used to collect more intensive and in-depth information to explore, understand and describe certain phenomena. This is suited for this empirical investigation, since the in-depth description of the chosen UA initiatives are used to motivate the inclusion of UA in urban planning practice. Qualitative research methodologies include biography, phenomenology, grounded theory, ethnography and case study research [86]. This paper made use of the case study analysis to analyze Global South and South African examples of UA initiatives.

The following sections will describe the case study analysis method, followed by a description of the sampling methods that were utilized to select appropriate cases. Lastly, the formulation of the case evaluation criteria will be discussed.

3.1.1. Case Study Analysis

The documentation of rich cases is popular in planning literature and is often used for teaching and concept building [87]. Moore et al. [88] also emphasized how case studies can describe deeper and more complex understandings of phenomena. In order to better motivate the inclusion of UA into urban planning practice, cases were analyzed based on their impact on food security and the food supply chain, and their contribution to ecosystem services and sustainable development. It is also important that these cases illustrate a clear link with urban planning practice.

In order to provide sufficient evidence of the impact of UA on food security and the food supply chain multiple cases were analyzed, and a multiple-case study design was implemented. Swanborn [89] highlighted how a multiple-case study design considers a series of instances of the same phenomenon occurring within different conditions. Yin [90] also emphasized how this design is considered more robust than single-case designs. Robustness can, however, only be confirmed through replication [90], which also gives more confidence to the results [91].

This paper thus strived for literal replication—the instance where the cases predict similar results [90]. Therefore, selected cases showing evidence of improved food security and impacting the food supply chain will be analyzed.

3.1.2. Sampling Methodology

Three sampling methods were applied sequentially to narrow the pool of potentially viable case studies down to only four cases, two international Global South cases and two local cases from South Africa. The first approach to sampling was theoretical sampling to determine the initial population of potential cases, where after the second sampling approach (criterion sampling) was applied to reduce the amount of cases to those that meet the developed criteria. The last sampling approach (purposeful sampling) was applied to determine the final four cases that were included in the case study analysis. The first sampling method that was applied was that of theoretical sampling, which according to Strydom and Delpont [91] is useful when only specific features need to be studied in order to further theory development. Thus, applying theoretical sampling allowed for cases to be chosen specifically based on their impact on food security and the food supply chain.

The second sampling method that was implemented was criterion sampling. Schensul [92] described criterion sampling as the selection of cases based on a set of criteria. The criteria were developed to assure that cases had some impact on improving food security and shortening supply chains. Cases also had to have a clear link with spatial planning to indicate how UA was facilitated as a part of urban planning practice. Lastly, cases had to not be too context specific in terms of their approach to UA and the methods that were employed to facilitate it. Cases therefore had to be replicable in a wide range of contexts and take cognizance of resource constraints that might be present in Global South contexts (i.e., too technologically advanced approaches might not be appropriate in all contexts considering financial constraints and a lack of support infrastructure). Purposeful sampling was the last sampling method applied and was used to select cases based on what could be learned from them and how information rich they were [88]. Variability in the application, scale and management of the UA initiatives would illustrate the viability thereof when applied to a range of contexts. Therefore, the two international Global South and two South African cases were chosen based on the spatial scale to which they were applied, namely the city and neighborhood scale. The chosen sites that were investigated were thus Rosario, Argentina and Belo Horizonte, Brazil representing the international Global South cases and Cape Town and Johannesburg representing the South African cases.

It was merely a coincidence that the two cases chosen to represent the “international” Global South perspective on urban agriculture happened to be in South America. These two cases were mentioned numerous times in resources from the FAO and other literature specifically orientated towards urban agricultural practices, which increased the validity of these cases as being “best practice” examples. The South African context was specifically chosen to determine whether there would be a difference in the approach to urban agriculture between that of South Africa and the countries of Brazil and Argentina. Information on the cases were gathered from leading academic search engines such as Google Scholar and Scopus, focusing on the key words of the case study (e.g., “Belo Horizonte” and “urban agriculture” or “food security program”). Preference was given to documentation from leading food, agriculture and urban agriculture organizations such as the FAO, RUAF (Resource Centre on Urban Agriculture and Food Security) and the Urban Agriculture Magazine. Some grey literature was considered for the South African cases, as these cases are not as extensively documented as the international cases are. Other sources such as dissertations and video interviews were also considered viable sources of information. This study thus exclusively made use of secondary data.

3.1.3. Formulation of the Analysis Criteria

The literature study aided in the formulation of the analysis criteria. Particularly with regards to the formulation of criteria in reference to food security (Section 2.1.3), the food supply chain (Section 2.2), ecosystem services (Section 2.4) and sustainable development (Section 2.3.2).

The criteria regarding the background information of the UA initiative is included to provide information on the functioning of the initiative and how it was established. The most important criteria with regards to the motivation to integrate UA in urban planning practice are the criteria regarding food security, the food supply chain, ecosystem services and sustainable development.

The purpose of the case study analysis is to highlight—via four best practice examples—how UA can serve as a viable method to increase food security and address the vulnerabilities of the food supply chain. The criteria in reference to ecosystem services and sustainable development will further motivate the applicability of UA as not only a means to increase food security, but also to address other urban inefficiencies and issues such as waste management, climate change adaptation and mitigation, poverty alleviation, neighborhood rejuvenation and community development (as theoretically highlighted in the literature study in the section about the benefits of UA (Section 2.3.2)).

3.2. Analysis of Case Studies

The analysis of each individual case study will follow the format of a short paragraph describing the context of the case, pertaining to the establishment of the initiative and general need to know information. Where after, the cases will be analyzed according to the analysis criteria, contained in Tables 2–5 for each case study analysis respectively. This section will only present a summary of the analysis for each case. A conclusion section will lastly represent the lessons for spatial planning that were derived from the case study analysis.

3.2.1. International Global South Case Study 1: Urban Agriculture Program—Rosario, Argentina

The Urban Agriculture Program of Rosario was established in response to the 2002 economic crisis [70] with the aim to contribute to the food security and income generation of the urban poor [93]. The municipality along with several NGOs had developed the program originally to support 20 groups of gardeners but was overwhelmed by the amount of people in need of support, resulting in the program supporting more than 800 farming groups [94]. The program reuses vacant and underutilized land for agroecological farming practices, thereby improving food security and income generation for the urban poor and revitalizing degraded urban land in the city [95].

The Municipal Agricultural Land Bank serves to connect those in need of productive land with vacant land owners [96]. The Land Bank serves as a repository of vacant land through which urban farmers might gain access to potential production sites. The Land Bank ensures a good supply of vacant land is available by giving tax breaks to land owners that make their land available for production, and levying taxes against those that let their land sit idle [96]. Mapping vacant land in the city highlighted the fact that 35% of the municipal area was suitable for agricultural production [97]. Mapping the vacant land in terms of cadastral information also made it easier for urban planners to integrate UA into municipal plans and policies, effectively including UA into land use plans, spatial policies and urban development projects [97]. Table 2 summarizes the results of the case study analysis.

Table 2. International Global South case study 1: urban agriculture program—Rosario, Argentina [70,78,86,93–95,97–100].

Urban Agriculture Program—Rosario, Argentina	
Evaluation Criteria	Description of Criteria Fulfillment
Background Information	
Initiative name	Urban Agriculture Program
Spatial Scale	City scale
Initiative Driver	Municipal government and NGOs
Main Focus	Increasing food security through employment in urban agriculture and food supply chain associated microenterprises.
Method of Implementation	Reuse of vacant and under-utilized land through promoting agroecological farming methods. Thus, not only providing food security and income streams to the poor, but also public services such as urban revitalization and increasing green areas.
Year opened	2002
Impact on food security	
<p>The program actively improves the food security of urban residents through supporting UA initiatives, which not only increases their access to fresh food, but also provides them with an additional income with which to supplement their diets. Recognition of UA as a legitimate land use increases the farmers' security of tenure, allowing them to access financial support more readily making them more economically viable.</p> <p>The multistakeholder establishment of community gardens has drastically increased the access to fresh food by the urban poor. These UA farms are also the only source of organically grown produce in the entire region, making more nutritious food in the area easily accessible.</p> <p>The elements of food security has been addressed comprehensively through this initiative in that it increases availability (increased fresh organic food production); access (directly supporting UA in low-income areas); utilization (improving nutrition through making fresh food affordable to the low-income classes); stability (land tenure, which minimizes the risk of closure due to developmental pressure); sustainability (only using agroecological growing methods, supporting employment and empowerment of low-income classes through entrepreneurship in UA) and agency (by enabling the empowerment of low-income classes by making a healthier variety of food available from which they can choose to supplement their diets, and enabling them to be a part of the food supply chain by participating in how, where and what is produced within the city).</p>	
Impact on food supply chain elements	
<p>The program fostered the establishment of shorter supply chains through directly supporting UA (in terms of providing the necessary equipment, training and input sources) and supporting the establishment of associated microenterprises in retail and processing. The creation of the municipal land bank helped to mitigate the constraint of gaining access to productive land. The levying of taxes on idle land together with the tax breaks given for land made available for production also increased the number of potential UA sites.</p> <p>Shorter supply chains were fostered by the UA production sites and associated enterprises in processing, retail and distribution, being located within the city region. Thus, limiting the food miles of fresh produce that typically would have been transported from far rural production areas or other areas within the region.</p> <p>The city also actively supports the localization of the supply chain by supporting UA farm establishment, encouraging markets and alternative retail channels and the emphasizing the reuse of household greywater and organic waste as input resources for improving production.</p>	

Table 2. Cont.

