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How Urban Growth in the Global South Affects Agricultural Dynamics and Food Systems Outcomes in Rural Areas: A Review and Research Agenda

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Abstract: The urbanisation in the Global South provides opportunities for improved rural livelihoods in the vicinity of cities, but these opportunities do not automatically occur. The literature shows that urban expansion leads to more intensive land use around cities and a shift of production towards high-value products. However, competition for land around growing cities can lead to increasing socioeconomic vulnerability in affected areas, particularly for those who have no or weak land ownership or tenancy rights. Urban expansion can also have negative ecological consequences such as the extinction of wetlands and deforestation. In the current literature, there are very few studies to be found that comprehensively and simultaneously analyse the effects of growing cities on food security, equity, and the ecological impacts on food systems in rural areas. To better map and understand the consequences of urban growth for agricultural dynamics, rural livelihoods, and the environment, a three-track research agenda is proposed: comparative field studies that analyse farmers' decision-making processes under increased competition for factors of production due to urban sprawl; the role of urban–rural connectivity, city size, and urbanisation patterns in agricultural dynamics around the city; and studies that analyse the socioeconomic and environmental effects of urban sprawl on agricultural development opportunities around cities.

Keywords: urbanisation; rural livelihood; land use; water; migration; food system; rural–urban linkages

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1. Introduction

The urban population in the Global South has grown from 1 billion city residents in 1980 to 3.4 billion in 2020, and is expected to reach 5.5 billion in 2050, which means that 7 out 10 people will live in the city [1]. Urbanisation has strong impacts on food systems as diets in urbanised areas are shaped by changing lifestyles and higher income levels [2]. Urbanisation provides opportunities for improved rural livelihoods in the vicinity of cities, favourably affecting farmers' access to markets, information, off-farm employment, utilities, inputs, and services [3,4]. However, these opportunities do not automatically occur, especially for farmers who are not part of modern supply chains in which efficiency, quality, diversity, and food safety are important factors to compete on [5–9]. Urban expansion also means an increasing competition for land, water, labour, and other production factors important for agriculture, which can have potentially major socioeconomic consequences, especially where land use is based on informal agreements and small farmers lack the resources to make business investments to anticipate increasing competition [10]. This begs the question of under what conditions urban food system dynamics will contribute to more inclusive and sustainable rural development in regions around growing cities.

Many of the theoretical notions explaining the relationship between urban sprawl and the agricultural use of inputs in the rural area surrounding a growing city stem from location theory and the concept of opportunity costs. Urbanisation is generally associated with increasing opportunity costs of agricultural land, with urban development as an

alternative use of agricultural land. This results in higher land rents around cities than in areas at further distance, with land rents and transportation costs determining crop location and the intensity of production around cities [11]. The expectation is that farmers around cities turn to high(er) value crops, and extensive farming shifts to more remote areas. While the original production location theory, based on von Thünen's ideas, assumes a ring pattern of agricultural commodity production around growing cities, more recent theories argue that this spatial continuity of land use changes becomes more nuanced when the structure of an urban system (in small, medium, or large cities) is taken into account [12–14]. Moreover, urbanisation is associated with improved off-farm labour opportunities, triggering rural–urban migration and what is expected to affect labour relations and the scale and intensity of production in agriculture around cities [13,15]. However, the nature of peri-urban land use change is also characterised by conflicts defined by power and resource discrepancies between those competing for entitlements to land [16–19]. In this line of thought, the nature and often the lack of (democratic) institutions and alternative income opportunities for the original users of the land under dispute are important factors that determine land use changes in conflict situations. Due to all of these different factors influencing land use around growing cities, it is challenging to obtain a clear understanding of the effect of urban expansion on agricultural development around the city.

This article examines the challenges and opportunities that urban expansion in developing countries and emerging economies creates for rural development by exploring the impacts of increasing competition for land, water, labour, and other production factors important for agricultural development in cities' hinterland. The article concludes with key findings from the literature and suggestions for further research to fill the identified knowledge and data gaps.

2. Method, Research Questions, and Approach

The study reviews scientific literature analysing empirically the relationship between urban and local agricultural development, with a particular focus on how local agricultural livelihoods respond to an increasing competition of resources due to city expansion. A literature search in the ScienceDirect and Scopus databases using the keywords '(Urbanisation OR Urbanization)', '(food system OR food systems)', '(rural livelihood OR rural livelihoods)', and '(developing countries OR global south') gave 787 relevant publications (journal/research articles and book chapters), published since 2015 in open access mode. Following a scan of the abstracts, the selection of articles was narrowed to those in which the impacts of urban growth on agricultural livelihoods in rural areas around cities were addressed explicitly. This led to the selection of 103 articles that were studied in more detail. Empirical evidence was sought to answer the following two sets of questions, one focusing on the impacts of urban expansion on land use changes and the second on the multidimensional linkages between resources:

1. How does urban sprawl affect agricultural land use patterns and the scale of production around cities? Does urban sprawl land conversion in the vicinity of cities lead to more intensive land use (e.g., increased use of chemical inputs), and is less productive agriculture driven to more distant areas? What are the rural socioeconomic (distributional) and environmental effects of land use changes as a result of urban expansion?
2. Given that agricultural production not only depends on land, but also on inputs such as water and labour, what are the consequences of growing competition for inputs other than land for agricultural production patterns around cities? Do local farmers and others in the local economy benefit from inputs that can flow from the city to the countryside, such as knowledge, organic waste, and capital (in the form of remittances)?

This study investigates the impacts of urban sprawl on food system outcomes in rural areas by exploring the interaction between urban sprawl, agricultural resource uses, agricultural production, and food system outcomes in rural areas in developing countries.

In this article, rural areas also include peri-urban areas that can be described as "peripheral areas of cities or adjacent rural areas, with a strong connection to the urban economy and characterized by a mix of rural and urban activities" [20]. Although there is no consensus on the definition of peri-urban agriculture, the term is often used in literature investigating impacts of the growth of cities on food security and ecological or social values, depending on the context [21]. In this article, the term peri-urban is only used to emphasise very explicitly that it mainly concerns the area close to the city.

Figure 1 illustrates the interactions between these important components of analysis. In particular, it reveals the interactions between urban expansion, agricultural resource use, rural livelihoods opportunities through agricultural production or other economic activities, and the socioeconomic, environmental, and food and nutrition security impacts in rural areas. These interactions can be described as follows: high urban expansion causes changes that affect the competitive use of natural resources in the vicinity of the city. Consequently, food system actors adapt or transform agricultural production, reorganising their activities in response to the pressures of urban sprawl. The outcomes of this transformative process are reflected in the ability of rural food system actors—that is, those working in primary agriculture (farmers, agricultural workers) and those earning their livelihoods outside primary agriculture (food traders, processors, and input suppliers)—to take advantage of the changing food needs of the expanding nearby city, and to adapt to and/or mitigate the environmental impacts associated with urban sprawl and agricultural intensification. Agricultural transformation as a result of urban expansion also changes the activities of the food value chain, creating employment both within and outside of the food value chain, thereby contributing to rural livelihoods in rural areas. To the extent that these aspects are taken into account in the literature, such broader impacts of urban expansion on rural livelihood opportunities are included in this review.

