

Urbanizing food systems: exploring opportunities for rural transformation

by
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Abstract

Urbanization is transforming food systems across sub-Saharan Africa and South Asia in conjunction with other dynamics such as rising average welfare. Where overall food demand is projected to increase approximately 2.5-fold in sub-Saharan Africa and 1.7-fold in South Asia, urban demand will rise two to four times more. In particular, the demand for high-value products such as dairy and processed foods will multiply. A further increase in economic inequality, in combination with the growing urban populations, is expected to pose a risk to future food security. Uncertainties in projections are large, however, because of interacting and unpredictable socio-economic and environmental developments and events, as well as the future implementation and operation of policies and investments.

This paper shows that, potentially, the anticipated rise in food demand by 2050 can largely be met regionally, especially in most parts of India and sub-Saharan Africa, specifically southern Africa. Water-saving measures and improved agricultural practices must be implemented to meet this scenario, although the impacts of climate change can decrease yield by up to 15 per cent. However, the potential yield increases or diversification will not contribute automatically to inclusive rural transformation. Conversely, urbanization may potentially increase rural inequality and poverty. Smallholder farmers located close to expanding cities are at risk of losing their land to urbanization processes. Also, people living in isolated areas far away from growing urban food markets or rural people who lack access to inputs, information and markets are at risk of losing out. To allow all rural food system actors to profit from the changing and growing urban markets, the spatial patterns of urbanization, the quality of rural-urban linkages and the functionality of secondary towns are of pivotal importance. Physical and communicative proximity and access to urban markets for all can provide better access to finance, inputs, information and services. Furthermore, off-farm employment opportunities can arise in the developing value chains. To realise the opportunities, this paper identifies a range of social, physical, spatial, economic and institutional conditions that enable inclusive rural transformation.

Keywords: Urbanization, food system change, rural-urban interactions, rural transformation, enabling conditions

1. Introduction

Over the next few decades, urbanization, rising welfare and associated changing dietary preferences are projected to pose unprecedented challenges in terms of food security. The impacts of urbanizing food systems are already manifest in several ways, primarily as a result of rising and changing food demand, moderated by social, economic and environmental dynamics. In particular, urban populations in sub-Saharan Africa and South Asia are projected to multiply towards 2050, alongside rising overall welfare but with high entrenched inequality and related food insecurity risks (Jiang and O'Neill, 2017; Rao et al., 2019). Changing consumer preferences in these regions are tied to urbanization and (unequal) welfare increases, which affect the way food is consumed, traded, processed and produced (Tefft et al., 2017). The rising and changing urban food demand requires a reassessment of the local and regional production capacity. Where could food for an urbanizing world come from? Although this is an important question to address, meeting this rising demand is not solely a question of how or where to sustainably and resiliently raise production capacity, but also a question of inclusion and equity: who will benefit from the opportunities that arise?

Most farmers in sub-Saharan Africa and South Asia (70–80 per cent) farm on plots smaller than 2 hectares (ha) and operate on about 30–40 per cent of the agricultural land in those countries (Lowder, Scoet and Raney, 2016). Poverty is high among these smallholder farmers, making the need to keep investing in this group of pivotal importance to work towards the Sustainable Development Goals (SDGs) 1: no poverty and 2: zero hunger. Growing food markets in nearby cities could provide an opportunity for this diverse group, if existing barriers to the urban markets are lowered, investments are made in improving access to resources and knowledge, and adaptation measures to climate change impacts are supported (Da Silva and Fan, 2017; Hussein and Suttie, 2018; Marshall and Randhawa, 2017). Opportunities for rural development are, however, not limited to the potential resulting from raising agricultural production and assumed increasing incomes. Opportunities can also come from new prospects in processing and distributing food and improving access to knowledge and inputs (Allen, Heinrigs and Heo, 2018; Djurfeldt, 2015). Urbanization thus provides chances for improving rural livelihoods and inclusive growth, the goals of inclusive rural transformation (IFAD, 2016a).

Urbanizing food systems will not automatically lead to inclusive rural transformation. Whether urbanization is good news for rural areas depends on a range of factors, including the spatial patterns of urbanization and the quality of rural-urban linkages. In general, food system value chains become longer and more complicated under the transformation of food systems from traditional to modern systems (HLPE, 2017). The challenge is how rural actors in sub-Saharan Africa and South Asia could benefit from this transformation.

The central questions posed in this paper are threefold. Firstly, how does urbanization change food systems, including rural opportunities? Secondly, which “foodsheds” are projected to be self-sufficient towards 2050? And thirdly, what enabling conditions are required to turn the growing and changing urban demand into opportunities for inclusive rural transformation? In this paper, we assess how the dynamics of urbanization affect food systems, where food for a rising urban population could come from, and what conditions could enable rural food system actors to grab the opportunities that come with the growing and changing urban markets.

Section 2 addresses the methods and conceptual framework guiding the paper. This clarifies the concepts of food system transformation and (inclusive) rural transformation in the context of the thematic focus, urbanization. Section 3 addresses the dynamics of urbanization to better understand how it could affect food systems, in terms of spatial dynamics, different city sizes and rural-urban linkages.

Section 4 discusses the impacts of urbanization on food systems, in terms of rising and changing food demand and land use changes to understand how urbanizing food systems can affect rural areas. This section also provides two in-depth case studies concerning the impact of urbanizing food systems on rural transformation in Senegal and Haryana State, India.

Section 5 delivers insights into the potential of different foodsheds to sustainably feed the growing urban population with a nutritious diet, without ignoring rural needs. This theoretical exercise provides insights into the self-sufficiency of different regions, and what regions might be “at risk” by 2050.

Section 6 analyses what enabling conditions are needed to empower rural actors in the food value chain to make use of the different opportunities that can come with urbanization. Finally, section 7 concludes on the main insights of the paper and provides recommendations.

2. Methodology and conceptual approach

This paper assesses how urbanization may offer an opportunity for rural transformation via changing food systems. The paper focuses on sub-Saharan Africa and South Asia, following the classification by the 2019 Rural Development Report (IFAD, 2019). As South Asia’s challenges and projections are heavily weighted by India, the paper gives extra attention to India.

Several pathways link changes in urbanizing food systems with rural transformation, depending on numerous contextual factors. The analysis in this paper is based on an interdisciplinary approach, including thorough literature review, two in-depth case studies, a brief demographic scenario analysis and a model-based analysis of foodsheds and their potential levels of self-sufficiency today and by 2050. The conceptual approach of the paper is visualized in Figure 1. The ways in which urbanization is changing food systems is influenced not only by the dynamics of urbanization – as discussed in section 3 – but also by the political, trade and environmental context, including import/export dynamics, institutional capacity, welfare distribution and water availability.

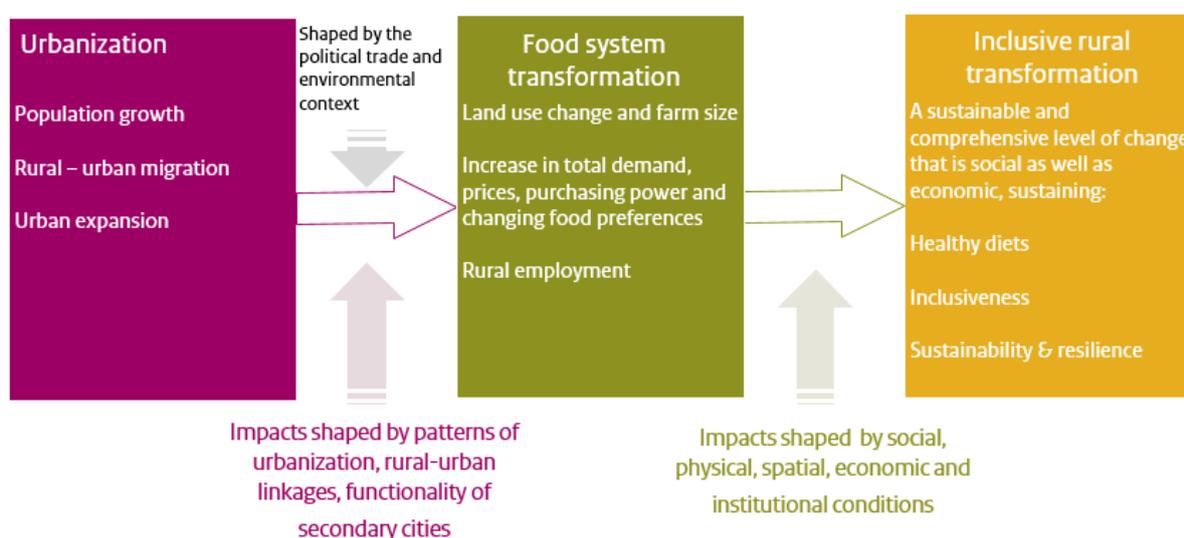


Figure 1: Conceptual approach of the paper

We analyse the potential of urbanization for inclusive rural transformation via food system change by assessing three aspects. First, by understanding the dynamics of urbanization and how these change food systems. Second, by analysing the biophysical and environmental limitations and opportunities of regional production responses (“foodsheds”) by evaluating projections regarding food production to feed the growing urban – and rural – share. This is done by spatially combining population and food production scenarios. The full methodology is provided in a separate background report, see Siderius, Velde and Biemans (2021). Third, we analyse which enabling conditions are needed to turn the opportunities that result from an urbanizing food system into opportunities for inclusive rural transformation.