Functional as part of ecosystem services
<p>The city boasts with five large garden parks—which are large landscaped areas that support agriculture, cultural, sports and educational activities. Combining UA with urban forestry in the garden parks enabled the protection of the limited natural areas still available in the city, while simultaneously utilizing these spaces to generate an additional income stream for the city. These garden parks are also used to absorb excess stormwater and provide a habitat for animals in the city.</p> <p>The garden parks are multifunctional and aids in creating a sense of place and community in Rosario. The citizens also aided in the creation of these parks, which mean that the spaces serve a functional purpose to not only be a space for recreation, but it is also used for agricultural production, farmers markets, various educational programs on UA, etc., which further supports cultural ecosystems services.</p>
Contribution to sustainable development
<p>The sustainability of the program lies in its ability to foster entrepreneurship in UA, allowing those in situations of structural poverty to access UA as a viable employment opportunity. Fostering entrepreneurship also empowers poor people to lift themselves out of poverty and access funding for investment more readily. The program, lastly, increases the environmental sustainability of the city by increasing and protecting the green spaces and natural areas.</p>
Challenges, constraints and concerns
<p>Many of the underutilized spaces identified as potential UA sites were previously used as dumping sites, therefore highly contaminated by heavy metals. This resulted in the program having unexpected costs for rehabilitation of UA sites.</p> <p>The program had initial support and success due to the fact that it was launched as a response to a major economic crisis. However, after the impacts of the crisis subsided, numerous farms were abandoned for higher paying jobs. The program thus had to grapple with the struggle of ensuring that UA became an economically profitable venture for low-income citizens in order to ensure the continued support for UA after the economic crisis situation lifted.</p> <p>The identified product marketing channels for UA farmers seem to separate UA farmers unequally based on the level of literacy, organizational expertise, access to secure income and so on. Smaller producers are only able to utilize the sales on farm, door-to-door sales and open air farmers markets to sell their produce. Where higher-yield producers might be able to sell to supermarkets, agroindustries and organic markets. This might cause smaller producers to remain marginally profitable whereas larger producers might actually turn a significant profit due to more profitable market opportunities.</p>

3.2.2. International Global South Case Study 2: Food Security Program—Belo Horizonte, Brazil

The Brazilian government has become a leader in incorporating food and nutrition security issues into a national policy agenda, with the Zero Hunger Program focusing on eradicating hunger and poverty [99]. The decentralized nature of the Brazilian government places the responsibility on local authorities to adopt and adapt the program to their local context [101]. The City of Belo Horizonte opted for the creation of a Secretariat for Nutrition and Food Security (SMASAN), which centralized the planning, coordination and execution of the numerous food security initiatives, resulting in the near elimination of hunger, at a cost of only 2% of the annual municipal budget [102,103]. The initiatives launched under this program are aimed at (1) subsidizing food sales; (2) food and nutrition assistance; (3) supply and regulation of food markets and (4) supporting urban agriculture [104]. Table 3 summarizes the results of the case study analysis.

Table 3. International Global South case study 2: Food Security Program—Belo Horizonte, Brazil [99,101–107].

Food Security Program—Belo Horizonte, Brazil	
Evaluation Criteria	Description of Criteria Fulfillment
Background Information	
Initiative name	Food Security Program
Spatial Scale	City scale
Initiative Driver	Municipal government
Main Focus	Increasing food security
Method of Implementation	The direct supply of food to the population; regulation of food markets; subsidizing food; and supporting UA
Year opened	1993

Table 3. Cont.

Impact on food security

Annually, the program handles more than 45,000 tons of food, providing it to the general public through popular restaurants and school feeding programs amongst others. Popular restaurants are mandated to sell some of their food at affordable prices and provide the homeless with free food. School gardens and feeding programs work with nutritionists to ensure that the food served has the correct nutritional value for the relative age group.

The program not only makes healthy food available at affordable prices, but also ensures that citizens are educated on sustainable diets, and how to prepare and store food to gain the most nutritional benefits. As long as the government is in support of this program, farmers will have a stable income and citizens will be able to access and afford nutritious food.

Impact on food supply chain elements

Public procurement from local producers is encouraged by law, directly linking producers and processors/retailers without the need for wholesalers, ensuring food prices remain low. Producers and the various places where food is made available are the only actors in the supply chain. Farmers are responsible for production and distribution, while processing, retailing and consumption are combined at the various outlets.

Food products that are not suitable for sale (due to size or cosmetic reasons) are redistributed to the city's food bank, which donates the produce to shelters, significantly reducing post-harvest waste and losses.

Functional as part of ecosystem services

Considering this program is solely focused on increasing food and nutrition security through the use of UA, the multifunctionality of UA cannot be implied. It can, however, be argued that the support and integration of UA into the fabric of the city has enabled the city to realize some ecosystem services. The orchard program has, for example, made an impact in stabilizing sloping land through planting fruit trees.

Contribution to sustainable development

The law on public procurement and the support of farmers markets make UA a viable employment opportunity. The resulting short food supply chains enable farmers to earn a higher income, reducing their dependency on government support, making this initiative more sustainable in the long-term.

Integration of food and nutrition security into the city's master plan, mean that it will be considered in all new development plans, making it sustainable.

Challenges, constraints and shortcomings

This initiative is wholly reliant on the capacity of government to continually support UA farms and associated microenterprises in terms of subsidies and educational and resource support. Therefore, any decision from government stop focusing on food security or to reduce the program funding might result in the termination of the program.

The multistakeholder and interdepartmental approach, which should be positive characteristics, threaten the long-term existence of the program and its initiatives. This is due to the fact that initiatives tend to be run in cooperation with other government departments such as education, health, social assistance, etc. The initiatives are thus perceived as a part of these departments and the food departments is seen as a supplementary supporter of the initiative. Therefore, they might be expendable.

The initiatives struggle to mainstream the importance of nutrition, and thus even though the consumption of fresh fruit and vegetables have increased, its consumption still remains very low. The city thus still faces the issues of obesity and non-communicable diet-related illnesses in spite of the clear support for proper nutrition.

3.2.3. South African Case Study 1: Johannesburg Urban Agriculture Initiative—Johannesburg

The Johannesburg Urban Agriculture Initiative was established by the Johannesburg Inner City Partnership and various other stakeholders to create employment opportunities and foster entrepreneurship [108]. The initiative aids in the establishment of rooftop hydroponic farms, providing the necessary training, infrastructure and funding [109]. Hydroponics is a form of cultivation that utilizes nutrient-rich water to supplement soil as the growing medium for plant growth [66]. The short-term goal is that 60 people will have been trained and 25 rooftop farms are up-and-running, and nine agriprocessing businesses are operational [110]. As of 2018, 60 other buildings in the city area have been made available for lease, and other areas such as sidewalks and underutilized spaces are also in consideration as potential farming sites [111]. Table 4 summarizes the results of the case study analysis.

Table 4. South African case study 1: Johannesburg Urban Agriculture Initiative—Johannesburg [109,111–114].