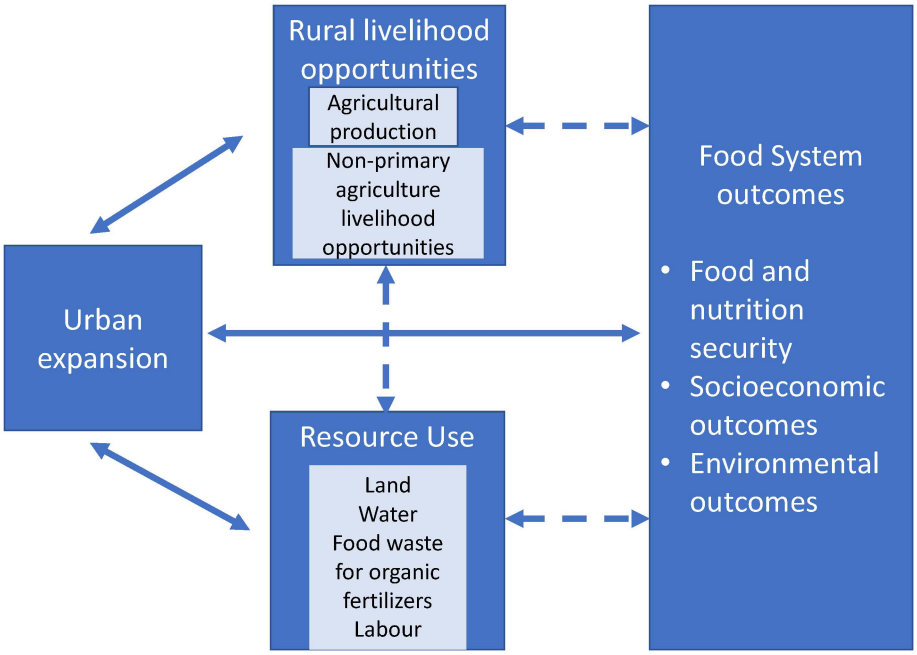

Figure 1. Conceptualisation of interactions between urbanisation, selected food system components (urban expansion, resource use, and rural livelihood opportunities), and food system outcomes (adapted from [22]).

A typical feature of urban–rural relations is that there are reciprocal influences: urban sprawl influences rural livelihoods, and conversely, rural livelihood opportunities affect urban sprawl (e.g., through migration). In Figure 1, this is expressed by the two-way arrows. This study focuses on the consequences of urban expansion for rural actors in the

food system and therefore mainly focuses on one direction, namely, how urban sprawl affects rural livelihood opportunities.

In this study, I focus on the interaction between the urban expansion process and agricultural production in the surrounding region. With this, I acknowledge that I only study a small part of the activities in the food system. After all, a food system can be seen as a chain of activities in a certain geographic region connecting food production, distribution, processing, consumption, and waste management, which is located in a broad biophysical and socioeconomic institutional context. I will not explicitly go into that context (the so-called drivers, such as social, political, cultural, technological, economic, and natural environments). Within these boundaries of my system definition, the analysis focuses as much as possible on the interactions between urban expansion, land use and the use of other resources in the agricultural sector, and agricultural production. For a comprehensive conceptual description of the food system, see, for instance, [23,24].

The structure of the report is as follows. Section 3 addresses the first question on the impact of urban expansion and rural–urban migration on land use patterns, farming structures, and distributional and environmental effects in rural areas. Section 4 addresses the second and third question, and focuses on competing claims on other inputs than land and the potential benefits of inputs that may flow from urban to rural areas. Section 5 presents the major findings and three suggested tracks for further research.

3. How Urbanisation Affects Land Use Patterns and Intensity and Impacts Food System Outcomes

3.1. Changes in Land Use Patterns Due to Urbanisation

As cities grow, the pressure on using the surrounding land for housing increases. This land is mostly used by farmers. A first consequence is that the price of land increases. This assumption follows the long-standing von Thünen model of agricultural land use developed in 1826; this model was an attempt to answer the problem of balancing the cost of land rent with the most effective crops to grow around a city. Land rents are at their highest near a city, resulting in (mostly) intensive farming closest to a city and extensive farming and grazing in more remote areas. In general, the model explains the variation in a region's land rent and market activity around cities, and establishes the relationship between the profitability of agricultural production and the distance from markets (see [16] for a contemporary conceptual application of von Thünen's model). Studies examining the interaction between urbanisation and land use for food production in the areas around cities indicate the evolution of two dominant land use patterns [10,22,25]. On the one hand, a shift of more extensive food production to more distant areas can be seen. On the other hand, urban and peri-urban agriculture takes on a greater role with more intensive land use features, such as higher agricultural input use per hectare and/or unit of output. How urban expansion affects food and nutrition security, as well as socioeconomic and environmental outcomes of the food system is highly dependent on the local context [10,22,26,27].

A typical illustration of the literature assessing the impacts of urban sprawl on agricultural land use comes from [28], showing that four decades of rapid urbanisation has led to a large-scale loss of farmland and increased land fragmentation in the Jabodetabek Metropolitan Area in Indonesia (encompassing Jakarta and its surrounding region, covering a total area of 6256 km^2 with a population of 28 million in 2010). Consequently, the peri-urban farming of horticultural crops has particularly emerged as the most robust agricultural activity around urbanised areas because it requires small patches of land close to urban areas on which farmers can earn reasonable incomes. However, non-irrigated paddy and food crops and livestock farming had to shift to places further away from urbanised areas. The study also shows that the loss of agricultural land was lower than the increase in urban land areas, as much of the built-up farmland was replaced by the development of new agricultural areas within the region through deforestation, which in turn causes environmental problems.

Studies on the impacts of urban sprawl see changes in land use and land cover (LULC) as their direct consequence, with the latter being considered in the literature as an uncontrolled process due to generally little attention and institutional capacity for urban planning, despite the strong migratory flow to urban areas in many LMICs [22]. Consequently, LULC changes are seen as an unavoidable consequence of urban development and growth, a process in which population growth is interrelated with land use and land loss pressures, and agricultural intensification processes. At the same time, the growth of cities has actuated the emergence of urban and peri-urban agriculture, which seems primarily driven by an increase in migration from rural to urban areas and the lack of sufficient employment for the urban population that causes city residents to grow their own food. The contribution of these different forms of agriculture—from urban home subsistence to entrepreneurial farming—to food and nutrition security is discussed as being limited. Yet, the literature also points out that this phenomenon is understudied—partly because of its informal and, in some cases, explicitly illegal status—and its potential in terms of food and nutrition security is not well understood [29–31].

The studies mentioned above argue in favour of peri-urban agriculture to be adequately integrated into the planning and management of the urban system (see [32] for a discussion of the requirements for an effective peri-urban land use management framework tested in Ethiopia). As a synthesis result of their review, Ref. [22] highlights the importance of continuous monitoring of the urbanisation process and analysing the impact of urbanisation on agricultural land use change, as more knowledge about what urban expansion growth implies for the capability of rural areas to feed the city and how it affects rural livelihoods will contribute to sustainable development in urbanising regions.