2.1 Urbanizing food systems

Urbanizing food systems are defined in this study as food systems in which urbanization, propelled by rural-urban migration, urban population growth and urban expansion, is a key driver of food system transformation. This transformation is characterized by a rising group of net food buyers, a rising and changing demand, land use changes and changing rural opportunities. Spatial dynamics shape the impacts

on rural development, including the spatial patterns of urban development, rural-urban linkages and the role of secondary cities.

2.2 Rural transformation

Rural transformation is a comprehensive concept, defined by IFAD as “a sustainable and comprehensive level of change that is social as well as economic” (IFAD, 2015). A more specific definition refers to the process of inclusive and sustainable improvements of all rural livelihoods, resulting from rising productivity of smallholder agriculture, increasing marketable surpluses, rising off-farm employment opportunities, better access to services and infrastructure, and the capacity to influence policy, embedded in national processes of economic growth and structural transformation (IFAD, 2016b).

3. Dynamics of urbanization

This section discusses the different forms of urban growth – population growth, rural-urban migration and urban expansion – in South Asia and sub-Saharan Africa and, and the spatial characteristics of urbanization that are of importance for inclusive rural transformation.

3.1 A growing urban share

Urbanization is the result of a growing urban population, expansion of cities (reclassification of rural to urban) and migration from rural to urban areas. This process is fickle, shaped by policies, geographies, resource availability and diverse economic developments. Urbanization is often related to economic growth and structural transformation, but institution and policies are likewise important processes (Henderson and Wang, 2007). Although countries with a high level of urbanization are often relatively prosperous, there is no univocal relationship between urbanization and economic growth or institutional constellation (Henderson, 2010; Turok and McGranahan, 2013). The pattern of falling overall poverty alongside urbanization is less evident in sub-Saharan Africa than historically observed in other regions (Hussein and Suttie, 2018; Turok and McGranahan, 2013). This observation is mirrored by the differences in poverty levels in South Asia and sub-Saharan Africa. South Asia is slightly less urbanized than sub-Saharan Africa, with “only” 14.2 per cent of the population living in extreme poverty (earning less than US\$1.90 per day), compared with 42.1 per cent in sub-Saharan Africa (World Bank, 2020).

3.1.1 Demographic change

Demographic growth in both South Asia and sub-Saharan Africa depends on several factors, including welfare dynamics and levels of education. The “middle-of-the-road” projection for sub-Saharan Africa implies a doubling of the population by 2050, whereas South Asia is projected see a rise of almost 50 per cent (Figure 2). A growing share of these people will live in urban areas (Figure 3), although these projections are actually difficult to compare. This is hard because in both the policy and academic arenas, it is not possible to find a widely accepted definition of urban areas, and countries have adopted different definitions for this classification (see Box 1). In addition, the strict distinction between rural and urban areas is increasingly blurred. The projected population growth in urban and numerous rural regions makes it increasingly hard to distinguish between urban and rural areas in the densely populated areas, such as certain parts of Uganda, India, coastal Nigeria and the highlands of Ethiopia.

Especially in parts of sub-Saharan Africa, a large share of the new urban dwellers is expected to live in peri-urban areas, i.e. outstretched urban areas around city centres (van Huijstee et al., 2018). Cities are often less compact and dense than in other world regions; historically, the built-up area in sub-Saharan Africa has been growing approximately 20 per cent more rapidly than the urban population size (Xu et al., 2019). This dynamic can largely be explained by the overall correlation between liveability indicators and population density (Lall, Henderson and Venables, 2017). Investments in housing, public infrastructure and other public services are lagging in African cities, which affects spatial expansion. In other words, the continent is “suburbanizing”, with more urban inhabitants living in the newly developing neighbourhoods further away from the initial city centre (Tieleman, 2020). In these peri-urban regions, people are often tied to both

agriculture and day jobs in the nearby cities. These peri-urban neighbourhoods not only have limited access to services but also face more land issues, including overlapping land rights, absence of formally registered land rights and rising land prices (de Jong et al., 2021), decreasing livelihood security.

Projected population growth 2010-2050

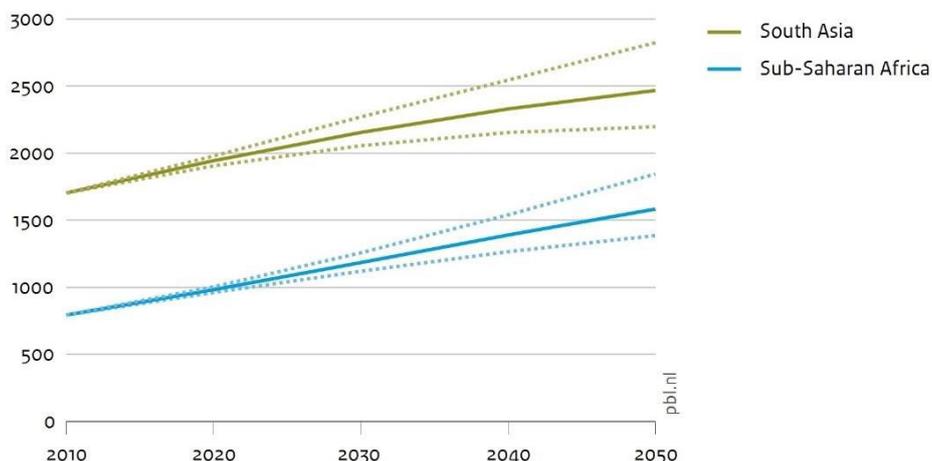


Figure 2: Projected population growth towards 2050 in millions. The solid line reflects a middle-of-the-road scenario projection (SSP2). The dotted lines in similar colours indicate a more negative (SSP3) and a more positive scenario (SSP1). Source: Samir and Lutz (2017).

Urban share

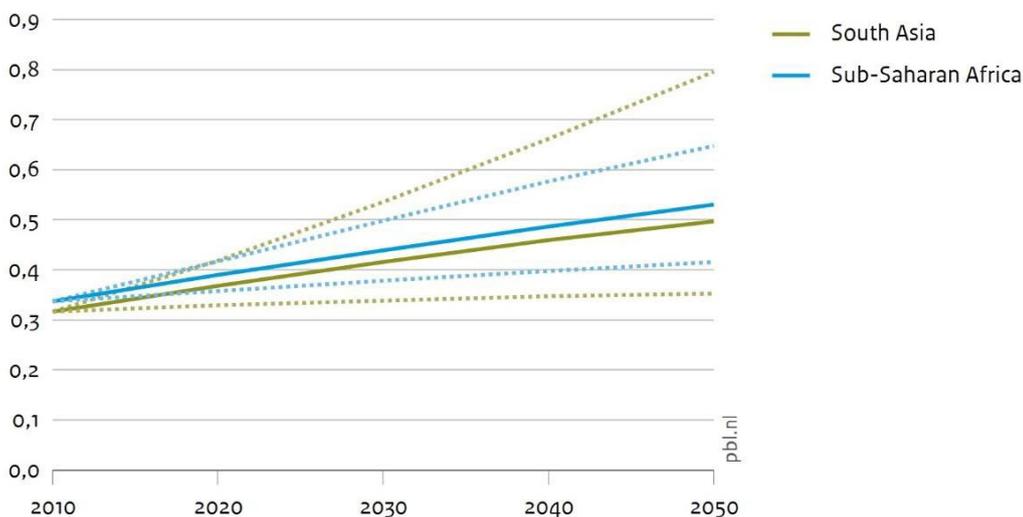


Figure 3: Urban population share projections following country definitions. Source: Jiang and O’Neill (2017)

3.1.2 Population distribution over city sizes

In sub-Saharan Africa today (2020), approximately 37 per cent of the urban dwellers live in a city of over 1 million people, whereas this is about 42 per cent in South Asia. An estimated 219 million urban dwellers in sub-Saharan Africa, 48 per cent of the total urban population, live in small cities (<300,000 inhabitants), whereas this is 42 per cent in South Asia (298 million people). Both in South Asia and sub-Saharan Africa a

reduced share of people living in small cities is projected by 2030, although the absolute number of people in small cities is projected to increase. From a food system perspective, the notion of city size is of importance as the smaller cities depend to a larger extent on the agricultural economy and have specific functions in local/national food systems (see Figure 4; Hardoy, Satterthwaite and Stewart, 2019; NIUA and HSML, 2017). However, governments in both South Asian and sub-Saharan African countries tend to invest less in smaller cities and tend to favour the capital region and urban deltas, with a variety of advantages including better access to financial assets, import-export licences and better provision of public services (Henderson, 2010; Sahoo, 2016).