Johannesburg Urban Agriculture Initiative—Johannesburg	
Evaluation Criteria	Description of Criteria Fulfillment
Background Information	
Initiative name	Johannesburg Urban Agriculture Initiative
Spatial Scale	City scale
Initiative Driver	Municipal government & NGOs
Main Focus	Addressing youth unemployment through creating entrepreneurial opportunities in UA
Method of Implementation	Hydroponic farming on inner-city rooftops
Year opened	2017
Impact on food security	
The case study highlights how UA can be used for more than increasing food security, in this case, addressing youth unemployment through entrepreneurship in UA. Thus, though this initiative does not specifically address food security, it does indirectly improve the food security of the urban farmers and employees by providing them with an increased income with which to supplement their diets.	
Impact on food supply chain elements	
With some of the farms, production is moved to within steps of the target market, eliminating transport requirements. Thus, shortening the food supply chain by producers selling directly to restaurants where further processing, retailing and consumption occurs. Due to the efficiency of hydroponics, growing times are significantly reduced, increasing the amount of growing cycles and the closed system of hydroponics allow year-round production.	
Functional as part of ecosystem services	
With hydroponic systems being a generally closed system, its contribution to ecosystem services is minimal. There is however potential for rainwater harvesting, but no evidence of this practice was found	
Contribution to sustainable development	
The efficiency of hydroponics allows for accelerated growing periods, and its vertical orientation increases the yield that can be harvested from a small area. Hydroponics also use 80% less water than conventional growing methods, thus reducing the pressure on fresh water sources. The initiative also specifically targets youth unemployment through entrepreneurship in agriculture, allowing for long-term employment in the green economy. Given that hydroponic systems are more effective at delivering nutrients directly to plant roots, growing times are significantly decreased, allowing for more growing cycles, and thus more profit.	
Challenges, constraints and shortcomings	
Rooftop spaces are relatively small (200 m ²), therefore farmers need to invest in crops that have quick growing periods to increase annual yield. This could result in farmers growing crops that do not necessarily have a market. Or that farmers might have to target a niche market (such as herbs or aromatic plants) that might be unstable in terms of consistent market demand. The incubation program requires that the farmer has to come up with a business plan and ensure that their produce has a market before any financial support is given for the establishment of the UA farm. This might make farmers vulnerable to price volatility as they are not protected by any formal market regulations that ensure minimum profit margins. The initiative relies on the financial support of NGOs to finance the establishment of UA farms. Thus, the initiative might fail if financial aid stops. Hydroponic systems are dependent on recirculating the nutrient rich and oxygenated water through the use of water pumps. An unstable power supply, and the fact that plants deteriorate quickly when the oxygen and nutrient content in the water is not sufficient, farms might be susceptible to crop failure.	

3.2.4. South African Case Study 2: Oranjezicht City Farm—Cape Town

The Oranjezicht City Farm (OZCF) is a non-profit public-benefit organization established by founding volunteers and managed by a larger group of committed volunteers from the community [115]. Established on a portion of the historic Oranje Zicht Farmstead, the OZCF, in partnership with the City of Cape Town Parks Department, entered into a co-operative agreement to transform the disused bowling green on the property into a community vegetable garden [116]. The farm serves as an outdoor classroom [117],

with the main focus on celebrating local food, culture and community through urban agriculture [118]. The farm is also focused on educating and empowering those aspiring to undertake urban farming, which is achieved through the programs and workshops hosted on the farm [115]. The farm and educational programs are mainly funded through the OZCF Market, which is a community-style farmers market selling a variety of organically grown produce and lightly processed food items [116]. Table 5 summarizes the results of the case study analysis.

Table 5. South African case study 2: Oranjezicht City Farm—Cape Town [116–119].

Oranjezicht City Farm—Cape Town	
Evaluation Criteria	Description of Criteria Fulfillment
Background Information	
Farm name	Oranjezicht City Farm
Spatial Scale	Neighborhood scale
Initiative Driver	Non-profit public-benefit organization and key governmental departments
Main Focus	Improving underutilized public green spaces through supporting the establishment of similar UA initiatives
Method of Implementation	Demonstration gardens and financial, professional and business management support for UA establishment
Year opened	2012
Impact on food security	
<p>The farm itself, the 26 allotment gardens and the market ensure that fresh, nutritious food is made available in an area dominated by fast food chains and restaurants.</p> <p>The various retail options (i.e., the market, the “pick-your-own harvest” and the “vegbox” scheme) mean that the produce from the farm is accessible outside of the immediate neighborhoods in which the farm and market are located.</p> <p>The initiative might only directly contribute to the food and nutrition security of the most affluent members of the public, considering the farm and markets location in upper-class neighborhoods, it can be argued that their business and educational support for similar UA initiatives indirectly contribute to the food security of those aided by the farm.</p>	
Impact on food supply chain elements	
<p>The market aids in localizing the food supply chain by offering producers and processors within a 50 km radius easy access to market. The localization of the food supply chain results in less food miles and reduces the amount of waste that can be generated along the chain. The Bokashi Brigade program also collects and actively diverts 100 tons of waste from municipal landfills annually, fostering circular resource use by using kitchen and garden waste productively on the farm as compost.</p> <p>The farm also ensures that produce not sold at market are then either sold directly to restaurants or donated to charity organizations. Therefore, eliminating post-harvest food losses on their end.</p>	
Functional as part of ecosystem services	
<p>The farm itself might be too small to have any significant impact on supporting ecosystem services. However, considering the support the farm provided in the establishment of at least 20 other UA initiatives, the farm might have aided in supporting ecosystem services in the wider community, especially with regard to provisioning services.</p> <p>Severe winds in the area are also detrimental to the health of the crops, the farm thus opted to use permaculture fruit trees not only as wind breaks to protect the crops, but also to increase the productive capacity.</p> <p>This farming initiative especially has wide ranging support for cultural ecosystem services, since the functioning of the farms has more to do with recreation and connecting people and nature, than with food security. It can thus be surmised that the sense of place and community, recreational and educational uses and tourism are the most significant ecosystem services gained by this farm.</p>	
Contribution to sustainable development	
<p>Seeing as the market is focused on locally produced and processed food, the money spent is kept circulating in the local economy. The market also keeps stall hire cost low to encourage entrepreneurship and allow local producers and processors to be more economically viable.</p> <p>The educational programs offered by the farm also educate and train youth and adults in the area, aiding in skills development within the community.</p> <p>The focus on cultivating indigenous and heirloom plants, and the use of organic seeds and compost results in this farming practice having minimal negative externalities.</p>	

Table 5. Cont.

Challenges, constraints and shortcomings

Leans on the direct involvement of active volunteers to remain profitable, which might result in difficulties if these voluntary associations should withdraw from the project.

It is estimated that a total of R1 million in in-kind contributions from donor organizations went into the farms first year of activity, allowing the growth of the farm at an unprecedented rate. It may thus not be a realistic measure by which to judge how quickly a UA farm might grow independent of such an immense support system

The market experienced some difficulty in securing a location, which resulted in the loss of income.

The farm has minimal financial support to offer other farmers seeking to establish their own UA initiative. Their mandate to support similar initiatives in the wider city-area is thus less effective considering no real financial support can be given (due to a lack of excess capital).

3.3. Synthesis of the Case Study Analysis

The case study from Rosario, Argentina (Section 3.2.1) highlighted the need to recognize UA as a legitimate land use, in order for it to be integrated into urban management and land use plans and policies. It is thus necessary to evaluate the current vacant land within the city and map them according to cadastral data to make integration into spatial plans easier, which can be facilitated through the use of GIS technology. Inclusion of UA practices within designated open spaces and natural areas can aid in increasing the non-monetary ecosystem services benefits that cities can derive from these spaces, and assist urban planners in protecting these spaces from further development pressures. One last lesson that can be learned from this case is the importance of governmental support (in the form of training, technical and financial support) and the necessity to establish norms and standards to mitigate the potential health risks associated with UA.

The case study from Belo Horizonte (Section 3.2.2) was included to illustrate how food and nutrition security issues can be integrated into urban plans and policies. The centralization of food issues into its own department made addressing food issues more effective than if it were to be facilitated as a subresponsibility of various municipal departments. A multistakeholder approach is also necessary if these policies are to be kept a priority in light of shifts in political leadership with different agendas. The case also highlights the importance of including food and nutrition security and the food supply chain into urban management and land use plans and policies, in order to ensure the long-term sustainability thereof.