Based on the available literature, it can be concluded that urban growth in the Global South generally implies that farmland is being converted into built-up areas, with agriculture around cities developing into more intensive land use systems, while crops with lower yields are shifting to areas further away from the city. However, the impacts of land use changes caused by urbanisation on food and nutrition security is little researched.

3.2. Socioeconomic and Environmental Impacts of Land Use Changes near Cities

Land use changes in peri-urban areas triggered by urban expansion cause and, in many cases, increase socioeconomic vulnerability. An example from Ghana shows how rapid urban expansion had quite significant negative consequences for rural livelihoods, particularly for those who used the land that was converted for residential use, but were not the owner of the land (see Box 1).

Box 1. How urban expansion on shared natural resources impacted livelihoods in peri-urban areas in the Wa municipality of north-western Ghana ([18], see also [19]).

The study describes a rapid urbanisation process in north-west Ghana, showing how four sites have changed from being self-standing villages to being an amalgam of the city of Wa as peri-urban areas. Rapid urban expansion is the main driver of the depletion of shea trees in a region in which two-third of the respondents ranked income from the sale of shea products such as shea nut, butter, and the charcoal/fuel wood trade as very important. Shea trees were cleared to make way for sand/stone mining and residential housing. The lumbering of shea trees for charcoal making and fuelwood to meet urban energy demands, the breakdown of traditional customary laws on land ownership and tenure rights over land and access to shea trees, and the non-existence of land use plans in these areas are further factors behind the depletion of shea trees. The study concludes that the peri-urbanisation of Wa and its rural surroundings is not producing the desired transformations in livelihood, but rather poses an enormous challenge for the use and management of shea trees for the population whose livelihoods depend on them, but are not owners of the land covered with shea trees. Besides these socioeconomic consequences, the respondents noted that weather changes impacted the shea trees, as the periods between rainfall and drought had become increasingly erratic and unpredictable over the last three decades, which has negative implications on the growth and fruiting of the shea trees and reduces fruit production.

The conversion of farmland around cities into built-up areas, which follows high urban development pressures, is associated with dynamic changes in land use that can lead to rising land values and land conflict ([33,34] for an example in Ethiopia; [35] for an example in Ghana). Particularly where informal arrangements to use land for agricultural

purposes dominate in urban and suburban areas, urban expansion can have a major impact on smallholder farmers who are particularly vulnerable when land pressure increases and land claims are contested (see Box 2 for an example). Ref. [10] highlights the co-occurrence of the replacement, expansion, and intensification of agricultural land when cities expand. This underlines the complexity of the urban growth-related effects on (peri-)urban agriculture. Where in some cases, the city expansion is an impetus to intensify and commercialise production (e.g., in horticulture), subsistence and informal producers may be forced to stop their agricultural activities or to continue them on land further away from the city.(Reporting on Kampala (Uganda), for example, ([36], p. 46) indicates that "urban sprawl on the one hand is expected to have negative consequences for subsistence farmers that are expected to lose up to 80% of their land, while the space for garden and commercial farming activities would even increase with almost 40% by 2030" (cited in [10]). Factors that play a role in farmers' decision making regarding how to respond to increasing land pressures relate to individual resources and local conditions, including, among others, land tenure status/land ownership rights, family composition, personal motivations (e.g., the need for cash to pay urgent costs or the option to move to a different economic activity), and cultural traditions [10,33]. Understanding farmers' decision-making processes is key for a better understanding of land use dynamics in urbanising areas.

Box 2. How urban expansion poses risks to land tenure security using an example from Botswana (based on [17]).

Gabarone, the capital of Botswana, is expanding. On the outskirts of the city, the land is communally owned, or used by individuals under the freehold municipal tenure system. The communal land is mainly used by livestock keepers for subsistence in addition to forestry (wood for energy) and arable farming activities. The village of Gabana—in the 1970s, still more than 15 km away from the capital—turned into being part of the city. Urban sprawl has mainly taken place on communal land, where user rights could be relatively easily overruled by private investors' interests, but also created many tensions and conflicts between land users on the one hand and government/city authorities and urban sprawl investors on the other regarding land claims. Over the last fifty years, much of the livestock farming and arable land use in the region around the village have disappeared and biodiversity has been lost for the benefit of building residences and industries.

An important driver of spatial expansion and agricultural intensification is the increasing and changing demand for food. However, these processes may have ecological consequences, as the spatial expansion of the city, agricultural intensification in peri-urban areas, and a shift of extensive agricultural activities further away from urban centres may occur at the expense of ecologically sensitive areas, such as forests (e.g., [28]) or wetlands (e.g., [37]). Illustrative in this context is [38] on the expansion of Kumasi, the second largest city in Ghana. The findings indicate the increasing depletion and gradual extinction of wetlands in and around Kumasi due to the conversion of wetlands into residential areas and other uses such as infrastructure. Fundamentally, alterations in the use of wetlands have led to increased floods in the city. In addition, the loss of agricultural land and intensification are often linked. An example from Burkina Faso shows that farmers in Bobo-Dioulasso "commonly attempt to intensify their farming activities as a compensation for the loss of food-growing fields," especially if they receive compensation money to invest and own "non-buildable" land with access to water resources. Similar investments in livestock are mainly made by wealthier urban (non-)farming dwellers in order to "supplement their income or prepare for their retirement" ([39], cited in [10]).

The existing literature shows that the competition for land associated with urban expansion does not follow purely economic laws, but also depends on land tenure laws and individual and cultural factors. Increased competition for land may lead to increasing socioeconomic vulnerability in the affected areas among those who use the land, but are not the owners. Furthermore, if not well planned, urbanisation can have major environmental consequences, such as biodiversity losses or the extinction of wetlands. However, there are few examples, and the limited number of studies on the social and environmental impacts

of urban sprawl makes it difficult to make general statements about when negative impacts will occur and how to avoid them.

3.3. Rural–Urban Connectivity, Land Use Management, and Food System Outcomes in Rural Areas

Rural and urban connectivity (that is, infrastructures, rules, and culture that impact transportation, logistics, and other transaction costs) is seen as an important factor for rural development as it facilitates access to (food) markets, and provides education and employment opportunities [3,9]. Studies testing the assumptions of what enhanced rural–urban linkages mean for food system outcomes in rural areas are scarce, though. For instance, Ref. [40] points out the potentially positive food security impacts on rural food suppliers that have the capacities to respond to increasing demand in the city as transport costs to cities decline, but substantiates this statement with only one example (in the Mekong Delta in Vietnam) and does not address other socioeconomic and ecological consequences of enhanced rural–urban connectivity. Ref. [9] specifically mentions the conditions under which farmers around cities can take advantage of the opportunities offered by a larger food market in growing cities. However, the authors provide few references to studies highlighting the social (inequality) and/or environmental impacts of land use change dynamics and farm structures caused by urban sprawl.