Table 1

Population development in different city sizes, following UNDESA (2018) definitions

	<i>Percentage of urban</i>			<i>Total population (million)</i>		
	<i>2000</i>	<i>2020</i>	<i>2030</i>	<i>2000</i>	<i>2020</i>	<i>2030</i>
South Asia						
< 300 000	47%	42%	39%	199	298	350
300 000 - 1 million	13%	13%	13%	56	90	119
> 1 million	40%	42%	47%	167	321	421
Sub-Saharan Africa						
< 300 000	52%	48%	42%	105	219	289
300 000 - 1 million	17%	15%	15%	32	71	101
> 1 million	31%	37%	43%	65	169	276

Box 1: The urban share: a definition issue

Urbanization is expected to continue towards 2050, although the projected urban share depends basically on the definition given to “urban”. There is no shared international definition of urban, as each country has its own classification (van Huijstee et al., 2018). These classifications can be based on political/administrative aspects, morphological characteristics related to population density and size or build-up area, or the functions cities perform for their inhabitants (OECD/SWAC, 2020). The projections given in Figure 3 are derived from the differing definitions provided by the countries themselves, rather than one general definition. Consequently, comparing levels of urbanization between countries is not accurate, although it gives an indication.

3.1.3 Rural-urban migration

Migration to cities, both temporary and definitive, is a common strategy to increase livelihood resilience by diversifying rural household incomes (Neumann and Hermans, 2017). However, migration from rural areas to cities is perceived as a concern by many governments of low- and middle-income countries. These concerns include rising urban unemployment, providing services to new arrivals, the proliferation of urban slums and the potential for political unrest (De Brauw, Mueller and Lee, 2014). For rural areas, concerns of rural out-migration include loss of vital workforce and a skewed composition of the population, as mostly young people decide to migrate (Bisht, Rana and Ahlawat, 2020). Globally, 84 per cent of the low- and middle-income countries have policies to lower rural-urban migration, which is more than twice the level seen in 1996 (UNDESA, 2013). These policies include restrictions in terms of formal registration needed to work in the formal economy, vote or to obtain education, and restrictive zoning (De Brauw, Mueller and Lee, 2014; Tacoli, McGranahan and Satterthwaite, 2015). Land tenure insecurity in rural regions can also indirectly cause people to (temporarily) migrate. Even if people hold use rights to their land, they often do not have the right to rent out this land, and as such they can lose their land if they leave the village (De Brauw, Mueller and Lee, 2014).

Despite restricting policies and limited services in new urban neighbourhoods, migration is expected to continue in African and southern Asian countries. Expected economic opportunities, education and existing social networks attract people to cities; in particular larger cities are perceived as attractive (Henderson, 2010; Hoffmann et al., 2019; Neumann and Hermans, 2017). These perceptions are also reflected in the

projected and historical growth of larger cities, as illustrated in Table 1. In general, these cities have better overall services and facilities in terms of electricity, water, health care and education. However, in the newly developing neighbourhoods of large cities, living conditions are scant in terms of proper housing, transport, education, utilities and health services, which creates a growing divide within cities between these neighbourhoods and the more developed and affluent ones, mostly inhabited by long-term residents (Henderson, 2010; Satterthwaite, 2017). Migrants find employment mostly in the unstable and low-paid informal sector (Tacoli, McGranahan and Satterthwaite, 2015). Enabling conditions for finding decent employment are multifaceted, including having a (secondary) education, a social network in the city, specific skills and access to information, for example by having a mobile phone (De Brauw, Mueller and Lee, 2014; Tacoli, McGranahan and Satterthwaite, 2015). However, the opportunity to be successful is also largely dependent on government policies.

Climate change and environmental degradation can affect rural-urban migration movements, in terms of both reductions and increases, depending on the context (Mueller et al., 2020). Historically, in rural regions where manufacturing cities are close by, drier conditions have contributed to urbanization (Henderson, Storeygard and Deichmann, 2017). Cities with a manufacturing industry offer employment opportunities independent from agriculture; this employment can offer an escape from environmental shocks affecting livelihoods depending on agriculture. However, in towns and cities dependent on economic activities in the agricultural sector, environmental shocks affecting agriculture also reduce the demand for urban services and urban labour, resulting in fewer urban opportunities for rural dwellers (Henderson, Storeygard and Deichmann, 2017), hindering rural transformation.

Migrants sometimes decide to move back to their rural region of origin when their conditions deteriorate. Newly arrived migrants are often among the most vulnerable groups, also in terms of food security, because of their unstable and low-paid jobs, spending a large part of their disposable income on food. This vulnerability became very clear during the 2007/2008 food crisis, when prices for staple food crops spiked and the urban poor were hit hardest, leading to food-related riots and an increase in circular migration back to the countryside (Matuschke, 2009; Potts, 2009). The impacts of COVID-19 have already forced numerous migrants to move back as a result of deteriorating employment opportunities for the non-skilled migrants.

3.1.4 Land use change and urban expansion

Growing urban populations almost always result in the spatial expansion of urban areas, often in informal peri-urban neighbourhoods and peri-urban agricultural land (Dapilah, Nielsen and Akongbangre, 2019; Marshall and Randhawa, 2017; Smit, 2016). This dynamic is sometimes referred to as urban sprawl, describing informal and uncoordinated expansion of cities on vacant or non-vacant land. Sometimes, land that is used informally by farmers is grabbed for urban development projects; in other cases, farmers sell their land, voluntarily or under pressure. Replacement of agricultural farmland and natural areas, and the construction of infrastructure have affected habitat quality and caused biodiversity loss, leading to serious environmental degradation (Abu Hatab et al., 2019; Mundia and Aniya, 2006).

A study by van Vliet (2019) shows that the historical share of urban land expansion into cropland areas has been relatively low in sub-Saharan Africa (1.9 million ha) and South Asia (2.4 million ha in Bangladesh) compared with the global total of about 38 million ha between 1992 and 2015. In South Asia, over 75 per cent of the urban expansion took place on former cropland, whereas urban expansion into cropland was less than 40 per cent in sub-Saharan Africa. The equivalent food production loss differed between approximately 1.1 million tonnes in sub-Saharan Africa and 7.1 million tonnes in South Asia. As farms in peri-urban areas make room for urban expansion, they often move further away from the cities and convert more remote natural areas, mostly forests and scrublands, into new farmland (van Vliet, 2019).

By 2030, the loss of cropland as a result of urbanization is expected to be 3 per cent in the whole of Asia, resulting in a 6 per cent production loss (d'Amour et al., 2017). In Africa, the effects are tripled: a 3 per cent cropland loss translates into a 9 per cent crop production reduction, most of which will take place in Egypt and Nigeria (d'Amour et al., 2017). This is because agricultural land around cities is often more fertile, an important reason why cities historically developed, and therefore the productivity loss is higher than the absolute loss of land. Thereby, farmers in South Asia and sub-Saharan Africa located close to cities tend to

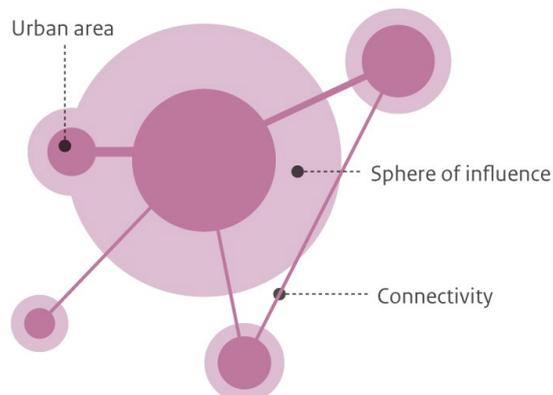
use more inputs and more advanced farming techniques (Gibson et al., 2017; Vandecasteele et al., 2018). The projected increase in urban area is projected to further harm biodiversity via direct conversion of natural to urban areas or indirectly via the loss of fertile cropland compensated on natural lands, which are often less productive (Seto Güneralp and Hutyra, 2012; van der Esch et al., 2017). In addition, rising urban-based food demand is an indirect driver of the conversion of natural lands into agricultural land, especially in combination with welfare increases, increasing the demand for animal products, which are more land use intensive.

3.2 Spatial patterns of urbanization

The spatial patterns of urbanization and the quality of rural-urban linkages are two important factors for inclusive rural-urban development (Akkoyunlu, 2015; Christiaensen and Todo, 2014). In general, a geographically balanced pattern of cities contributes to more poverty reduction, as a result of several mechanisms (conceptualized in Figure 4). A dispersed pattern of urban markets implies that more smallholder farmers have physical access to these markets. Thereby, farmers close to urban markets receive higher returns on average and they benefit most from growing markets for high-value products (Diao et al., 2019; Tadesse, 2012). Rural and peri-urban households living close to cities are more likely to diversify their incomes, shifting part of their employment in agriculture to rural non-farm activities (Diao et al., 2019; Djurfeldt, 2015). An extensive study by Christiaensen and Todo (2014) shows that migration out of agriculture into the “missing middle” (rural non-farm economic activities and employment in secondary urban regions) has yielded more inclusive economic growth patterns and faster poverty reduction than agglomeration in megacities. A growing local middle class¹ and expanding labour force drive changes in local food markets that may further accelerate opportunities for rural transformation. These opportunities are not only accelerated by the growth of urban low-skilled employment and rural incomes out of food production, but also via remittances from migrated family members and access to services, knowledge and technologies, infrastructure, roads, transport, finance, markets and electricity.