The case study from Johannesburg (Section 3.2.3) differs from the other cases as it demonstrates how UA can be utilized to target specific problem areas in a city, in this case youth unemployment. This case is also used to illustrate how UA can be facilitated in cities where limited vacant land is available, and how vacant land availability should not be the sole determinant on whether UA can be facilitated or not. Even though this case had no clear connection with the wider food security issues of the city, it does illustrate how UA is not purely reserved for food provision, but for economic and social upliftment as well. Lastly, it also highlights the potential for UA to establish short food supply chains and associated microenterprises.

The case study from Cape Town (Section 3.2.4) highlighted the need to incorporate an educational component in UA. In this case, the agreement that the OZCF made with the government stipulated that it had to contain an educational component and had to aid in the establishment of similar projects in the city. This makes the support for UA more sustainable since it does not depend on already strained municipal budgets to establish new farms. This case also highlights how UA can aid in waste management by collecting urban organic waste and making productive use thereof. This practice was incorporated throughout the entire neighborhood and effectively diverted 100 tons of organic waste from the landfill per year. Lastly, this case illustrated the importance of farmers markets and having a central place for farmers to sell their produce, which will aid in making UA much more financially viable.

4. Conclusions

The conclusion section serves the purpose of introducing the main conclusions formulated from the literature study and empirical investigation, in line with the research aims and objectives as captured in Section 1 of the paper.

4.1. Conclusion 1: Food Security Is an Urban Planning Issue

The investigation into food security highlighted the importance of focusing on availability, access, utilization, stability, sustainability and agency in order to effectively address food security issues. In spite of this, global food security discourse is still dominated by the ideal that increasing rural production will ensure the food security of the global population, even when the definition recognizes that the mere presence of food is not enough to ensure security. The rural–urban divide fostered by this rural bias results in urban food insecurity being equated to production shortages, and not accessibility or utilization challenges. It also results in planners neglecting to acknowledge food as one of the essentials of life, which require adequate planning and coordination. This neglect is one of the reasons why food security associated risks such as food deserts, the insecurity–obesity paradox and the triple-burden of malnutrition, micronutrient deficiency and obesity thrive in urban environments.

A strong modernist perception amongst planners also hinders the development of UA since agriculture is perceived as a rural activity, which has no place in modern economic development activities. This perception should not be overlooked and should be considered when UA initiatives are designed and proposed for cities in the Global South. It is thus imperative that UA initiatives be supported in formal policy and legislation to ensure that planners perceive it as a step towards “modern” sustainable development, and not a regression back to an agrarian economy. Formulating UA into planning policy and legislation (as in both the Belo Horizonte and Rosario cases) will help to gain planning support for implementation.

4.2. Conclusion 2: Globalised Supply Chains Are Inefficient, and Planning Can Aid in Making It More Resilient

The current business as the usual model of the food supply chain is fraught with inefficiencies and, as Table 1 highlights, not only actively contributes to climate change, but also will increasingly fall victim to the impacts thereof. The recent COVID-19 pandemic also highlighted the inherent vulnerability of globalized supply chains in the event of a disaster (natural or man-made), and how detrimental it can be to the food security of urban residents. It is thus imperative that supply chains be made more resilient, and planners can facilitate this through supporting shorter food supply chains. Facilitating UA can aid in establishing shorter food supply chains, and supporting the establishment of microenterprises in processing, distribution and retail will further aid in localizing the entire supply chain. It should be recognized that UA alone will not be able to produce all the food needed to sustain urban populations, but it can, however, make the supply chain more resilient in times of shock.

Food waste and losses are a significant feature of the globalized food supply chain, resulting in an annual loss of 1.3 billion tons. This is why the argument for a 40% increase in food production is irrational considering enough food is produced globally to support 10 billion people, and it is the inefficiency of the supply chain that results in reduced food availability. The Belo Horizonte and Rosario cases highlight how through short supply chains post-harvest losses can be reduced, and waste can be minimized through redistribution to food banks and charity organizations. The Cape Town case also highlighted how food that is lost can be reabsorbed into the supply chain by using it as input supplies for production in the form of compost.

4.3. Conclusion 3: Best Practice Examples from the Global South and South African Cases Can Support the Integration of UA into Urban Planning Practice

The theoretical investigation into UA found that the main constraint to the establishment of urban farms is the availability of land. Recognizing UA as a legitimate land use can aid in the identification of vacant land suitable for production. Identifying land for potential UA production should, however, also include unconventional spaces such as rooftops, the sides of buildings and road reserves, since UA can be facilitated independently from conventional production requirements (such as soil and natural light). The Rosario case highlights the potential of vacant land mapping in bringing together owners of vacant land and those seeking land for production, and how mapping land according to cadastral data makes it easier to integrate UA sites into land use plans. The Johannesburg case highlights how rooftops can be made part of vacant land mapping on which to facilitate non-soil dependent UA growing methods.

Integrating best practice examples of UA initiatives will also aid in making plans and policies formulated around UA more successful. Doing so means that the arguments for UA are not based on theoretical evidence alone but are also anchored by practical examples illustrating these benefits. For example, the Belo Horizonte case is a good example with which to highlight the benefits of making food and nutrition security a governmental responsibility and formulating plans and policies to realize that responsibility.

4.4. Conclusion 4: The Multifunctionality of UA Can Increase the Non-Monetary Benefits of Ecosystem Services and Sustainable Development

As the theoretical investigation emphasized, UA can be used for more than just increased food production. The Belo Horizonte case highlights how trees and permaculture can be used to address soil erosion on sloping land, or act as wind breaks in the Cape Town case. The Rosario case also showed how UA can be used to improve the local climate, giving evidence to a 2.4 °C temperature decrease in areas surrounding urban farms compared to other areas in the city. These cases highlight the non-monetary environmental benefits that can be derived from facilitating UA as part of ecosystem service support.

UA can also be used to support sustainable development objectives. This is useful from a planning standpoint, since unemployment rates are generally high in the Global South, and UA provides a multifunctional opportunity to:

- Provide employment (Johannesburg, Rosario and Belo Horizonte cases);
- Increase food security (Belo Horizonte and Rosario cases);
- Alleviate poverty (Rosario and Johannesburg cases);
- Reconnect people and the city with nature (Cape Town and Rosario cases);
- Generate entrepreneurship (Johannesburg and Cape Town cases);
- Establish associated microenterprises (Rosario and Belo Horizonte cases) and;
- Formulate alternative supply chains (Belo Horizonte, Rosario and Cape Town cases).

5. Planning Recommendations

This section aimed to provide planning recommendations in line with the research question and objectives captured in Section 1. This section will thus introduce several suggestions on how UA can be facilitated as part of urban planning practice within the Global South context.

5.1. Recommendation 1: Food and Nutrition Security Should Be Prioritized as Part of the Urban Agenda

There is a clear rural bias on food security issues dominating global discourse, and it is important that the urban dimension of food security be more widely recognized. This can be done by incorporating food and nutrition security as part of governmental responsibility. If food is a basic human right, then it is the government's responsibility to do all they can to secure this right. The Belo Horizonte case is a good example of how a clear governmental agenda can significantly improve food and nutrition security. The case also highlighted

the importance of establishing food in a separate department if food planning is to be addressed in a more integrated way [101]. It is thus recommended that a separate food government department be established.

Due to the complex nature of food security issues and the food supply chain, a multi-stakeholder and participatory approach to food planning should be followed. Involving members of the public and private sector will aid in making food strategies and programs a long-term feature of the city, unaffected by political leadership change. The participatory approach will also improve the success and sustainability of implementation, since a wider range of stakeholders takes ownership in the strategies and programs [120].

The food department should also be responsible for compiling their own food spatial plan, identifying their vision and highlighting how strategies will be implemented to, for instance, protect land for cultivation and safeguard food security, and coordinate with various government departments to include food in the municipal development plans, policies and frameworks. There is thus a need to include food systems planning into the syllabus of planning degrees, to ensure that planners have the necessary knowledge and expertise to incorporate food into the planning agenda [63]. In South Africa, planning curricula covers subjects such as settlement history, planning theory, sustainable cities, regional development, environmental planning, transport planning, land use and zoning, economics, geography, anthropology and placemaking/urban design [121].