The empirical research that clarifies the role of rural–urban connectivity in rural agricultural dynamics largely points at the high costs of poor infrastructure, indicating the benefits of bringing these trade costs down (see examples in [3]); few studies measure what an investment in better infrastructure means for food security in rural areas (e.g., [41]). Ref. [25] assesses whether and how greater rural–urban connectivity is associated with changes in land management (e.g., agricultural input use measured by fertilizer application rates) and yields. Their study area encompasses countries in Latin America, sub-Saharan Africa, and south-east Asia, and they use two hexagon grids, one equal to 13,000 km^2 for a subregional-scale analysis and another one equal to 130 km^2 for a local-scale analysis. The authors find some empirical evidence that locations with greater rural–urban connectivity (that is, rural areas closer to urban areas) and urban extents (that is, % built-up area of the hexagon grid) have higher agricultural land use intensity than the more remote areas with low market access. This particularly holds in Asian countries—most notably in northern India and eastern China. Next, the study found some support for the hypothesis that areas closer to markets that experience rural outmigration tend to have greater agricultural land use intensity compared to relatively remote areas or those that experience in-migration. This is especially the case for irrigated areas, as locations with high connectivity and urban extents have significantly more irrigated cropland compared to areas with lower connectivity and urban extents across the Global South. The study finds empirical evidence for higher yields and cropping frequency in areas around cities compared to more remote rural areas. However, the study does not find a consistent relationship between urbanisation processes and agricultural field size (as a proxy for farm size, and trends towards consolidation) at either the subregional or local scales. This suggests that urban sprawl does not have to lead to agricultural consolidation per se, but that in the periphery of urban areas, farm size is bound by land constraints and population density. Overall, the study shows many non-significant relationships between rural–urban connectivity and different agricultural variables. Nevertheless, all of these results are still insightful in that they show disparities in how rural agriculture can respond differently to urbanisation across regions.

In recent years, land purchases took place through urban or foreign investments in quite a few African countries, which led to an increase in scale [42,43] and has exacerbated rural income inequality [44–46]. In addition, it generates little employment, and to the extent that it does, it is often low paid [43]. However, this increase in farm size and land consolidation does not necessarily take place close to cities.

The literature discussed above shows that the role of (enhanced) connectivity in how urbanisation affects rural agriculture remains little researched and is therefore poorly

understood. While in some regions in Asia, greater rural–urban connectivity is associated with overall higher agricultural inputs and yields, no clear relation between urbanisation and farm size or land consolidation has been found. To my knowledge, there are no studies linking rural–urban connectivity to implications for food system outcomes in an integrative holistic approach.

3.4. Rural–Urban Linkages May Vary as a Function of City Size

A further discussion in the literature on rural–urban connectivity and its impacts on rural livelihoods is about the composition of urbanisation affecting a country's growth and distribution [13,47]. The urbanisation pattern is often polycentric (meaning that there is not one city with one centre, but several cities of different sizes in a region), which complicates the interface between rural and urban areas. The assumption is that agricultural production intensity near large city centres decrease because alternative employment opportunities in those cities are more attractive to farming families than the continuation or intensification of agricultural production, whereas agricultural production intensification is highest around smaller 'secondary' cities.

In a case study area around Bangalore, India, with several secondary cities in its close vicinity, the authors in [14] find evidence that supports the above assumption: agricultural intensification is highest around secondary cities in the region, whereas agricultural activities in the proximity to Bangalore do not exhibit an increasing adoption of modern inputs. While agricultural intensity can be boosted by higher output prices (as a result of increasing food demand in the city), the proximity to urban centres also results in higher land prices while increasing employment opportunities outside the farm. The case study shows that the opportunity costs of intensified agricultural production become higher with proximity to Bangalore, which would explain less intensive agricultural production methods near the urban centre (than around secondary cities) as farm households decide to assign more household labour to the off-farm sector. This study illustrates how patterns of agricultural intensification are more complex than often anticipated by the literature and concludes that the assumption of concentric and uniform agricultural change around a city—in the sense of von Thünen [11] and later studies—is at least debatable. The study also indicates that the hierarchical pattern of settlements (size) influences regional land use and agricultural intensity, and that local urban development also influences factors such as land prices and alternative employment opportunities on how close farming activities can take place.

The study in [14] links to the framework developed by [13] in which a city typology is connected to urban interactions with the countryside. Ref. [13] groups cities that share similar characteristics in terms of population (e.g., small/large; fast/slow growing) and in relation to the agricultural sector and food system characteristics. The typology distinguishes five groups. At one end of the spectrum are the relatively small agricultural towns situated in the middle of agricultural production areas and at the other end the megacities with high population numbers and densities, and diverse food systems (traditional, modern, informal) that are challenged to operate in congested environments. Using this typology, Ref. [13] argues that investment along the urban–rural continuum in small and medium-sized cities is vital and strategic for rural and economic transformation, because rural townships and medium-sized cities serve as intermediate settlements that connect rural and urban areas while providing social and economic benefits. Besides being service delivery nodes for rural producers and the rural economy to markets, small and intermediate cities also offer non-agricultural employment in agro-processing and other commercial or industrial activities. As a result, investments in small and medium-sized cities may generate equitable growth patterns and contribute more to rural poverty reduction than investments in big urban centres. Apart from a single study (such as [14,41] for a case study in Tanzania), there is very little empirical evidence for this claim.

The existing literature testing the assumption that the size of the city and the associated alternative employment opportunities a city may offer drive agricultural development (in terms of structure, intensity, distribution effects) around cities is scarce. Because polycentric

patterns of urbanisation seem to reflect reality well, the empirical testing of the assumed relationship between city size and agricultural development deserves more attention.

4. Competing Claims on Resources: Taking into Account Multidimensional Linkages

Most empirical literature examining the consequences of urban expansion for agricultural development around the city focuses on the increasing competition for land and changes in land use patterns due to urbanisation. Yet, competition for resources is also about labour and water as cities with their diverse economies may offer alternative employment to rural populations, and the growing number of urban residents and industries will make greater demands on water. Thus, an analysis of how urban expansion impacts the resource use of the agricultural sector surrounding it will also need to examine the impact of urban growth on the availability of inputs other than land to obtain an accurate understanding of how a growing city affects the agriculture around it. Moreover, multidimensional relationships between resources (i.e., coherence of inputs such as land and water) determine the development of agricultural production potentials. In addition, rural–urban linkages are bidirectional; for example, labour migration from rural areas to the city often involves remittances to families in rural areas, where it provides their livelihood and ends up in the local economy, and food from rural to urban areas can flow back to the countryside as organic waste that can be used as fertilizers. This section summarises what increasing competition for non-land resources and the bidirectional rural–urban interactions mean for inclusive and sustainable agricultural development near growing cities.