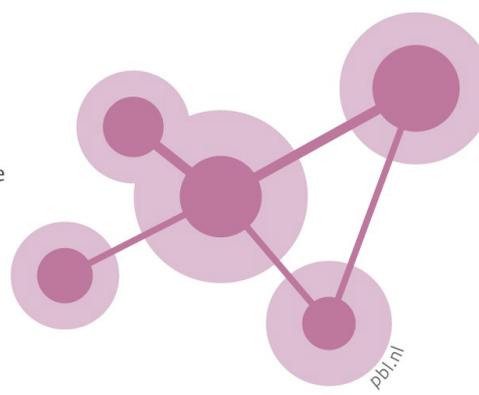
Patterns of urbanisation

Metropolisation



- Centralised markets and demand
- More centralised economic growth
- Higher levels of economic inequality
- Increased risk of slums and urban poverty

Dispersed urbanisation



- Decentralised markets and demand
- Scattered centres of economic growth
- More dispersed non-farm employment
- More inclusive economic growth

Figure 4: Conceptualization of urbanization patterns.

Source: de Bruin and Dengerink (2020)

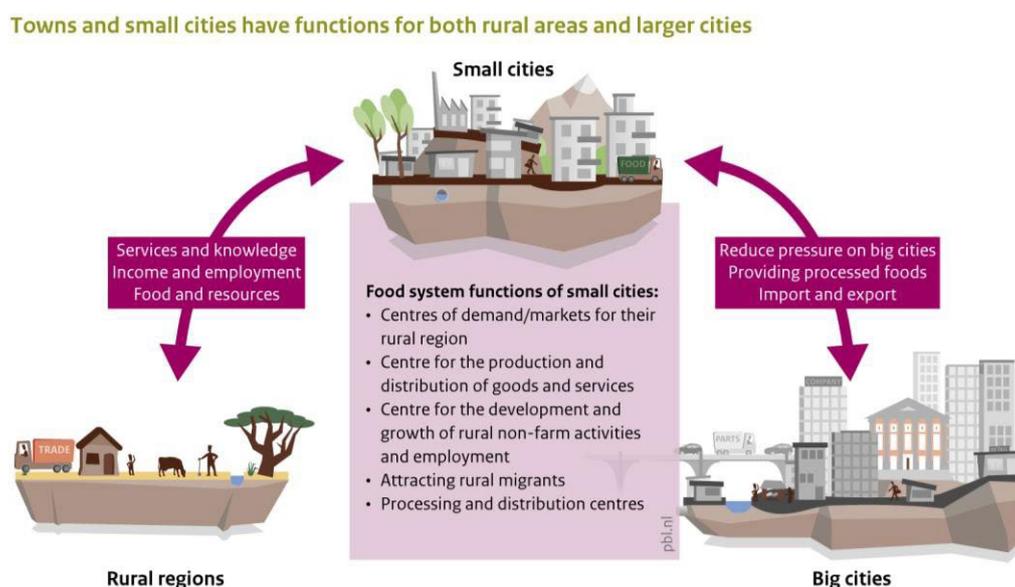
¹ The term middle class has multiple interpretations. As there is no shared definition of the African middle class, estimations of size range from 18 to 300 million in Africa: see van Berkum et al. (2017, pp. 8–9) for a discussion concerning the African middle class.

3.2.1 The role of secondary cities in food systems

The growth of secondary cities has been promoted explicitly by local, national and international policies, emphasized by the New Urban Agenda (Agergaard et al., 2019). This is because smaller cities tend to contribute more to regional poverty reduction than the development of larger cities, through generation of more accessible local non-farm employment for the (rural) poor and the lower cost of living in these smaller cities (Christiaensen and Todo, 2014; Gibson et al., 2017). Imai, Gaiha and Garbero (2018) found that a rising population in megacities (>1 million inhabitants) has little effect on poverty reduction, and even increases poverty in some cases. Similarly, the expansion of secondary cities in India generated more poverty reduction than the growth of large metropolitan areas by displaying more inclusive growth patterns (Gibson et al., 2017). This implies that the current growth of major cities in sub-Saharan Africa and South Asia could weaken significantly future growth–poverty linkages.

Investing in infrastructure and facilities in secondary cities and towns is crucial to connect different urban centres with each other and with the rural hinterlands, and to stimulate more dispersed patterns of urbanization (Dorosh and Thurlow, 2013; Torero, 2014). Both pre-harvest facilities (including financial services and the possibility to buy inputs and equipment) and post-harvest facilities such as collection hubs, (cooled) storage, distribution or processing centres, are of importance (Allen, Heinrigs and Heo, 2018; Dorosh and Thurlow, 2013). Access to storage would bring another advantage for farmers. They can increase their revenues with the seasonal increase in selling prices, if they are able to wait (Sheahan and Barrett, 2017). In line with the importance of storage, Torero (2014) underlines the importance of energy generation in sub-Saharan Africa, as up to 20 per cent of general sales get lost in the informal sector as a result of energy shortages in all areas. The problem of energy shortages is also present in South Asia although less stringent. In 1970 the region had almost three times less energy-generating capacity per person than in sub-Saharan Africa, while in 2000, capacity was almost twice that of sub-Saharan Africa (Torero, 2014).

The local availability and accessibility to (food value chain) infrastructure and facilities/services affect local labour markets and skills demands (Allen, Heinrigs and Heo, 2018), affecting the attractiveness of secondary cities and towns. The presence of these infrastructures and facilities also affects the functions of smaller cities and towns in food systems (conceptualized in Figure 5). These functions contribute to improved food system outcomes, by enabling farm households to gain access to the markets in towns, but also serve bigger cities by potentially reducing pressure on infrastructure, absorbing migrants and providing (processed) food.



Source: PBL

Figure 5: Food system functions of small cities

3.2.2 Rural-urban linkages

Rural and urban areas are not separate spaces, but two ends of a spectrum, connected via numerous linkages. How well rural areas are connected to both small and big cities is essential for the generation and (re)distribution of employment via (temporary) migration, income/cash, agricultural products, financial support and knowledge; i.e. the linkages between rural and urban areas. Figure 6 illustrates the different linkages that exist between rural and urban areas in the food system context. These linkages can be stimulated or blocked by the absence or presence of social networks, the quality of physical and communication infrastructure and policies stimulating rural-urban interaction. The linkages between rural and urban areas change as a result of urbanization, because of increasing population density and food demand, shortening distances to markets and the level of connectivity in terms of infrastructure or communication (Akkoyunlu, 2015; World Bank, 2009). When linkages are strengthened, farmers can sell increasing shares of their produce in urban markets (Agergaard et al., 2019; Da Silva and Fan, 2017). The importance of these linkages differs according to the situation. Torero (2014), for example, shows that having access to (digital) information on market prices via internet connections tend to have a positive impact on farmers' incomes. The better existing information streams, the more specific information is needed for farmers to raise their incomes, especially for farmers producing high-value crops. Box 2 provides information on rural-urban nutrient linkages.

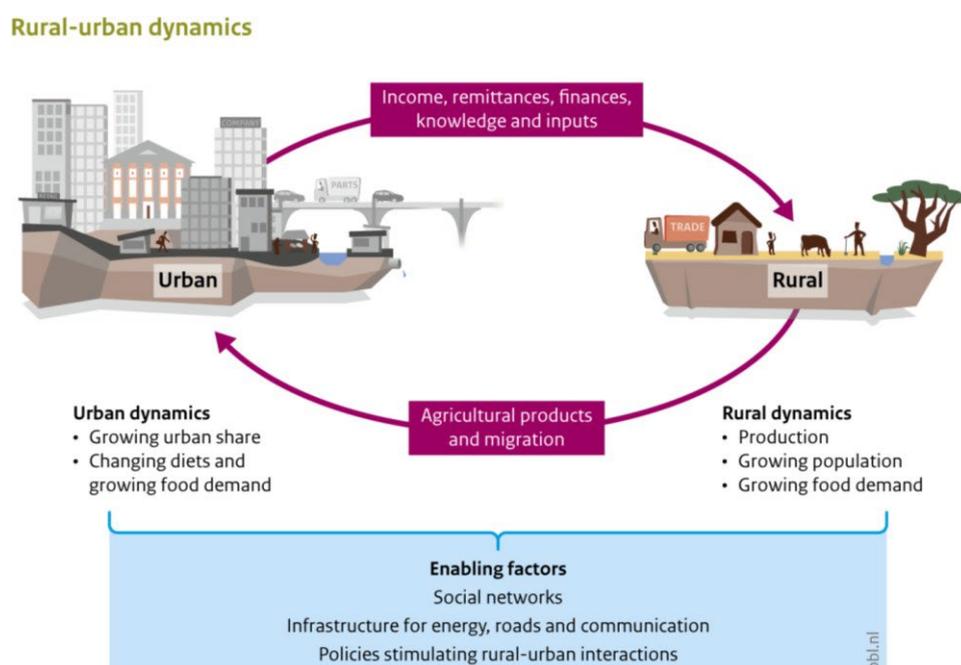


Figure 6: Conceptualization of rural-urban dynamics (Source: PBL)

Box 2: Urban-rural nutrient linkages: closing the nutrient loop

Large parts of rural sub-Saharan Africa and South Asia face major nutrient deficiencies and soil organic carbon loss (van der Esch et al., 2017). Soil degradation processes limit the soil's ability to provide nutrients for sustainable agriculture. The limited availability of micronutrients such as phosphorus (P), and macronutrients such as nitrogen (N), limits crop yields and decreases the nutritional quality of the food produced. Until the large-scale emergence of fossil-fuelled production of fertilizers, faeces and urine produced by city inhabitants were used to fertilize the lands that fed them (Bricas, 2019). Today, sludge from sewage treatment plants is often dumped (Bricas, 2019), if wastewater is treated at all. Nutrients in these waste streams are increasingly concentrated in the growing cities in sub-Saharan Africa and South Asia or discharged into the sea or rivers. These waste materials are generally just wasted – becoming sources of pollution, even though they can potentially be re-used as fertilizer. Lagging development in wastewater treatment in sub-Saharan Africa and South Asia are projected to dramatically increase nutrient discharge towards 2050, even in the most positive scenarios (Van Puijenbroek, Beusen and

Bouwman, 2019). If collected properly in sewage systems, N and P collection may yield substantial amounts for recycling in agriculture, up to 10 per cent* for rural and urban combined. The reclosure of N, P and more generally biomass cycles is therefore a key urban food policy challenge, linking urban growth with rural agriculture.