5.2. Recommendation 2: Urban Planning Should Be Used to Create Sustainable, Local Food Supply Chains

The food department (Section 5.1) should also be involved in local food supply chain mapping, in order to identify how and where shorter/alternative chains can be established. This department can develop a short supply chain development center [70], which can provide funding, technical assistance and training in the establishment of UA farms and associated microenterprises in processing, distribution, marketing and waste management. The department can aid in making UA initiatives more economically viable by supporting the establishment of farmers markets and public procurement policies, which states that a certain percentage of food for feeding programs must be sourced from local producers (as in the Belo Horizonte case).

Food systems assessment can be used to map the status quo of the food system, highlighting the economic, ecological, sociocultural and health impacts [122]. Planners can play a key leadership role in food systems assessment since their expertise in mapping at different spatial scales and ability to map complex linkages will be needed in the assessment. Food systems assessment is crucial to identify gaps and inefficiencies in the system that could benefit from the creation of more sustainable, local supply chains. Mapping food deserts and combining that information with the food systems assessment map will illustrate specific areas in the city that are in need of healthy food outlets. These areas can then be specifically highlighted in food strategies and support for UA establishment.

5.3. Recommendation 3: UA Should Be Integrated into Urban Planning Practice

Recognizing UA as a legitimate urban land use is necessary if these activities are to be regulated, planned and managed effectively. UA should also then be easier to incorporate into municipal land use and management plans. It will also then be easier to make provision for community gardens and other group cultivation activities within open spaces and consider home cultivation activities within public housing programs and slum upgrading schemes [62]. In UA's recognition as a land use, norms and standards can be established that promote ecologically friendly production methods and short food supply chain associated microenterprises. UA can also be facilitated as part of placemaking, urban greening and urban renewal practices and has the potential to serve as a highly effective community development activity.

UA as a legitimate land use not only means incorporation into land use considerations, but zoning as well. There is potential for UA to be horizontally and vertically integrated. Vertically since UA can be facilitated on roadsides or the sides of buildings, within the

building itself and on rooftops. Horizontally by allowing space-limited forms of UA (such as hydroponics) within denser inner-city areas, and more space consuming UA forms (such as open-field farming and livestock keeping) in less densely populated areas, such as residential neighborhoods or peri-urban areas [120].

The food department can be responsible for coordinating with other urban management departments to facilitate the integration of UA into urban land use and management plans and policies. The department will also then be responsible for mapping sites in the urban environment that could potentially support UA activities. Mubvami and Mushamba [79] suggested that GIS mapping technologies be utilized as far as possible to aid in identifying vacant land. The example from the Rosario case can be used to highlight how the food department can levy additional taxes on idle land and provide tax reductions to those that make their land available for cultivation. The Johannesburg case can also be used to illustrate how potential UA sites should not be restricted to vacant land alone, and unconventional spaces such as rooftops and roadsides should also be considered viable for production.

5.4. Recommendation 4: The Integration of UA into Urban Planning Practice Can Aid in Sustainable Development

The theoretical and empirical investigation highlighted the potential for UA to be facilitated for more than just production purposes. It is thus important to incorporate the multifunctionality of UA into other urban management departments, such as health, parks and open spaces, engineering services, community and economic development. It is important to clearly state what the purpose of the UA initiative being promoted is in order to determine which UA type will be more efficient in achieving this goal. The Rosario case highlighted a strong contribution to ecosystem services and sustainable development since the UA farms were integrated into the wider open space protection program. The Belo Horizonte case had the clear purpose of promoting UA in order to improve the food and nutrition security of low-income citizens, which is why there was a minimal contribution to ecosystem services in this case. The Johannesburg case also had minimal contributions to ecosystem services and sustainable development considering the purpose of the initiative was to generate entrepreneurship amongst the unemployed youth. In the Cape Town case, UA was used as a means of social development, mainly for recreational purposes rather than to improve food security and provide significant employment opportunities.

It is also recognized that UA can aid in encouraging circularity of resource use. It can therefore act as an effective sink for urban organic waste and wastewater, absorbing these problematic urban sources and utilizing it more productively for cultivation. The Cape Town case highlighted how waste absorption activities can be effectively incorporated into neighborhood waste management plans. If these practices could be extended throughout the entire city, pressure on rapidly filling landfills can be alleviated and resource circularity can be promoted. The food department can coordinate with waste management to establish microenterprises that will be responsible for absorbing urban organic waste and making these sources available to urban farmers in the form of organic compost. These microenterprises can supply compost for free to support low income urban farmers in increasing soil fertility and promote more organic cultivation practices. The health and safety risks associated with urban organic waste use should be considered and adequate regulations should be put in place to minimize the risk of contamination. Most of the health concerns for UA can be managed if it is adequately planned for and preventative measures put in place and producers educated on the health aspects associated with UA [123].

In conclusion, the theoretical and empirical evidence collected in this paper more than emphasizes the fact that food security is a planning issue and not addressing this issue adequately will perpetuate the detrimental impacts on food security, the food supply chain and sustainable development. The paper highlighted the detrimental impact on food security due to a lack of adequate planning, and how that impact is further exacerbated by the globalized nature of the food supply chain and a lack of planning intervention in this regard. UA is presented in this paper as a potential method to address the urban risks

arising from the lack of planning for food, and as a tool to shorten supply chains. UA was lastly motivated in terms of ecosystem services and sustainable development to harness the multifunctionality of UA for more than just food production but to address various other urban inefficiencies and problems.

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References

1. UN General Assembly. *Transforming Our World: The 2030 Agenda for Sustainable Development*; A/RES/70/1; UN General Assembly: New York, NY, USA, 2015.
2. FAO; IFAD; UNICEF; EFP; WHO. *The State of Food Security and Nutrition in the World 2020: Transforming Food Systems for Affordable Healthy Diets*; FAO: Rome, Italy, 2020.
3. Arora, N.K. Impact of climate change on agriculture production and its sustainable solutions. *Environ. Sustain.* **2019**, *2*, 95–96. [[CrossRef](#)]
4. FAO. *The State of Food and Agriculture in 2020: Overcoming Water Challenges in Agriculture*; FAO: Rome, Italy, 2020.
5. FAO. *The State of Food and Agriculture: Leveraging Food Systems for Inclusive Rural Transformation*; FAO: Rome, Italy, 2017.
6. Ritchie, H.; Roser, M. Urbanization; Our World in Data. 2019. Available online: <https://ourworldindata.org/urbanization> (accessed on 7 January 2021).
7. Crush, J.; Frayne, B. *The Invisible Crisis: Urban Food Security in Southern Africa*; Unity Press: Cape Town, South Africa, 2010.
8. Thompson, H.E.; Berrang-Ford, L.; Ford, J.D. Climate change and food security in sub-Saharan Africa: A systematic literature review. *Sustainability* **2010**, *2*, 2719–2733. [[CrossRef](#)]
9. Morgan, K. Feeding the city: The challenge of urban food planning. *Int. Plan. Stud.* **2009**, *14*, 341–348. [[CrossRef](#)]
10. Slade, C.; Baldwin, C.; Budge, T. Urban planning roles in responding to food security needs. *J. Agric. Food Syst. Community Dev.* **2016**, *7*, 33–48. [[CrossRef](#)]
11. Siborema, E. The Contribution of Urban Agriculture to Sustainable Development: Potential Role in Improving Food Security and Reducing Poverty. Master's Thesis, Stellenbosch University, Stellenbosch, South Africa, 2019.
12. Cilliers, E.J.; Lategan, L.; Cilliers, S.S.; Stander, K. Reflecting on the potential and limitations of urban agriculture as an urban greening tool in South Africa. *Front. Sustain. Cities* **2020**, *2*, 1–17.
13. Battersby, J.; Maya, M. Growing communities: Integrating the social and economic benefits of urban agriculture in Cape Town. *Urban Forum* **2013**, *24*, 447–461. [[CrossRef](#)]
14. Taguchi, M.; Santini, G. Urban agriculture in the global north & south: A perspective from FAO. *Field Action Sci. Rep.* **2019**, *20*, 12–17.
15. Toth, A.; Rendall, S.; Reitsma, F. Resilient food systems: A qualitative tool for measuring food resilience. *Urban Ecosyst.* **2016**, *19*, 19–43. [[CrossRef](#)]
16. McClintock, N. Why farm the city? Theorizing urban agriculture through the lens of metabolic rift. *Camb. J. Reg. Econ. Soc.* **2010**, *3*, 191–207. [[CrossRef](#)]
17. Martellozzo, F.; Landry, J.S.; Plouffe, D.; Seufert, V.; Rowhani, P.; Ramankutty, N. Urban agriculture: A global analysis of the space constraint to meet urban vegetable demand. *Environ. Res. Lett.* **2014**, *9*, 1–8. [[CrossRef](#)]
18. Sonnino, R. The new geography of food security: Exploring the potential of urban food strategies. *Geogr. J.* **2016**, *182*, 190–200. [[CrossRef](#)]
19. Connolly-Boutin, L.; Smit, B. Climate change, food security, and livelihoods in sub-Saharan Africa. *Reg. Environ. Chang.* **2016**, *16*, 385–399. [[CrossRef](#)]
20. Battersby, J.; Haysom, G. Linking food security, urban food systems, poverty and urbanization. In *Urban Food Systems Governance and Poverty in African Cities*; Battersby, J., Watson, V., Eds.; Routledge: New York, NY, USA, 2019; pp. 56–67.
21. Anderson, M.D.; Cook, J.T. Community food security: Practice in need of theory? *Agric. Hum. Values* **1999**, *16*, 141–150. [[CrossRef](#)]
22. FAO (Food and Agricultural Organisation of the United Nations). *Trade Reforms and Food Security: Conceptualizing the Linkages*; FAO: Rome, Italy, 2003.