4.1. Water

With cities expanding, regionally available water resources are increasingly directed towards urban spaces, putting stress on peri-urban and rural areas around cities. Due to increasing competing claims, water shifts from being a traditionally common property resource to a traded commodity that has to be paid for [22]. Ref. [10] posits that water scarcities and contamination are key urban growth-related challenges for agriculture in and surrounding cities, with growing urban populations demanding higher volumes of water and industrial development, causing increasing water pollution. Urbanisation contributes to not only changing consumption patterns such as the shift from a plant- to animal-based diet and the boom of construction activity, but also changing energy and water demand in households and industries. Ref. [48] analyses the current and future water stress in China in the context of increasing urbanisation, and unveils an increasing imbalance of water availability (highest in Western parts of the country) for meeting the demand between food and energy sectors (the latter largely based in eastern parts of the country that are the most urbanised). The authors conclude that the rapid and perennial urbanisation has substantially affected the extent of water availability, particularly in China's eastern provinces, and point out that in addressing the imbalance of sectoral demand for water in the context of China's progressive urbanisation, China will need to align national targets for water, energy, and food (focusing on nexus) and use water as efficiently as possible. In agriculture, for example, this means making more use of (new technologies in) irrigation.

The increased competition for water between urban and rural areas also has social or distributional effects. While better-off farmers are able to proactively invest in water sourcing and irrigation, in most cases, farmers lack the financial resources to do so. Consequently, their responses are rather reactive, including, for instance, only farming during the rainy seasons and leaving land fallow, and increasingly using (untreated) waste water, the latter of which is related to health and environmental problems [21,49]. Insufficient availability of water and/or contaminated water can also have a major impact on food and nutrition security, as it affects yields and, subsequently, the income and food availability of farm households. Moreover, food prices for consumers can rise as less food is available as a result of increasing water stress in competitive sectoral claims on water.

Innovations based on circular principles could reduce the growing competition for water and nutrients between urban areas and the agricultural sector. Taking the problem of

water scarcity mainly from an urban perspective, Ref. [50] discusses investments options in technology that can help city dwellers save on water use. For instance, in addition to investments in rainwater harvesting and circular sanitation systems, measurements using ICT applications will make people aware of personal water use and waste costs (see [51] for some case studies tested in Bangalore, India). In addition, investments are needed in the recovery of nutrients (such as phosphorus and nitrogen) from urban wastewater that can be used as fertilizers for food production. There are numerous studies that give suggestions for this, but the techniques are either still in the experimental phase or are only being carried out on a very small scale (e.g., [52–54]). Ref. [50] claims that nutrients recovered from cities replace half of all chemical fertilizers needed for food production.

4.2. Food Waste as a Source of Organic Fertilizer

Food that is wasted in cities is often used as organic fertilizer in urban and peri-urban areas in LMICs [55]. Collecting and recycling municipal waste for the production of organic fertilizers is often an informal activity (conducted by urban dwellers, traders, or farmers themselves), but various developments associated with urban growth make obtaining organic urban waste for agricultural purposes more difficult [10]. For example, due to changing urban lifestyles (increasing demand for processed food products, packed in plastic), the proportion of inorganic waste in urban waste composition rises, resulting in higher costs to separate organic waste matter. Next, its changing composition also increases competition over waste as a resource (e.g., for energy). Moreover, urban governance reforms to formalise and privatise waste management result in less organic material available for small farmers. There is evidence that growing intensive livestock farming due to increased urban demand for animal products can provide organic manure to growers, but the costs of waste recycling are high and indicate the need for government incentives (see, e.g., [56] for a case study in Ethiopia). Transport costs (to locations with nutrient shortages) depend on networks of livestock farmers and vegetable growers (e.g., [30], with an example from Ghana). Moreover, policies (such as subsidies) affecting the prices of inorganic fertilizers also play a role: cheap chemical fertilizers may outcompete organic fertilizers from waste and/or animal manure.

4.3. Labour and Remittances

Migration from rural areas to the city can be initiated by technological developments in agriculture that makes labour obsolete ('labour push'), or by improved job opportunities outside the farm, especially when urbanisation is driven by strong economic growth that generates attraction for labour ('labour pull') [57]. Regardless of which driving factor dominates, labour that leads to urbanisation is generally associated with increasing opportunity costs of agriculture and improved off-farm labour opportunities, especially where urbanisation is driven by strong economic growth that generates pull forces for labour (e.g., [14]). The literature shows that urbanisation resulting from rural–urban migration may lead to two responses in agriculture in areas from which migration occurs: migration to cities can lead to shortages and higher labour costs on farms, forcing farmers to adapt their choice of crops and shift to less labour-intensive cultivation methods, or migration leads farmers to switch to high-value products to compensate for the higher costs [10,14]. In addition, many fall back on deploying more family labour or/and temporarily help one another through labour sharing, often in informal arrangements. Although some of these outlined labour dynamics are recognised across different regions, these usually informal labour-related dynamics are mixed and vary depending on local contexts [10].

Migration to the city is not only based on individual motives, but often on a family decision in which a member of the family provides extra income from work in the city. Part of the additional income is used for the family's livelihood in the countryside, increasing their resilience to income shocks. Moreover, remittances can be spent for farm input purchases, and consequently increase farm productivity and the capital intensity of farming ([58], for an example in Tanzania). Several country studies confirm the positive effects on rural

development of remittances send by migrants who have left the countryside to relatives 'at home'. For instance, based on 2007–2010 household data from three provinces in Vietnam, Ref. [59] found that rural households that receive remittances from their migrants become less dependent on their income from rice production, increase their land productivity, and derive more income from non-agricultural labour. In contrast, the authors point out that migration without remittances reduces the farm labour productivity growth and crop diversification of rural households. Based on research in 17 local villages spread across Indonesia, Ref. [60] illustrates the positive effect of money transfers sent by migrants to their relatives left behind in the countryside. Next to spending money on daily needs (e.g., food), remittances are used for investing in assets (e.g., motor vehicles and land) and improved education and health, which is perceived to have a positive impact on the overall development of rural areas. However, Ref. [61] reports a much less positive story from Nepal when examining the effects of male out-migration on household food and nutrition security, especially for the women who stayed behind (see Table 1 below). The authors find that migration offers neither substantial nor sustainable improvements to the quantity or quality of foods consumed by households, but is allowing households to "live in hope", meaning hope that the migrant household member might be able to send money home. Drawing on caste- and gender-specific findings, Ref. [61] highlights the need to look beyond the financial aspects of migration (that is, social costs such as children growing up without their father) when examining its effects on food and nutrition security.

Table 1. Effects of male out-migration on core household food insecurity experiential domains in Maulali, Far West Nepal.