*Calculation made in the context of the Integrated Nitrogen Management System project. Data not published.

4. How urbanization changes food systems

4.1 Food preferences, purchasing power and food prices

Food preferences are altering in both South Asia and sub-Saharan Africa through a combination of globalization, rising average incomes and urbanization (Pingali et al., 2019; Reardon et al., 2015). Urbanization is not affecting food preferences and diets in splendid isolation. Even though urban food environments are, in general, different from rural food environments, affecting how often people eat out of their homes, other social and economic factors are of equal or even greater importance than whether people live in rural or urban areas (Popkin, 2014; Stage, Stage and McGranahan, 2010; Tschirley et al., 2015).

Because urban dwellers have, on average, higher incomes, urban diets differ from rural diets (d'Amour et al., 2020; Tschirley et al., 2015). Figure 7 illustrates the differences between average rural and urban food expenditures (including estimates on all own produced goods consumed), showing that urban dwellers have, on average, a higher purchasing power parity (PPP) and spend more on animal products and fruits and vegetables. The figure also shows that there are important differences between countries.

Per capita expenditure per year PPP\$ 2010

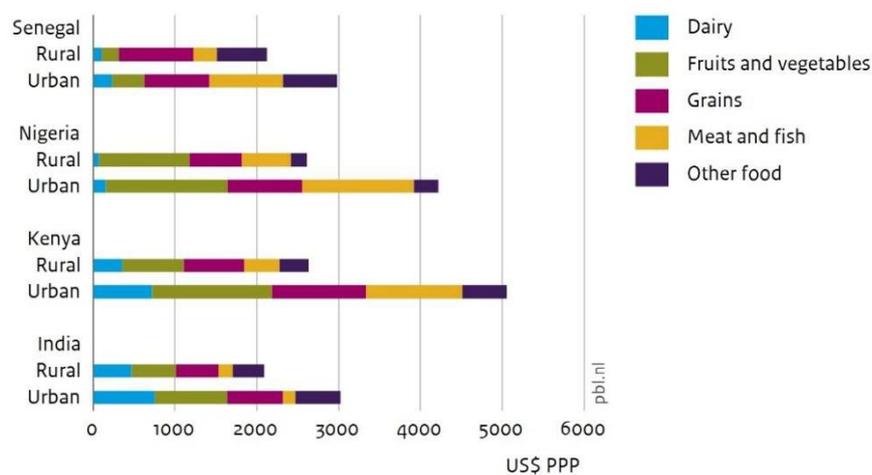


Figure 7: Average rural and urban per capita expenditure on different food groups in 2010. Source: World Bank (2020)

When incomes rise, people consume, on average, more animal products, fats and sugars as well as fruits and vegetables (d'Amour et al., 2020; Hawkes, Harris and Gillespie, 2017; Pingali et al., 2019). Total expenditure on food rises with income, although the share of food expenditure decreases (Gandhi and Zhou, 2014). Figure 8 illustrates that food consumption within rural and urban income groups does not differ much; the major differences can be observed between income groups, and between different regions (see Box 3 for an example from Nigeria). The data in Figures 7 and 8 provide an indication, although it is not possible to compare exactly between countries because of major differences in household surveys and in

price calculations of own produce. These figures confirm the importance, however, of including income levels when analysing potential dietary differences between rural and urban regions. Tschirley et al. (2015) confirm the importance of income by showing that rural middle class diets are going through the same nutrition transition as the urban middle class in Southern and Eastern Africa. Zhou and Staats (2016) expect that in West Africa, the demand for foods with high income elasticities, such as meat, dairy products, fruits, vegetables and oils, will rise relatively more rapidly towards 2040 than the demand for foods with low income elasticities. This growth will be higher in urban areas as a result of higher urban incomes, on average, and the growing urban share. Also in India, evidence shows the rising importance of non-staples in terms of expenditures. The share of monthly expenditure on cereal products is decreasing, whereas there is an increase in the share of expenditures on non-staples (Pingali et al., 2019). In rural areas, expenditures on cereals went down from 41.1 per cent to 10.8 per cent between 1971/72 and 2011/12. At the same time, in urban areas, cereal expenditure shares declined from 23.4 per cent to 6.6 per cent (Pingali et al., 2019).

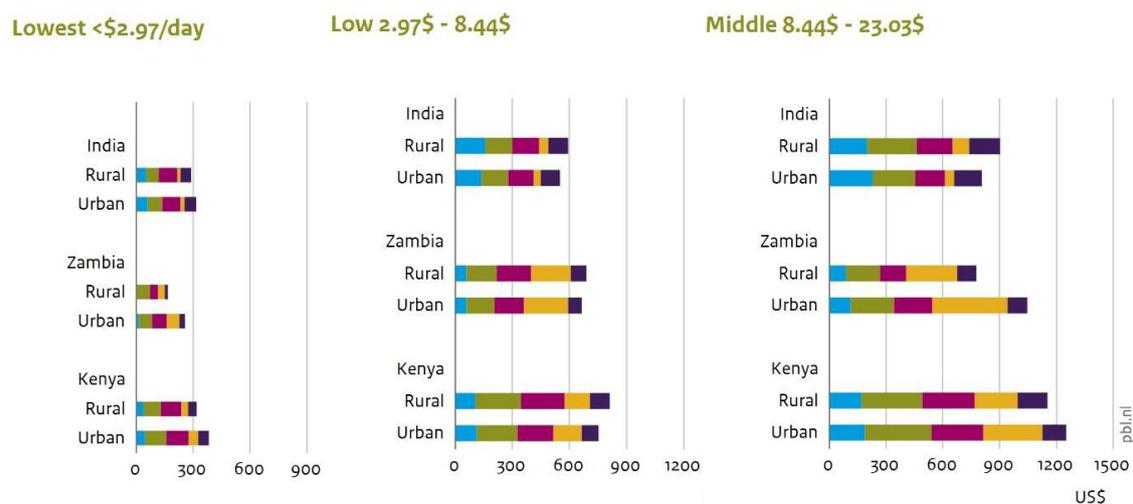


Figure 8: Expenditure on food groups per income group in rural and urban areas. “High” ranking has been left out because of missing data and limited credibility according to the World Bank (World Bank, 2020)

Box 3: Regional differences in Nigerian staple crop consumption

In Nigeria, the regional difference in staple crop consumption is larger than the difference between rural and urban consumption (de Lange, 2019). In the north, sorghum and millet are the most important staple crops, whereas roots, tubers and maize are important for the southern regions. Nigeria is the continent’s leading consumer and importer of rice, as well as one of the largest producers in Africa (FAO, 2019). A study from 2010 reported that Nigerians prefer imported rice to local rice because imported rice is free of stones and other debris, and is perceived to have a better quality and taste (Bamidele, Abayomi and Esther, 2010). The fact that people living in the south consume more imported rice than those in the north could be explained by at least two factors. The south is richer on average, making imported rice more affordable. Also, the ports are located in the south, making imported rice physically closer. Northern Nigeria is economically and culturally part of the Sahelian zone, less prosperous and not well connected to markets where imported foods are available.