23. HLPE (High Level Panel of Experts). *Food Security and Nutrition: Building a Global Narrative towards 2030*; CFS: Rome, Italy, 2020.
24. Crush, J.; Frayne, B. Urban food insecurity and the new international food security agenda. *Dev. S. Afr.* **2011**, *28*, 527–544. [[CrossRef](#)]
25. FAO (Food and Agricultural Organisation of the United Nations). *Rome Declaration in World Food Security*; World Food Summit: Rome, Italy, 1996.
26. Clover, J. Food security in sub-Saharan Africa. *Afr. Secur. Stud.* **2003**, *12*, 5–15. [[CrossRef](#)]
27. CFS (Committee on World Food Security). *Mid-Term Review of Achieving the World Food Summit Target*; CFS: Rome, Italy, 2006.
28. Crush, J.; Riley, L. Rural bias and urban food security. In *Urban Food Systems Governance and Poverty in African Cities*; Battersby, J., Watson, V., Eds.; Routledge: New York, NY, USA, 2019; pp. 42–55.
29. Battersby, J.; Crush, J. The making of urban food deserts. In *Rapid Urbanization, Urban Food Deserts and Food Security in Africa*; Crush, J., Battersby, J., Eds.; Springer: Cham, Switzerland, 2016; pp. 1–18.
30. Warshawsky, D.N. Civil society and the governance of urban food systems in sub-Saharan Africa. *Geogr. Compass* **2016**, *10*, 293–306. [[CrossRef](#)]
31. FAO (Food and Agricultural Organization of the United Nations). *FAO Framework for the Urban Food Agenda: Leveraging Sub-National and Local Government Action to Ensure Sustainable Food Systems and Improved Nutrition*; FAO: Rome, Italy, 2019.
32. Dubbeling, M.; Santini, G.; Renting, H.; Taguchi, M.; Lançon, L.; Zuluaga, J.; De Paoli, L.; Rodriguez, A.; Andino, V. Assessing and planning sustainable city region food systems: Insights from two Latin American cities. *Sustainability* **2017**, *9*, 1455. [[CrossRef](#)]
33. Morgan, K. The rise of urban food planning. *Int. Plan. Stud.* **2013**, *18*, 1–4. [[CrossRef](#)]
34. Castillo, G.E. Livelihoods and the city: An overview of the emergence of agriculture in urban space. *Prog. Dev. Stud.* **2003**, *3*, 339–344. [[CrossRef](#)]
35. Armar-Klemesu, M. Urban agriculture and food security, nutrition and health. In *Growing Cities, Growing Food: Urban Agriculture on the Policy Agenda. A Reader on Urban Agriculture*; Baker, N., Dubbeling, M., Gündel, S., Sabel-Koschella, U., de Zeeuw, H., Eds.; Deutsche Stiftung für Internationale Entwicklung: Feldafing, Germany, 2000; pp. 99–117.
36. Battersby, J.; Peyton, S. The spatial logic of supermarket expansion and food access. In *Rapid Urbanization, Urban Food Deserts and Food Security in Africa*; Crush, J., Battersby, J., Eds.; Springer: Cham, Switzerland, 2016; pp. 33–46.
37. Battersby, J.; Watson, V. Introduction. In *Urban Food Systems Governance and Poverty in African Cities*; Battersby, J., Watson, V., Eds.; Routledge: New York, NY, USA, 2019; pp. 1–26.
38. SACN (South African Cities Network). *A Study on Current and Future Realities for Urban Food Security in South Africa*; SACN: Braamfontein, South Africa, 2015.
39. Capelli, A.; Cini, E. Will the COVID-19 pandemic make us reconsider the relevance of short supply chains and local production? *Trends Food Sci. Technol.* **2020**, *99*, 566–567. [[CrossRef](#)]
40. Ringler, C.; Zhu, T.; Cai, X.; Koo, J.; Wang, D. *Climate Change Impacts on Food Security in Sub-Saharan Africa: Insights from Comprehensive Climate Change Scenarios*; International Food Policy Research Institute: Washington, DC, USA, 2015.
41. Godfray, H.C.J.; Beddington, J.R.; Crute, I.R.; Haddad, L.; Lawrence, D.; Muir, J.F.; Pretty, J.; Robinson, S.; Thomas, S.M.; Toulmin, C. Food security: The challenge of feeding 9 billion people. *Science* **2010**, *327*, 812–818. [[CrossRef](#)] [[PubMed](#)]
42. Sen, A. *Poverty and Famines: An Essay on Entitlement and Deprivation*; Oxford University Press: Oxford, London, 1982.
43. FAO (Food and Agricultural Organisation of the United Nations). *Climate-Smart Agriculture Resource Book*; FAO: Rome, Italy, 2013.
44. Gold, S.; Kunz, N.; Reiner, G. Sustainable global agrifood supply chains. *J. Ind. Ecol.* **2016**, *21*, 249–260. [[CrossRef](#)]
45. Aiello, G.; Giovino, I.; Vallone, M.; Catania, P. A multi objective approach to short food supply chain management. *Chem. Eng. Trans.* **2017**, *58*, 313–318.
46. Edame, G.E.; Ekpenyong, A.B.; Fonta, W.M.; Duru, E.J.C. Climate change, food security and agriculture productivity in Africa: Issues and policy directions. *Int. J. Humanit. Soc. Sci.* **2011**, *1*, 205–223.
47. Balaji, M.; Arshinder, K. Modelling the causes of food waste in Indian perishable food supply chains. *Resour. Conserv. Recycl.* **2016**, *114*, 153–167.
48. Biel, R. *Sustainable Food Systems: The Role of the City*; UCL Press: London, UK, 2016.
49. Chappell, M.; LaValle, L.A. Food security and biodiversity: Can we have both? An agroecological analysis. *Agric. Hum. Values* **2011**, *28*, 3–26. [[CrossRef](#)]
50. FAO (Food and Agricultural Organisation of the United Nations). *The 10 Elements of Agroecology: Guiding the Transition to Sustainable Food and Agricultural Systems*; FAO: Rome, Italy, 2018.
51. Ye, L.; Xiong, W.; Li, Z.; Yang, P.; Wu, W.; Yang, G.; Fu, Y.; Zou, J.; Chen, Z.; Van Ranst, E.; et al. Climate change impact on China food security in 2050. *Agron. Sustain. Dev.* **2013**, *33*, 363–374. [[CrossRef](#)]
52. Mogensen, L.; Hermansen, J.E.; Halberg, N.; Dalgaard, R. Life cycle assessment across the food supply chain. In *Sustainability in the Food Industry*; Baldwin, C.J., Ed.; Wiley-Blackwell: Hoboken, NJ, USA, 2009.
53. Kummu, M.; de Moel, H.; Porkka, M.; Siebert, S.; Varis, O.; Ward, P.J. Lost food, waste resources: Global food supply chain losses and their impacts on fresh water, cropland, and fertilizer use. *Sci. Total Environ.* **2012**, *438*, 477–489. [[CrossRef](#)]
54. HLPE (High Level Panel of Experts). *Food Losses and Waste in the Context of Sustainable Food Systems*; CFS: Rome, Italy, 2014.
55. Dani, S. *Food Supply Chain Management and Logistics: From Farm to Fork*; Kogan Page Limited: London, UK, 2015.
56. Juhola, S.; Neset, T.S. Vulnerability to climate change in food systems: Challenges in assessment methodologies. In *Climate Change Adaptation and Food Supply Chain Management*; Palovitta, A., Järvelä, M., Eds.; Routledge: New York, NY, USA, 2016.