	Effects of Male Out-Migration		
Core Household Food Insecurity	**Income via Remittances and Improved Access to Credit and Loans**	**Labour Supply and Agricultural Productivity [a,b]**	**Women's Workload [a,b]**
Insufficient quantity	- Improve economic access to market [b] - Improve ability to meet immediate consumption needs - Help avoid having to eat less [b] - Help relieve perception that there is not enough food	- (Perceived) reduction in agricultural output, reports of grains running out earlier - Increased reliance on foods purchase from market	- Given additional work burden (seasonal): - Women forced to eat less/not at all - Typical meal patterns are disrupted
Inadequate quality	- Little change to limited variety within and between meals largely due to market unavailability	- Consumption of less preferred foods (maize) given reduction in agricultural productivity	Given additional work burden (seasonal): - Women unable to cook and are forced to consume leftovers/old foods from earlier in the day
Uncertainty and worry	- Help reduce short-term worry about having enough to eat - Help alleviate psychological distress/insomnia about having enough to eat - Help reduce worry about trade-off between health, education, clothing and food - Alleviate short-term uncertainty and worry about having enough to eat - Does not reduce long-term uncertainty and worry	- Divest income via remittances to hire male agricultural labour, worry about "having to spend more to produce less"	Given additional work burden (seasonal): - Women unable to feed children and note feeling worried and guilty

Source: [61]. Notes: ([a]) refers to observation(s) with caste differences; ([b]) refers to observation(s) with gender differences.

4.4. Multidimensional Linkages

Urban growth-related agricultural dynamics are also complex because of the multidimensional linkages between resources. Ref. [10] created a 'wheel of urban growth-related peri-urban agriculture dynamics' showing conceptually the interlinkages of land, water, organic waste, labour, and food markets that determine the spatiotemporal dynamics in agriculture in and around cities. The review highlights there is little literature specifically addressing resource interlinkages, except for some that research those between land and

water. For instance, the use of land for intensified agriculture is spatially linked to water sources, such as floodplains, and farmers are often forced to relocate their fields due to water inaccessibility. The relationships between land and labour are reported as land fragmentation and shrinking farm sizes, resulting in a reduced need for agricultural labour. However, the processes of crop change and production intensification challenge this direct relationship—changing production to more labour-intensive products such as vegetables, for example, increases the need for labour—while according to some studies, in direct response to a growing labour shortage, farmers use more agrochemicals. Additionally, some studies cited by [10] suggest that the increasing use of agro-chemicals is linked to an increasing demand for fresh, leavy green vegetables by urban consumers. Ref. [62] (p. 102) offers another example, observing how labour scarcity, aging farmers, and land pressure jointly influence the choice of crops. For peri-urban Ho Chi Minh City, they explain that farmers turn to lime cultivation, as "lime appeared suitable in dealing with a situation of labour shortage and low access to land", while providing a "continuous flow of income" that matched the locally available labour supply of older farmers who preferred light work.

The multidimensional linkages between resources are often overlooked in research studying the urban growth-related agricultural dynamics around cities. Yet, it is clear that, next to land, growing cities lead to increasing competition for available water and labour. Capital raised through remittances from family members working in the city are used as to finance agricultural inputs or invested in education and health, hence also playing an important role sustaining rural livelihoods. In order to gain a better understanding of livelihood opportunities in agriculture and in rural areas surrounding cities, the multidimensional relationships between resources should be given more attention in the literature studying urban–rural interaction.

5. Conclusions and Suggestions for Further Research

This article explores how expanding cities impact agricultural production and livelihoods around cities through increased competing claims on resources. The research questions addressed focus on the impact of urban expansion and rural–urban migration on land use patterns, farming structures, and distributional and environmental effects in rural areas (Section 3) and on competing claims on other inputs than land and the potential benefits of inputs that may flow from urban to rural areas (Section 4).

A range of empirical studies seem to confirm the hypothesis that urbanisation impacts agricultural transformation, pointing at increasing competition for land near growing cities to lead to more intensive land use and a shift of production towards high-value products such as poultry and horticultural production. However, other studies claim that the spatial continuity of land use around cities (i.e., the most intensive farming is closest to the city centre and the more extensive farming is further away) is more nuanced because farmers' decisions to abandon or intensify farming around cities depend on more than purely economic motives, while connectivity (in terms of distance and accessibility) and the polycentric pattern of urbanisation (with associated opportunities for alternative employment) also determine how farmland is used around large cities. As for structure and rural–urban migration, there is no clear empirical evidence that larger farms arise around growing cities or are more mechanised. The literature shows several examples where urban sprawl and the marginalisation of agriculture in rural areas are at the expense of ecologically sensitive areas, such as forests or wetlands. Particularly where informal arrangements to use land for agricultural purposes dominate in urban and suburban areas, urban expansion can have a major impact on smallholder farmers who are particularly vulnerable when land pressure increases and land claims are contested.

Competing claims on non-land resources related to urbanisation have been little explored, while agricultural production potential is highly dependent on the multidimensional relationships between agricultural inputs such as land and water. Empirical studies indicate the rising costs of water and organic fertilizers (i.e., food waste from cities) for farmers around growing cities, with distribution effects. Several country studies confirm

the positive effects on rural development of remittances sent by migrants who have left the countryside to relatives 'at home'. However, labour migration can also lead to high social costs such as children growing up without their father.

This literature review shows that many questions remain in this area. Research into what urbanisation means for agricultural development around growing cities is usually built on stand-alone case studies, often focusing on the consequences for land use and where little attention is paid to social (distribution) and/or environmental effects. To serve policy with insights that can contribute to more sustainable urban and rural food systems, a better understanding of the competition for resources between urban and rural areas is needed. I suggest follow-up research according to the following three tracks:

1. Comparative field studies in the form of surveys and interviews to better understand how farmers near cities experience competition for land and other inputs, and how they weigh up decisions to intensify further or move away from the city as a result of competing claims. Such field studies should also address the role of cultural diversity and governance-related issues (for example, informal agreements on the use of communal land), as the case studies analysed in this review pay little attention to these two aspects. This trail of research would provide better insight into farmers' decision-making processes, and comparative empirical studies could help to conceptually improve existing analytical frameworks (such as those of [10,14,22]).
2. The role of connectivity and size of the city affecting rural dynamics needs further research. The argument that investments in small and medium-sized cities are most effective for rural and economic transformation while providing most equitable social and economic benefits (see [13]) should be empirically tested more widely.
3. A third track is to zoom in on the trade-offs of agricultural intensification and diversification of agricultural production around growing cities and the economic, social, and ecological effects of this process. Case studies can be elaborated using qualitative and/or quantitative trade-off analysis methods considered relevant and/or practically implementable.

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References

1. UN. *World Urbanization Prospects: The 2018 Revision*; Department of Economic and Social Affairs: New York, NY, USA, 2019. Available online: https://population.un.org/wup/publications/Files/WUP2018-Report.pdf (accessed on 6 October 2022).
2. Popkin, B.M. Nutrition Patterns and Transitions. *Popul. Dev. Rev.* **1993**, *19*, 138–157. [CrossRef]
3. AGRA. *Africa Agriculture Status Report: Feeding Africa's Cities: Opportunities, Challenges, and Policies for Linking African Farmers with Growing Urban Food Markets*; Alliance for a Green Revolution in Africa (AGRA): Nairobi, Kenya, 2020.
4. World Bank. *World Development Report 2009: Reshaping Economic Geography*; World Bank: Washington, DC, USA, 2009. Available online: https://openknowledge.worldbank.org/handle/10986/5991 (accessed on 19 October 2022).
5. Djurfeldt, A.A. Urbanization and linkages to smallholder farming in sub-Saharan Africa: Implications for food security. *Glob. Food Secur.* **2015**, *4*, 1–7. [CrossRef]
6. Vorley, B.; Lançon, F. *Food Consumption, Urbanisation and Rural Transformation the Trade Dimensions*; IIED: London, UK, 2016.
7. Sharma, A. Urban proximity and spatial pattern of land use and development in rural India. *J. Dev. Stud.* **2016**, *52*, 1593–1611. [CrossRef]