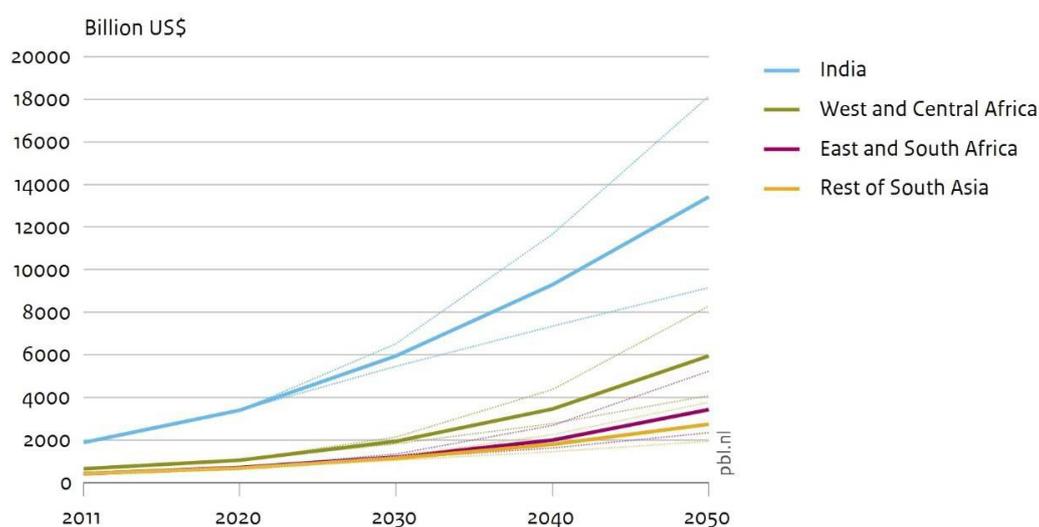
4.1.1 Rising and unequal incomes

Although urbanization and rising per capita income often occur simultaneously, these are separate processes, as urbanization can occur without substantial levels of economic growth (Chen et al., 2014; Turok and McGranahan, 2013). Income growth is associated with reductions in undernutrition as well as increases in overweight (Webb and Block, 2012). This is mirrored in the overall percentage decrease of food-insecure people in sub-Saharan Africa and South Asia since 2000, where per capita incomes have been rising over the last few decades. As inequality, in terms of both income and property, has increased in

most countries (Rao et al., 2019), poverty headcounts and food insecurity have not decreased in line with increasing gross domestic product (GDP), and the absolute number of people being food insecure actually went up. In some countries, poverty has not decreased at all, or only slightly. In particular, Nigeria has a large share of people living in extreme poverty, despite its natural and economic wealth (Stephen and Simoen, 2013). Other countries, including Ethiopia, India, Kenya and Niger, have managed to decrease substantially the share of people living in poverty. However, many of these people are at risk of falling back into poverty (income of < US\$1.90 per day) as a result of climatic or economic shocks (Hallegatte et al., 2016), such as the economic impacts of COVID-19.

Although locally produced food is, in absolute terms, often more expensive in urban than in rural areas, food security levels are higher in cities than in rural areas because of the higher average purchasing power (Headey et al., 2018; Stage, Stage and Mcgranahan, 2010; Tibesigwa and Visser, 2016). For example, while 18 per cent of West Africa's rural population is undernourished, the figure for the urban population is 13 per cent (van Wesenbeeck, 2018). Studies in Ethiopia show that dietary diversity is also higher in urban areas than in rural areas, and affordable to more people (Geburu et al., 2018). Also, gendered differences in food security seem to be less marked in urban areas (Sharma et al., 2020). A study by Tibesigwa and Visser (2016) finds that differences in food security between female- and male-headed households in South Africa are, on average, lower in urban areas, although female-headed households are, on average, more food insecure in both areas. The study also confirms that all rural households are more likely to report chronic food insecurity. However, most rural and urban people cannot afford a healthy and diverse diet, as proposed by the EAT-Lancet commission in sub-Saharan Africa and South Asia (Hirvonen et al., 2019; Sharma et al., 2020).

Gross Domestic Product



Towards 2050, GDP is projected to rise in sub-Saharan Africa and South Asia, especially in India. Per capita incomes will also rise, although population growth will reduce this progress. Commodity prices are expected to rise in most African regions, lowering overall food accessibility (Tabeau et al., 2019). Figure 9 illustrates the projected GDP and GDP per capita growth for three scenarios, specified for four regions, to show the differences within the regions. The economic consequences of COVID-19 are not included in the projections, so the growth patterns are likely to be overly optimistic. Although average absolute incomes are expected to rise, income inequality in both sub-Saharan Africa and South Asia are fairly high. The top 10 per cent of the population receives, on average, 65 per cent of the national income in sub-Saharan Africa, and 56 per cent in India (Alvaredo et al., 2018). As economic inequality is expected to remain high, or even rise further (Rao et al., 2019), it would not be surprising if food insecurity remains high in both regions if no targeted measures are taken (Rougour and Van Marrewijk, 2015; Varadharajan, Thomas and Kurpad, 2013).

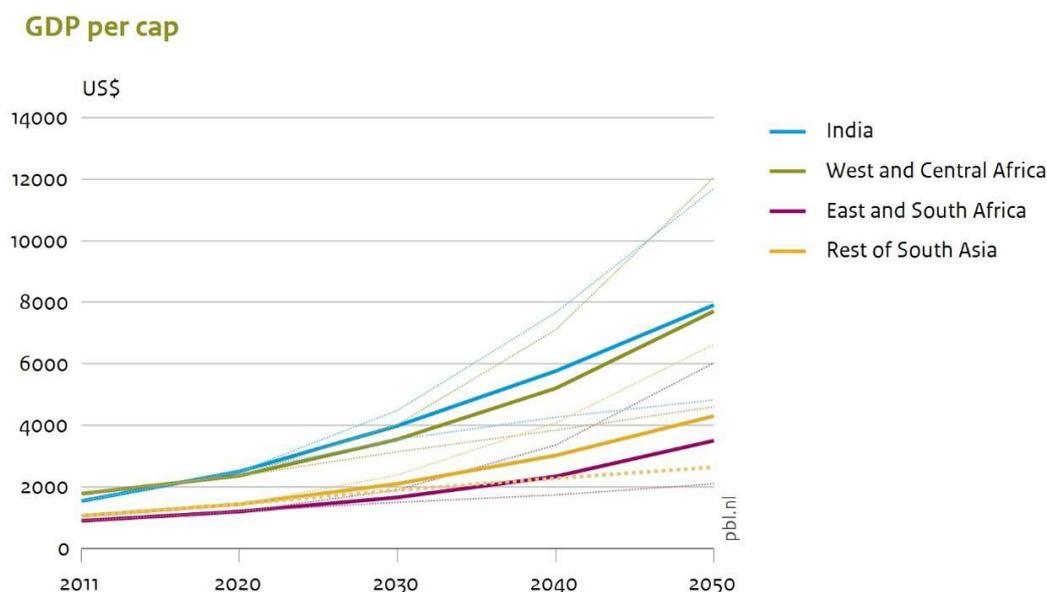


Figure 9: Above projected GDP and below GDP per capita; projections stem from before COVID-19. The solid line indicates a projection following a middle-of-the-road scenario (SSP2). The dotted lines in similar colours indicate a more negative (SSP3) and a more positive scenario (SSP1) (MAGNET-IMAGE).

4.1.2 Food prices

Whether urbanization affects food prices depends on whether urban food supply systems develop in parallel with the urbanization trend, which is affected by economic growth, trade dynamics, environmental degradation and absolute population growth. In coastal and major cities, imported foods are often relatively cheaper than local foods, especially when rural-urban connectivity is limited by weak supply chains (Vorley and Lançon, 2016b). The historically low price of imported rice from South-East Asia have stimulated a rise in imports, especially in West African coastal cities (Moseley, Carney and Becker, 2010). However, during the food price spike in 2007/08, the relative high dependence on imported staples hit poor urban households most, although higher consumption of local cereal products were also observed (Moseley, Carney and Becker, 2010). In general, poor households in coastal and capital cities are most vulnerable to high world food prices because of the relatively high consumption of imported food in these cities (Stage, Stage and McGranahan, 2010). As urban population growth continues, especially in the big cities, poverty also becomes more urbanized and therefore increasingly tied to global food prices (Djurfeldt, 2015). This is not bad news per se, as Minot (2014) shows that, in general, food price volatility is lower in the largest cities of 11 African countries than in the secondary cities. This is presumably because the large cities benefit from inflows from several regions, diminishing dependency on a limited number of supplying regions. However, smaller cities and towns are often well connected to the rural areas close by and have cheaper supplies of local foods during years of good harvests (Minot, 2014). The price of imported or processed foods can be more volatile in more remote towns or rural regions, although some prices are regulated, as in India (d'Amour et al., 2020; Minot, 2014; Pingali et al., 2019). Another factor contributing to higher food prices in cities is the formalization of food systems. Crush and Caesar (2014) show that in Msunduzi, a city in South Africa, the rising number of supermarkets in the city contributes to rising food prices, as well as to higher food quality and safety standards. This negatively affects the poor with unstable incomes, especially female-headed households whose levels of unemployment are higher than average and whose incomes are lower than average.

4.1.3 Urban food environments

An important difference between rural and urban areas is the local food environments. There are major differences between urban food environments, depending on the sizes of cities as well as their geographical position. Larger coastal cities and internationally well-connected cities are often better linked to international markets, providing a higher variety of imported goods (Vorley and Lançon, 2016b). In general, urban food environments provide more options regarding food products and places to buy food (supermarkets, food

vendors and restaurants) compared with rural food environments (Minot, 2014; Pingali et al., 2019). This wider range of food options includes unhealthy foods, often street food containing too much sugar, salt and fat, and/or highly processed food, which is accessible and cheap (Hawkes, Harris and Gillespie, 2017; Pingali et al., 2019). Urban food environments also provide access to diverse nutritious foods for people who can afford them. However, for the urban poor, the most easily available and affordable diets are mostly unhealthy (Hawkes, Harris and Gillespie, 2017). For them, access to healthy food categories such as fish, fresh fruits and vegetables is limited, as these types of food are more expensive in urban areas. The poorer households are inclined to prioritize calories over quality, spending their resources on more affordable, calorie-dense, micronutrient-poor food groups (Hawkes, Harris and Gillespie, 2017; Pingali et al., 2019). They depend mostly on their daily wages to buy food, and therefore are vulnerable to price spikes or other shocks as illustrated by the impacts of COVID-19.