57. Benis, K.; Ferrão, P. Potential mitigation of the environment impacts of food systems through urban and peri-urban agriculture (UPA)—A life cycle assessment approach. *J. Clean. Prod.* **2017**, *140*, 784–795. [[CrossRef](#)]
58. HLPE (High Level Panel of Experts). *Nutrition and Food Systems*; CFS: Rome, Italy, 2017.
59. Wiskerke, J.S.C. Urban food systems. In *Cities and Agriculture: Developing Resilient Urban Food Systems*; de Zeeuw, H., Drechsel, P., Eds.; Routledge: London, UK, 2015; pp. 1–25.
60. Lin, B.B.; Egerer, M.H. Urban agriculture: An opportunity for biodiversity and food production in urban landscapes. In *Urban Biodiversity*; Ossola, A., Niemelä, J., Eds.; Routledge: New York, NY, USA, 2018; pp. 71–86.
61. Rezai, G.; Shamsudin, M.N.; Mohamed, Z. Urban agriculture: A way forward to food and nutrition security in Malaysia. *Procedia Soc. Behav. Sci.* **2016**, *216*, 39–45. [[CrossRef](#)]
62. Van Veenhuizen, R. (Ed.) *Cities Farming for the Future: Urban Agriculture for Green and Productive Cities*; International Institute of Rural Reconstruction and ETC Urban Agriculture: Silang, Philippines, 2006; pp. 2–7.
63. Rabkin, N.N. Food for the Future: Planning for Urban Agriculture in Cape Town’s City Bowl. Master’s Thesis, University of Cape Town, Cape Town, South Africa, 2013.
64. Weidner, T.; Yang, A.; Hamm, M.W. Consolidating the current knowledge on urban agriculture in productive urban food systems: Learning, gaps and outlook. *J. Clean. Prod.* **2019**, *209*, 1637–1655. [[CrossRef](#)]
65. Krikster, T.; Piore, A.; Berges, R.; Opitz, I. Urban agriculture oriented towards self-supply, social and commercial purposes: A typology. *Land* **2016**, *5*, 28. [[CrossRef](#)]
66. De Anda, J.; Shear, H. Potential of vertical hydroponic agriculture in Mexico. *Sustainability* **2017**, *9*, 140. [[CrossRef](#)]
67. Stander, K. Considering Sustainable Urban Agriculture as Spatial Planning Instrument: A South African Framework. Master’s Thesis, North-West University, Potchefstroom, South Africa, 2018.
68. Perkins, E. Public policy and the transition to locally based food networks. In *For Hunger-Proof Cities: Sustainable Urban Food Systems*; Koc, M., MacRae, R., Mougeot, L.J.A., Welsh, J., Eds.; International Development Research Centre: Ottawa, ON, Canada, 2000; pp. 60–63.
69. Charatsari, C.; Kitsios, F.; Stafyla, A.; Adonis, D.; Lioutas, E. Antecedents of farmers’ willingness to participate in short food supply chains. *Br. Food J.* **2018**, *120*, 2317–2333. [[CrossRef](#)]
70. Moustier, P.; Renting, H. Urban agriculture and short supply chain food marketing in developing countries. In *Cities and Agriculture: Developing Resilient Urban Food Systems*; de Zeeuw, H., Drechsel, P., Eds.; Routledge: London, UK, 2015; pp. 121–138.
71. Joubert, L. *The Food Dialogues Report*; Oranjezicht City Farm & Cape Town Partnership: Cape Town, South Africa, 2014.
72. Clinton, N.; Stuhlmacher, M.; Miles, A.; Aragon, N.U.; Wagner, M.; Georgescu, M.; Herwig, C.; Gong, P. A global geospatial ecosystem service estimate of urban agriculture. *Earths Future* **2018**, *6*, 40–60. [[CrossRef](#)]
73. Cilliers, J.; Cilliers, S. *Green Infrastructure: Options for South African Cities*; South African Cities Network: Johannesburg, South Africa, 2016.
74. Goldstein, B.; Hauschild, M.; Fernández, J.; Birkved, M. Urban versus conventional agriculture, taxonomy of resource profiles: A review. *Agron. Sustain. Dev.* **2016**, *36*, 9–27. [[CrossRef](#)]
75. Cofie, O.; Adam-Bradford, A.; Drechsel, P. Recycling of urban organic waste for urban agriculture. In *Cities Farming for the Future: Urban Agriculture for Green and Productive Cities*; van Veenhuizen, R., Ed.; International Institute of Rural Reconstruction and ETC Urban Agriculture: Silang, Philippines, 2006; pp. 210–229.
76. Lwasa, S.; Dubbeling, M. Urban agriculture and climate change. In *Cities and Agriculture: Developing Resilient Urban Food Systems*; de Zeeuw, H., Drechsel, P., Eds.; Routledge: London, UK, 2015; pp. 192–217.
77. Van Tuijl, E.; Hospers, G.J.; van den Berg, L. Opportunities and challenges of urban agriculture for sustainable city development. *Eur. Spat. Res. Policy* **2018**, *25*, 5–22. [[CrossRef](#)]
78. Viljoen, A.; Schlesinger, J.; Bohn, K.; Drescher, A. Agriculture in urban design and spatial planning. In *Cities and Agriculture: Developing Resilient Urban Food Systems*; de Zeeuw, H., Drechsel, P., Eds.; Routledge: London, UK, 2015; pp. 88–120.
79. Mubvami, T.; Mushamba, S. Integration of agriculture into urban land use planning. In *Cities Farming for the Future: Urban Agriculture for Green and Productive Cities*; van Veenhuizen, R., Ed.; International Institute of Rural Reconstruction and ETC Urban Agriculture: Silang, Philippines, 2006; pp. 54–74.
80. Olivier, D.W. Urban agriculture promotes sustainable livelihoods in Cape Town. *Dev. S. Afr.* **2018**, *36*, 17–32. [[CrossRef](#)]
81. Bryld, E. Potentials, problems and policy implications for urban agriculture in developing countries. *Agric. Hum. Values* **2003**, *20*, 79–86. [[CrossRef](#)]
82. The Economics of Ecosystems & Biodiversity. *TEEB Manual for Cities: Ecosystem Services in Urban Management*; TEEB: Geneva, Switzerland, 2010.
83. Lin, B.B.; Philpott, S.M.; Jha, S. The future of urban agriculture and biodiversity-ecosystem services: Challenges and next steps. *Basic Appl. Ecol.* **2015**, *16*, 189–201. [[CrossRef](#)]
84. Lapan, S.D.; Quartaroli, M.T.; Reimer, F.J. Introduction to qualitative research. In *Qualitative Research: An Introduction to Methods and Design*; Lapan, S.D., Quartaroli, M.T., Reimer, F.J., Eds.; Jossey-Bass: San Francisco, CA, USA, 2012; pp. 3–18.
85. Chawla, D.; Sondhi, N. *Research Methodology: Concepts and Cases*, 2nd ed.; Vikas Publishing House Pvt Ltd.: New Delhi, India, 2015.
86. Fouché, C.B. Qualitative research designs. In *Research at Grass Roots: For the Social Sciences and Human Service Profession*, 3rd ed.; de Vos, A.S., Strydom, H., Fouché, C.B., Delpont, C.S.L., Eds.; Van Schaik Publishers: Pretoria, South Africa, 2005; pp. 267–273.