8. Agergaard, J.; Tacoli, C.; Steel, G.; Ørtenblad, S.B. Revisiting rural–urban transformations and small town development in sub-Saharan Africa. *Eur. J. Dev. Res.* **2019**, *31*, 2–11. [CrossRef]
9. De Bruin, S.; Dengerink, J.; Van Vliet, J. Urbanisation as driver of food system transformation and opportunities for rural livelihoods. *Food Secur.* **2021**, *13*, 781–798. [CrossRef]
10. Follmann, A.; Willkomm, M.; Dannenberg, P. As the city grows, what do farmers do? A systematic review of urban and peri-urban agriculture under rapid urban growth across the Global South. *Landsc. Urban Plan.* **2021**, *215*, 104186. [CrossRef]
11. Atkins, P.J. The charmed circle: Von Thünen and agriculture around Nineteenth Century London. *Geography* **1987**, *72*, 129–139.
12. Parr, J.B. Overlooked aspects of the Von Thünen system. *Spat. Econ. Anal.* **2015**, *10*, 471–487. [CrossRef]
13. Tefft, J.; Jonasova, M.; Adjao, R.; Morgan, A. Food Systems for an Urbanizing World. World Bank Group and FAO. 2017. Available online: http://documents1.worldbank.org/curated/en/454961511210702794/pdf/Food-systems-for-an-urbanizing-world-knowledgeproduct.pdf (accessed on 25 September 2022).
14. Steinhübel, L.; Von Cramon-Taubadel, S. Somewhere in between Towns, Markets and Jobs—Agricultural Intensification in the Rural-Urban Interface. *J. Dev. Stud.* **2021**, *57*, 669–694. [CrossRef]
15. Vandercasteelen, J.; Beyene, S.T.; Minten, B.; Swinnen, J. Big cities, small towns, and poor farmers: Evidence from Ethiopia. *World Dev.* **2018**, *106*, 393–406. [CrossRef]
16. De Jong, L.; De Bruin, S.; Knoop, J.; Van Vliet, J. Understanding land-use change conflict: A systematic review of case studies. *J. Land Use Sci.* **2021**, *16*, 223–239. [CrossRef]
17. Mpofu, G.; Darkoh, M.K.; Gwebu, T. Peri-urbanization land use dynamics: An analysis of evolving patterns and their impacts on Gabane Village, Botswana. *GeoJournal* **2018**, *83*, 725–741. [CrossRef]
18. Dapilah, F.; Østergaard Nielsen, J.; Akongbangre, J.N. Peri-urban transformation and shared natural resources: The case of shea trees depletion and livelihood in Wa municipality, Northwestern Ghana. *Afr. Geogr. Rev.* **2018**, *38*, 374–389. [CrossRef]
19. Kuusaana, E.D.; Eledi, J.A. Customary land allocation, urbanization and land use planning in Ghana: Implications for food systems in the Wa Municipality. *Land Use Policy* **2015**, *48*, 454–466. [CrossRef]
20. Eurostat. *Applying the Degree of Urbanisation: A Methodological Manual to Define Cities, Towns and Rural Areas for International Comparisons: 2021 Edition*; Publications Office of the European Union: Luxembourg, 2020. [CrossRef]
21. FAO; Rikolto; RUAF. *Urban and Peri-Urban Agriculture Sourcebook—From Production to Food Systems*; FAO: Rome, Italy; Rikolto: Leuven, Belgium, 2022. [CrossRef]
22. Abu Hatab, A.; Rigo Cavinato, M.E.; Lindemer, A.; Lagerkvist, C.J. Urban sprawl, food security and agricultural systems in developing countries: A systematic review of the literature. *Cities* **2019**, *94*, 129–142. [CrossRef]
23. HLPE. *Nutrition and Food Systems*; A Report by the High Level of Experts on Food Security and Nutrition of the Committee on World Food Security; HLPE: Rome, Italy, 2017.
24. Van Berkum, S.; Dengerink, J.; Ruben, R. *The Food System Approach: Sustainable Solutions for a Sufficient Supply of Healthy Food*; Memorandum 2018-064; Wageningen Economic Research: Wageningen, The Netherlands, 2018.
25. Boudet, F.; MacDonald, G.K.; Robinson, B.E.; Samberg, L.H. Rural-urban connectivity and agricultural land management across the Global South. *Glob. Environ. Change* **2020**, *60*, 101982. [CrossRef]
26. Güneralp, B.; Reba, M.; Hales, B.U.; Wentz, E.A.; Seto, K.C. Trends in urban land expansion, density, and land transitions from 1970 to 2010: A global synthesis. *Environ. Res. Lett.* **2020**, *15*, 44015. [CrossRef]
27. Zoomers, A.; Van Noorloos, F.; Otsuki, K.; Steel, G.; Van Westen, G. The Rush for Land in an Urbanizing World: From Land Grabbing Toward Developing Safe, Resilient, and Sustainable Cities and Landscapes. *World Dev.* **2017**, *92*, 242–252. [CrossRef]
28. Prabidi, D.O.; Pauleit, S. The dynamics of peri-urban agriculture during rapid urbanization of Jabodetabek Metropolitan Area. *Land Use Policy* **2015**, *48*, 13–24. [CrossRef]
29. Poulsen, M.N.; McNab, P.R.; Clayton, M.L.; Neff, R.A. A systematic review of urban agriculture and food security impacts in low-income countries. *Food Policy* **2015**, *55*, 131–146. [CrossRef]
30. Robineau, O. Toward a systemic analysis of city-agriculture interactions in West Africa: A geography of arrangements between actors. *Land Use Policy* **2015**, *49*, 322–331. [CrossRef]
31. Warren, E.; Hawkesworth, S.; Knai, C. Investigating the association between urban agriculture and food security, dietary diversity, and nutritional status: A systematic literature review. *Food Policy* **2015**, *53*, 54–66. [CrossRef]
32. Wubie, A.M.; De Vries, W.T.; Alemie, B.K. Synthesing the dilemmas and prospects for a peri-urban land use management framework: Evidence from Ethiopia. *Land Use Policy* **2021**, *100*, 105122. [CrossRef]
33. Schlimmer, S. *Land Governance in the Outskirts of African Cities: Socio-Economic Challenges of Growing Peri-Urban Land Markets*; Briefings de l'Ifri; French Institute of International Relations: Paris, France, 2021.
34. Adam, A.G. *Urban Built-Up Property Formation Process in the Peri-Urban Areas of Ethiopia*; IntechOpen: London, UK, 2020. [CrossRef]
35. Kidido, K.J.; Ajabuin, B.A. Peri-urban land governance and market dynamics: Perceptions and adaptation strategies of smallholder farmers in Tamale, Ghana. *Afr. Geogr. Rev.* **2022**, *41*, 1–24. [CrossRef]
36. Vermeiren, K.; Adiyia, B.; Loopmans, M.; Tumwine, F.R.; Van Rompaey, A. Will urban farming survive the growth of African cities: A case-study in Kampala (Uganda)? *Land Use Policy* **2013**, *35*, 40–49. [CrossRef]
37. Omisore, A.G. Attaining Sustainable Development Goals in sub-Saharan Africa; The need to address environmental challenges. *Environ. Dev.* **2018**, *25*, 138–145. [CrossRef]