There is one clear difference between rural and urban consumers in both sub-Saharan Africa and India for all income groups. The amount spent on eating out is significantly larger in urban areas than in rural areas, as illustrated in Figure 10 for India, Nigeria and Zambia. This difference can be clearly understood by the difference in food environments, shaped by the demands of consumers. D'Amour et al. (2020) show that in India, there is a significant positive correlation between processed food expenditure share and eating out, in that households more often eating outside the home are also likely to spend more on processed foods.

Yearly expenditures on eating out US\$ PPP 2010

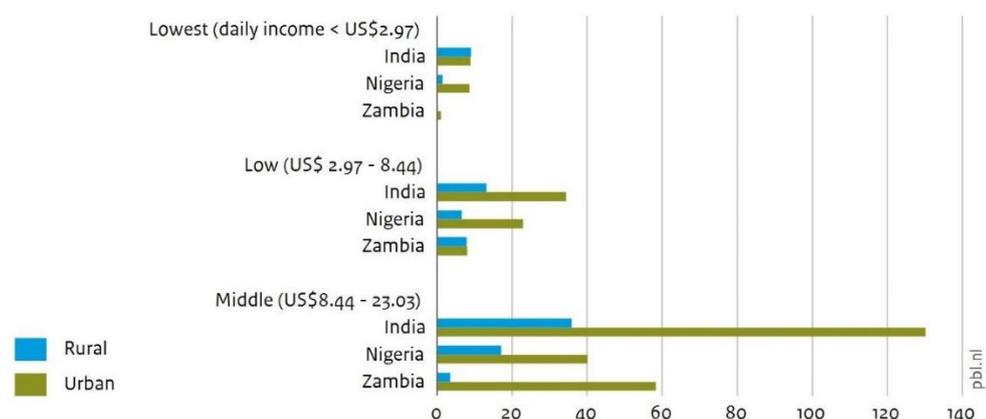


Figure 10: Expenditures in \$PPP on eating out in 2010. Source: World Bank (2020)

4.2 The projected rise in food demand

Future food demand depends on a range of factors including future population, level of urbanization and income growth dynamics. These underlying drivers are subject to uncertainty and not easily predictable in the long term. Different models provide a wide range of food demand projections, with projections by the Food and Agriculture Organization of the United Nations (FAO), as reported in Alexandros and Bruinsma (2012), being the lowest in a comparison of 10 models (Valin et al., 2014). Numbers given in the text below provide only a brief indication of expected growth in demand for food.

In sub-Saharan Africa, food demand is expected to rise approximately 2.5-fold by 2050 compared with 2010, following a “medium” scenario (Tabeau et al., 2019; Van Ittersum et al., 2016). Demand for meat, fruits and vegetables (Table 2) as well as dairy is expected to increase more, not only in urban areas, but also in the rural areas where welfare increases (Tschirley et al., 2015; Zhou and Staatz, 2016). In South Asia, total food demand is projected to rise less than in sub-Saharan Africa. The rise in food demand is projected to be around 70 per cent because of lower population growth projections, although the projected per capita income growth is relatively higher compared to sub-Saharan Africa (Alexandros and Bruinsma, 2012). The rise in income is reflected in the rising demand for meat, fruits and vegetables. Although meat consumption might increase five-fold in India, the average consumer would still be a modest meat eater in 2050, at around 18 kilogrammes per year (Alexandros and Bruinsma, 2012).

Table 2

Projected food demand for three food groups, including the impacts of climate change

		<i>Total demand (million tonnes)</i>		<i>Index (2010 = 1)</i>	
		<i>2010</i>	<i>2050</i>	<i>2010</i>	<i>2050</i>
Fruits and vegetables	South Asia (ex. Iran)	188	901	1.0	5.0
	Sub-Saharan Africa	102	321	1.0	3.1
Meat	South Asia (ex. Iran)	10	412	1.0	4.3
	Sub-Saharan Africa	11	48	1.0	4.2
Cereals	South Asia (ex. Iran)	283	479	1.0	1.7
	Sub-Saharan Africa	141	337	1.0	2.4

Source: IFPRI (2017)

Urban food demand is expected to rise two to four times more than rural demand because of the concentration of welfare and the growing urban population (Pingali et al., 2019; Zhou and Staatz, 2016), depending on the rate of urbanization and income differences between rural and urban areas. D'Amour et al. (2020) find that consumption of processed foods is higher in the large metropolitan areas of India compared with the smaller cities, controlled for socio-economic and demographic differences. This indicates that the consumption of processed (and fast) food will rise even faster if the megacities grow at a more rapid pace than the smaller cities, as is projected for South Asia and sub-Saharan Africa.

4.3 Changing rural opportunities

The growing dietary diversity and overall increase in demand cannot be met merely by the traditional food supply chains, and modernization of the food retail sector is required. This creates opportunities for millions of farmers, processors and traders, although millions of smallholder farmers remain isolated in less accessible or detached hinterlands. This heterogeneity is tied, not only to geographic isolation, but also to gender barriers, social exclusion and political decisions. This section includes a box on the impact of urbanization on farm sizes (Box 4) and ends with two in-depth case studies from India and Senegal (Boxes 5 and 6). These illustrate in more detail how changing and rising urban demand affects opportunities for rural transformation.

In rural regions that are well connected to urban markets or storage/processing facilities, small- and large-scale farmers are increasingly commercial in terms of crop and livestock production, and relatively well served by agribusinesses providing inputs and farm output marketing (Masters et al., 2013; Sharma, 2016). For example, in Meru, Tanzania, urbanization has stimulated the demand for milk, a reliable source of income for smallholders in a region facing (fertile) land scarcity (Hillbom, 2011). Access to inputs, backed up by stable institutions, were important conditions for intensification, resulting in higher incomes. The agricultural dynamic zones can extend quite far from towns and cities, depending on the connectivity between rural and urban areas, shaped by the proximity of cities and existing transport routes (Masters et al., 2013). The farmers located close to urban markets often receive higher returns on their agricultural products and benefit most from growing markets for high-value products, as discussed in section 3.2 (Diao et al., 2019; Tadesse, 2012). But although proximity to growing cities has a positive effect on crop and livestock prices, and on uptake of modern inputs and productivity, the effects on prices and productivity are lower for farmers in the rural hinterlands of secondary towns compared with more major cities (Vandercasteelen et al., 2018).

A rise and diversification in the production of (high-value) agricultural products close to cities also results in additional off-farm employment opportunities. An illustrative example of fruit production comes from Ilula, Tanzania, described in Tacoli and Agergaard (2017). Ilula is a mix of built residential and commercial areas, surrounded by land suitable for the production of tomatoes. The settlement is located around six to eight hours from Dar es Salaam beside a highway connecting large towns that are expanding. Trade in this settlement has been supported by a new centralized market and sustained by growing urban demand and improved infrastructure. Along with the growing market, off-farm employment has increased and diversified, including activities such as sorting, grading, packaging and transport to urban markets, raising overall welfare of the settlement. The weaving of baskets, creating off-farm employment, especially for women, is a

small industry on its own. Another example is given in a study by Afriyie, Abass and Adomako (2014), showing the multiple development impacts resulting from the growth of Kumasi in Ghana. Peri-urban (< 20km from the city in the study) agricultural activities are declining, but new livelihood activities are evolving in response to urbanization. In the study areas, an increase in non-farm job opportunities, infrastructure development and greater access to knowledge and skills were clearly observed.

A study by Tadesse (2012) provides evidence for the importance of towns to rural development in Ethiopia. Data from four major regions in Ethiopia have been used to show that some functions, such as roads, transport and communication services, enable commuting to towns where non-farm jobs are concentrated. These functions facilitate the flow of information about mainly non-farm employment and help households take their products to markets at a lower cost. A second mechanism is the way public services, like the provision of utilities, contribute to the production process in non-farm enterprises. They help increase productivity and efficiency, which increase the probability of employment and income. The study also shows that towns' functions positively influence the ability of households to access markets for selling their crops and for buying inputs, especially fertilizers. The evidence suggests that road proximity and the quality of the roads contribute to promoting crop marketing and fertilizer adoption and application.

The producers in the dynamic agricultural zones also face potential trade-offs from urbanization, with pollution from industry and untreated wastewater from the cities and competition for land and water undermine food safety and rural livelihoods. Urban expansion can threaten rural livelihoods by depleting local natural resources. In particular, smallholder farmers located close to expanding cities are at risk of losing their livelihoods. An example can be found in north-western Ghana, where the clearing of shea trees for sand and stone mining and residential housing reduces the opportunities of rural communities, especially minorities and women, as the loss of income is not compensated by other opportunities (Dapilah, Nielsen and Akongbangre, 2019).