87. AAPS (Association of African Planning Schools). *Guidelines for Case Study Research and Teaching*; MegaDigital: Cape Town, South Africa, 2010.
88. Moore, T.S.; Lapan, S.D.; Quartaroli, M.T. *Qualitative Research: An Introduction to Methods and Design*; Lapan, S.D., Quartaroli, M.T., Reimer, F.J., Eds.; Jossey-Bass: San Francisco, CA, USA, 2012; pp. 243–270.
89. Swanborn, P.G. *Case Study Research: What, Why and How?* SAGE Publication Ltd.: London, UK, 2010.
90. Yin, R.K. *Case Study Research: Design and Methods*, 5th ed.; SAGE Publications Inc.: Thousand Oaks, CA, USA, 2016.
91. Strydom, H.; Delpont, C.S.L. Sampling and pilot study in qualitative research. In *Research at Grass Roots: For the Social Sciences and Human Service Profession*, 3rd ed.; de Vos, A.S., Strydom, H., Fouché, C.B., Delpont, C.S.L., Eds.; Van Schaik Publishers: Pretoria, South Africa, 2005; pp. 327–332.
92. Schensul, J.J. Methodology, methods, and tools in qualitative research. In *Qualitative Research: An Introduction to Methods and Design*; Lapan, S.D., Quartaroli, M.T., Reimer, F.J., Eds.; Jossey-Bass: San Francisco, CA, USA, 2012; pp. 69–103.
93. Piacentini, R.D.; Bracalenti, L.; Salum, G.; Zimmerman, E.; Lattuca, A.; Terrile, R.; Bartolomé, S.; Vega, M.; Tosello, L.; Di Leo, N.; et al. Monitoring the climate change impacts of green agriculture in Rosario, Argentina. *Urban Agric. Mag.* **2014**, *27*, 50–53.
94. Guénette, L. *A City Hooked on Urban Farming*; IDRC: Ottawa, ON, Canada, 2006.
95. Roitman, S.; Bifarello, M. *Urban Agriculture and Social Inclusion in Rosario, Argentina*; Inclusive Cities Observatory: London, UK, 2007.
96. Baker, L.; de Zeeuw, H. Urban food policies and programmes. In *Cities and Agriculture: Developing Resilient Urban Food Systems*; de Zeeuw, H., Drechsel, P., Eds.; Routledge: London, UK, 2015; pp. 26–55.
97. Dubbeling, M. Optimisation of the use of vacant land in Rosario. In *Cities Farming for the Future: Urban Agriculture for Green and Productive Cities*; van Veenhuizen, R., Ed.; International Institute of Rural Reconstruction and ETC Urban Agriculture: Silang, Philippines, 2006; pp. 44–46.
98. Ponce, M.; Terrile, R. An analysis of markets in Rosario, Argentina. *Urban Agric. Mag.* **2010**, *24*, 55–57.
99. FAO (Food and Agricultural Organization of the United Nations). *Growing Greener Cities in Latin America and the Caribbean*; FAO: Rome, Italy, 2014.
100. Lattuca, A. Social transformation through urban agroecology in Argentina. *Farming Matters* **2018**, *34*, 40–43.
101. Hawkes, C.; Halliday, J. *What Makes Urban Food Policy Happen? Insights from Five Case Studies*; International Panel of Experts on Sustainable Food Systems: Brussels, Belgium, 2017.
102. Future Policy. Belo Horizonte Food Security Policy; 2020. Available online: <https://www.futurepolicy.org/food-and-water/belo-horizontes-food-security-policy/> (accessed on 19 August 2020).
103. Göpel, M. *Celebrating Belo Horizonte Food Security Programme*; World Future Council: Brussels, Belgium, 2009.
104. Gerster-Bentaya, M.; Rocha, C.; Barth, A. The food security system of Belo Horizonte—A model for Cape Town? Available online: https://www.worldfuturecouncil.org/wp-content/uploads/2016/01/2009_Feasibility_Study_Cape_Town.pdf (accessed on 18 August 2020).
105. Rocha, C.; Lassa, I. Urban governance for food security: The alternative food system in Belo Horizonte, Brazil. *Int. Plan. Stud.* **2010**, *14*, 389–400. [CrossRef]
106. Chappell, M.J. Beginning to end hunger: Food and the environment in Belo Horizonte, Brazil and beyond. *Hum. Ecol. Rev.* **2018**, *24*, 195–198.
107. Delgado, C. Integrating food distribution and food accessibility into municipal planning: Achievements and challenges of a Brazilian metropolis, Belo Horizonte. In *Integrating Food into Urban Planning*; Cabannes, Y., Marocchino, C., Eds.; UCL Press: London, UK, 2018; pp. 209–228.
108. JICP (Johannesburg Inner City Partnership). *Urban Agriculture Initiative*. 2017. Available online: [https://www.jicp.org.za/urban-agriculture-initiative/#:~:text=The%20Urban%20Agriculture%20Initiative%20\(UAI\)%20has%20been%20developed%20by%20the,in%20job%20creation%20for%20entrepreneurs](https://www.jicp.org.za/urban-agriculture-initiative/#:~:text=The%20Urban%20Agriculture%20Initiative%20(UAI)%20has%20been%20developed%20by%20the,in%20job%20creation%20for%20entrepreneurs) (accessed on 16 August 2020).
109. Janneker, A. *Urban Farming Project Hola Harvest Launched in Joburg*. 2018. Available online: <https://www.bizcommunity.com/Article/196/780/184010.html> (accessed on 13 August 2020).
110. Davie, L. *Farms in the Sky over Joburg*. 2018. Available online: <https://www.jicp.org.za/urban-agriculture-initiative/> (accessed on 13 August 2020).
111. Mineral Council South Africa. *The Urban Agriculture Initiative Fact Sheet*. 2018. Available online: <https://www.mineralscouncil.org.za/industry-news/publications/fact-sheets/send/3-fact-sheets/748-the-urban-agriculture-initiative> (accessed on 13 August 2020).
112. Lazareva, I. *Johannesburg's New "Agripreneurs" Dig for Gold on Skyscraper Rooftops*. 2017. Available online: <https://news.trust.org/item/2017120170852-tcvbl/> (accessed on 13 August 2020).
113. Magondo, M. *Urban Agriculture Initiative*. Talk presented at the fourth Inner City Partnership Forum held on 27 June 2018. 2018. Available online: <https://drive.google.com/open?id=1XvfcBpCBFVeBnkK0kjz9P67p4kInm1GA> (accessed on 13 August 2020).
114. Preyser, J.D. *Johannesburg's Rooftop Farmer*. [Video]. *BBC News*. 2018. Available online: <https://www.bbc.com/news/av/business-44005335> (accessed on 13 August 2020).
115. De Villiers, S. *True Food: An Exploratory Study if Organic Consumers in Cape Town*. Bachelor's Thesis, Vega School of Brand Leadership, Cape Town, South Africa, 2015.

116. Ozinsky, S.; Ackermann, K. *OZCF Annual Review of the City of Cape Town: Oranjezicht City Farm Year Two*. Oranjezicht City Farm. 2014. Available online: <https://www.ozcf.co.za/wp-content/uploads/2014/12/OZCF-Annual-Report-to-CCT-2014.pdf> (accessed on 10 June 2020).
117. Pieters, F. *Fertile Ground: Enhancing Local Food Production in Delft, South Africa*. Master's Thesis, University of Cape Town, Cape Town, South Africa, 2016.
118. Green Cape. *Oranjezicht City Farm and Market: Building Resilient Urban Communities through Circular Food Systems*. 2020. Available online: <https://www.greencape.co.za/content/building-resilient-urban-communities-through-circular-food-systems/> (accessed on 10 June 2020).
119. OZCF (Oranjezicht City Farm). *Oranjezicht City Farm*. 2020. Available online: <https://ozcf.co.za/> (accessed on 10 June 2020).
120. Dubbeling, M.; Merzthal, G. Sustaining urban agriculture requires the involvement of multi stakeholders. In *Cities Farming for the Future: Urban Agriculture for Green and Productive Cities*; van Veenhuizen, R., Ed.; International Institute of Rural Reconstruction and ETC Urban Agriculture: Silang, Philippines, 2006; pp. 20–40.
121. SACPLAN (South African Council for Planners). *Guidelines for Competencies and Standards for Curricula Development*; SACPLAN: Midrand, South Africa, 2014.
122. De Zeeuw, H.; Dubbeling, M. Process and tools for multi-stakeholder planning of the urban agro-food system. In *Cities and Agriculture: Developing Resilient Urban Food Systems*; de Zeeuw, H., Drechsel, P., Eds.; Routledge: London, UK, 2015; pp. 56–87.
123. Gerster-Bentaya, M. Urban agriculture's contributions to urban food security and nutrition. In *Cities and agriculture: Developing Resilient Urban Food Systems*; de Zeeuw, H., Drechsel, P., Eds.; Routledge: London, UK, 2015; pp. 139–161.