38. Cobbinah, P.B.; Korah, P.I.; Boadi Bardoe, J.; Mensah Darkwah, R.; Marshall Nunbogu, A. Contested urban spaces in unplanned urbanization: Wetlands under siege. *Cities* **2022**, *121*, 103489. [CrossRef]
39. Robineau, O.; Dugu´e, P. A socio-geographical approach to the diversity of urban agriculture in a West African city. *Landsc. Urban Plan.* **2018**, *170*, 48–58. [CrossRef]
40. Hussein, K.; Suttie, D. *Rural-Urban Linkages and Food Systems in Sub-Saharan Africa*; The Rural Dimension, 05 IFAD Research Series; IFAD: Rome, Italy, 2016.
41. Christiaensen, L.; Weerdt, J.; Todo, Y. Urbanization and poverty reduction: The Role of rural diversification and secondary towns. *Agric. Econ.* **2013**, *44*, 435–447. [CrossRef]
42. Jayne, T.S.; Chamberlin, J.; Traub, L.; Sitko, N.; Muyanga, M.; Yeboah, F.K.; Anseeuw, W.; Chapoto, A.; Wineman, A.; Nkonde, C.; et al. Africa's changing farm size distribution patterns: The rise of medium-scale farms. *Agric. Econ.* **2016**, *47*, 197–214. [CrossRef]
43. Neubert, R.; Voget-Kleschin, L. *What are the Effects of Large-Scale Land Acquisitions in Africa on Selected Economic and Social Indicators*; Bischöfliches Hilfswerk MISEREOR e. V. (The German Catholic Bishops' Organisation for Development Cooperation): Aachen, Germany, 2021.
44. Sitko, N.J.; Jayne, T.S. Structural transformation or elite land capture? The growth of "emergent" farmers in Zambia. *Food Policy* **2014**, *48*, 194–202. [CrossRef]
45. Chu, J.; Phiri, D. *Large-Scale Land Acquisitions in Zambia: Evidence to Inform Policy*; Research Report 50; Institute of Poverty, Land and Agrarian Studies (PLAAS): Cape Town, South Africa, 2015; Available online: https://www.plaas.org.za (accessed on 4 October 2022).
46. Muyanga, M.; Jayne, T.S. Revisiting the farm size-productivity relationship based on a relatively wide range of farm sizes: Evidence from Kenya. *Am. J. Agric. Econ.* **2019**, *101*, 1140–1163. [CrossRef]
47. Christiaensen, L.; Kanbur, R. Secondary Towns and Poverty Reduction: Refocusing the Urbanization Agenda. *Annu. Rev. Resour. Econ.* **2016**, *9*, 405–419. [CrossRef]
48. Niva, V.; Cai, J.; Taka, M.; Kummu, M.; Varis, O. China's sustainable water-energy-food nexus by 2030: Impacts of urbanization on sectoral water demand. *J. Clean. Prod.* **2019**, *251*, 119755. [CrossRef]
49. Simon, D. Urban Environments: Issues on the Peri-Urban Fringe. *Annu. Rev. Environ. Resour.* **2008**, *33*, 167–185. [CrossRef]
50. Drangert, J.O. Urban water and food security in this century and beyond: Resource-smart cities and residents. *Ambio* **2021**, *50*, 679–692. [CrossRef] [PubMed]
51. Drangert, J.O.; Sharatchandra, H.C. Addressing urban water scarcity: Reduce, treat and reuse—The third generation of management to avoid local resources boundaries. *Water Policy* **2017**, *19*, 978–996. [CrossRef]
52. Woltersdorf, L.; Zimmermann, M.; Deffner, J.; Gerlach, M.; Liehr, S. Benefits of an integrated water and nutrient reuse system for urban areas in semi-arid developing countries. *Resour. Conserv. Recycl.* **2018**, *128*, 382–393. [CrossRef]
53. Rufí-Salís, M.; Calvo, M.J.; Petit-Boix, A.; Villalba, G.; Gabarrell, X. Exploring nutrient recovery from hydroponics in urban agriculture: An environmental assessment. *Resour. Conserv. Recycl.* **2020**, *155*, 104683. [CrossRef]
54. Lehtoranta, S.; Malila, R.; Sarkilati, M.; Viskari, E.L. To separate or not? A comparison of wastewater management systems for the new city district of Hiedanranta, Finland. *Environ. Res.* **2022**, *208*, 112764. [CrossRef]
55. Drechsel, P.; Keraita, B.; Cofie, O.; Nikiema, J. Productive and safe use of urban organic wastes and wastewater in urban food production systems in low-income countries. In *Cities and Agriculture: Developing Resilient Urban Food Systems*; de Zeeuw, H., Drechsel, P., Eds.; Routledge: New York, NY, USA, 2015; pp. 162–191.
56. Tadessa, S.T. Nutrient Use and Recycling in Urban, Peri-Urban and Rural Farms in Ethiopia. Ph.D. Thesis, Wageningen University and Research, Wageningen, The Netherlands, 2021. Available online: https://edepot.wur.nl/542694 (accessed on 25 September 2022).
57. Alvarez-Cuadrado, F.; Poschke, M. Structural Change Out of Agriculture: Labor Push versus Labor Pull. *Am. Econ. J. Macroecon.* **2011**, *3*, 127–158. [CrossRef]
58. Msinde, J.; Salehe, F. What Role for Remittances in Farm Inputs Expenditure among Paddy Farming Households? A Case Study of Kilombero Valley, Tanzania, Sokoine University of Agriculture, Tanzania. 2017. Available online: https://www.suaire.sua.ac.tz/handle/123456789/2103 (accessed on 14 September 2022).
59. Nguyen, D.C.; Grote, U.; Nguyen, T.T. Migration, crop production and non-farm labor diversification in rural Vietnam. *Econ. Anal. Policy* **2019**, *63*, 175–187. [CrossRef]
60. Hidayati, I. Migration and rural development: The impact of Remittance. *IOP Conf. Ser. Earth Environ. Sci.* **2020**, *561*, 12018. [CrossRef]
61. Kim, J.J.; Stites, E.; Webb, P.; Constas, M.A.; Maxwell, D. The effects of male out-migration on household food security in rural Nepal. *Food Secur.* **2019**, *11*, 719–732. [CrossRef]
62. Nguyen, Q.; Kim, D.C. Farmers' landholding strategy in urban fringe areas: A case study of a transitional commune near Ho Chi Minh City, Vietnam. *Land Use Policy* **2019**, *83*, 95–104. [CrossRef]