Box 4: The impact of urbanization on farm sizes

Urbanization has ambivalent impacts on farm sizes and therefore on inclusive rural transformation, depending on land tenure security, non-farm opportunities, and the magnitude and impact of land purchases by urban buyers. There are in total 137 million farms in India and 51 million in sub-Saharan Africa, and over 80 per cent of the smallholder farmers have less than 2 ha. In low-income countries, farm sizes have decreased from an average of 2.5 ha in 1960 to 1.5 in 2000 (Lowder, Scoet and Raney, 2016). The rising populations have decreased farm sizes, with less land available per family until non-farm opportunities, often in cities, expand sufficiently to absorb all new workers. Asia has now passed this turning point so its average farm sizes can rise, while in Africa average farm sizes are expected to continue to fall, posing challenges in both hinterlands and commercialized areas (Masters et al., 2013). The rising acquisitions of farmland by urban buyers in sub-Saharan Africa increases average farm sizes (Jayne et al., 2016). The growth of emergent farmers in Nigeria and Zambia for example is partly attributable to land acquisition by salaried urbanites, which exacerbates rural income inequality (Muyanga et al., 2019; Sitko and Jayne, 2014). The implications for rural development are not completely clear, although Jayne et al. (2016) concludes that this is likely to reduce the rural impacts of agricultural growth and local overspill to the rural non-farm economy, and thus reduce opportunities for inclusive rural transformation.

In the more isolated rural areas, opportunities that arise from growing and more diverse urban demand are limited due to low productivity and high transaction cost (Masters et al., 2013). Swain and Teufel (2017) provide an example by showing that farmers with limited access to urban markets have limited opportunities to profit from urban development. Dorosh et al. (2012) show that in sub-Saharan Africa, the adoption of high-input technology and crop productivity is negatively correlated with travel time to urban centres. Stifel and Minten (2008) specify these dynamics for Madagascar, where they find a strong negative relation between level of isolation and agricultural productivity as well as welfare, controlled for soil fertility. The authors provide several explanations. Higher transaction costs associated with isolation lead households to employ less household labour and use less fertilizer. High prices for inputs in isolated areas make households invest little in their land, but rather expand into less fertile land. Finally, Stifel and Minten (2008)

find that more isolated households underinvest resources in their agricultural land when the benefits are uncertain in the presence of violence and other forms of insecurity.

Box 5: Case study I: Food system transformation in the National Capital Region of India: opportunities for inclusive rural transformation in Haryana State

Food habits and choices in India are shifting because of urbanization, rising incomes and transforming food markets. This trend is also reflected in the National Capital Region (NCR), the central planning region centred around Delhi, encompassing Delhi and surrounding districts from the states of Haryana, Uttar Pradesh and Rajasthan (Figure 11). The NCR has a population of over 46 million and an urbanization level of 63 per cent.

Urbanization, food consumption and growth in vegetable cultivation

Most low- and middle-income households in Delhi spend at least two-thirds of their income on food (Pradhan et al., 2013). The major expenditures include vegetables (22 per cent of total food expenditure), milk and milk products (16 per cent), and cereal and related products (15 per cent). Incomes, food prices, food preferences and seasonal variations influence food expenditures. Vegetables and dairy products are becoming increasingly important components of consumption in high-income households, but also in low- and middle-income households (Pradhan et al., 2013). These changes in urban consumption have direct impacts on vegetable cultivation and dairy farming in the rural areas of the NCR region. Vegetable production in Haryana has increased significantly because of its close proximity to Delhi. In 2009/10, the production area of vegetables was 300,860 ha, with a harvest of 4 million tonnes. This increased to 443,598 ha with a production of 7.3 million tonnes in 2018/19 (Government of Haryana, 2010; 2019). Land that used to be cultivated with cereals is increasingly being converted to vegetable production and productivity is rising. This trend is also reflected in a study by Swain and Teufel (2017), conducted in the 20 villages of Karnal district, Haryana. The study shows major changes in land use, diversification of crops and increasing productivity. More land is being used to produce vegetables and fodder grass, rather than the primary focus being on grains. Improved access to markets as a result of urbanization, and irrigation facilities, appear to be the main drivers for increasing cropping intensity and diversification.

The trend towards increasing land use for more productive vegetable cultivation is expected to continue in 2019/20 as a target of cultivating 463,000 ha of vegetables has been set with a production of over 9 million tonnes. According to the Horticulture Vision prepared by the Haryana government, 15 per cent of the total cultivated area will be brought under vegetable cultivation by 2030, up from 7.6 per cent at present (Government of Haryana, 2019). This goal will materialize only if there are also simultaneous efforts to develop a regional-level plan to secure and protect fertile agricultural land from the widespread process of urbanization and real estate development.

Source of income and changing consumption in rural areas

Transformation of food habits in urban areas and changing agricultural practices have had a positive impact on the incomes of rural households in Karnal district, where the major source of income comes from farming followed by the income earned through agricultural labour (Swain and Teufel, 2017). Similar findings in a comparable part of the NCR also show growing consumption by rural households. Sharma (2018) shows that the growth in consumption by rural households (9.7 per cent) is greater than that for their urban counterparts (8.6 per cent). However, a reduction in agricultural wages because of reductions in social security and lowering of crop prices indicates that this rising welfare is not distributed equally (Sharma, 2018).

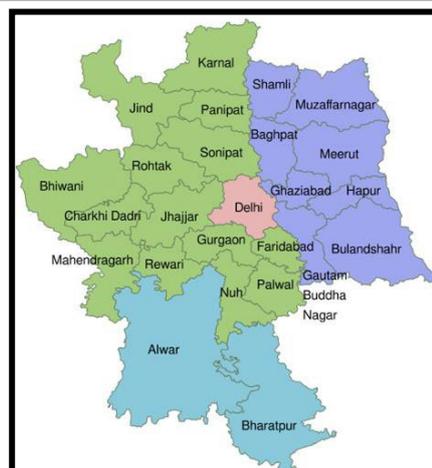


Figure 11: The National Capital Region

Opportunities for inclusive transformations

There are several initiatives by the Haryana government in the NCR region to support vegetable cultivation including establishment of high-tech polyhouses for cultivating non-seasonal vegetables, climate-smart agriculture initiatives, establishment of a horticulture university and supporting farmers'/producers' organizations. There is, however, barely any plan at the regional level to protect fertile agricultural land from land acquisition for urban development projects. A comprehensive city-region plan for the NCR, which encapsulates agriculture as a land use category, could be an additional step to support vegetable cultivation. There is also a need to enable institutional and policy mechanisms to promote dairy farming, which could significantly improve rural livelihoods in the region (Swain and Teufel, 2017). Farmers travel long distances to sell their produce in the formal market, with some even travelling to Delhi (The Times of India, 2018). Establishing decentralized markets will benefit small-scale farmers as it will save transportation costs and add to their incomes.

Box 6: Case study II: Urbanization, dietary changes and rural-rural migration in Senegal

Senegal has undergone unprecedented economic, demographic and institutional changes in recent decades, seeing its society evolve from a predominantly subsistence rural economy to an economy that is increasingly market-driven. Senegal's population increased five-fold between 1960 and 2018, from 3.2 million to 15.9 million, and the urban population increased from 23 per cent to 47 per cent in the same period (UNDESA, 2020). In Senegal, urbanization is coupled with changes in dietary habits. Rice, which is mainly imported, has a more significant place in the urban diet, to the disadvantage of local cereals (John, 2015). The consumption of rice started under colonial rule when the introduction of groundnut cultivation diminished local cereal production. The local cereal production became insufficient to feed the rural and even more so the urban populations (Van Chi-Bonnardel, 1978). Broken rice imported from South-East Asia made up for this shortfall, resulting in a dichotomous food system. In urban areas, imported rice has become the staple food, whereas people in rural areas rely on a variety of local cereals. Broken rice has penetrated the dietary habits of the urban population because of its ease of use and the diversity of its dishes, which include the national dish, *Ceebu jen*. Under the combined effects of population growth, changing dietary habits and urbanization, dependence on imported rice is increasing (John, 2015), as in many West African coastal cities (Moseley, Carney and Becker, 2010).

Urbanization and transformation in rural areas

The rising consumption of rice as a staple food has increased the demand for vegetables, since these are included in almost the entire range of rice dishes. To meet this demand, production of vegetables has increased almost 30-fold from 45.3 million tonnes in 1960 to 1,349 million tonnes in 2019 (ANSD, 2020). This increase, resulting from both intensification and expanding agricultural land use, has led to the development of dynamic vegetable value chains. The Niayes area is an important area for vegetable production because of the favourable climatic conditions and the existence of agricultural facilities that allow for year-round activity. The Niayes area has benefited from significant public investments for water control and the development of irrigated agriculture. However, overuse of groundwater sources and climate variability are threatening the sustainability of irrigation in the Niayes area (Fare et al., 2017). Today, Niayes farmers provide half to two thirds of the national production of fresh vegetables (Fare et al., 2017).

The Niayes area (pink area in Figure 12) has become a rural inflow area for workers from the rain-fed areas, the so-called groundnut basin (46,367 square km), where farmers are dependent on rainfall and subject to soil degradation. Migration is quite significant in this region and migrants represent, on average, 15 per cent of households, compared with 6 per cent in Niayes (Hathie et al., 2015). Especially at the end of the rainy season, people from the groundnut basin temporarily move to the Niayes area for around three or four months of the year, where they are engaged mostly in watering vegetable plots or farming on plots owned by locals, a practice known as sharecropping (Hathie et al., 2015).

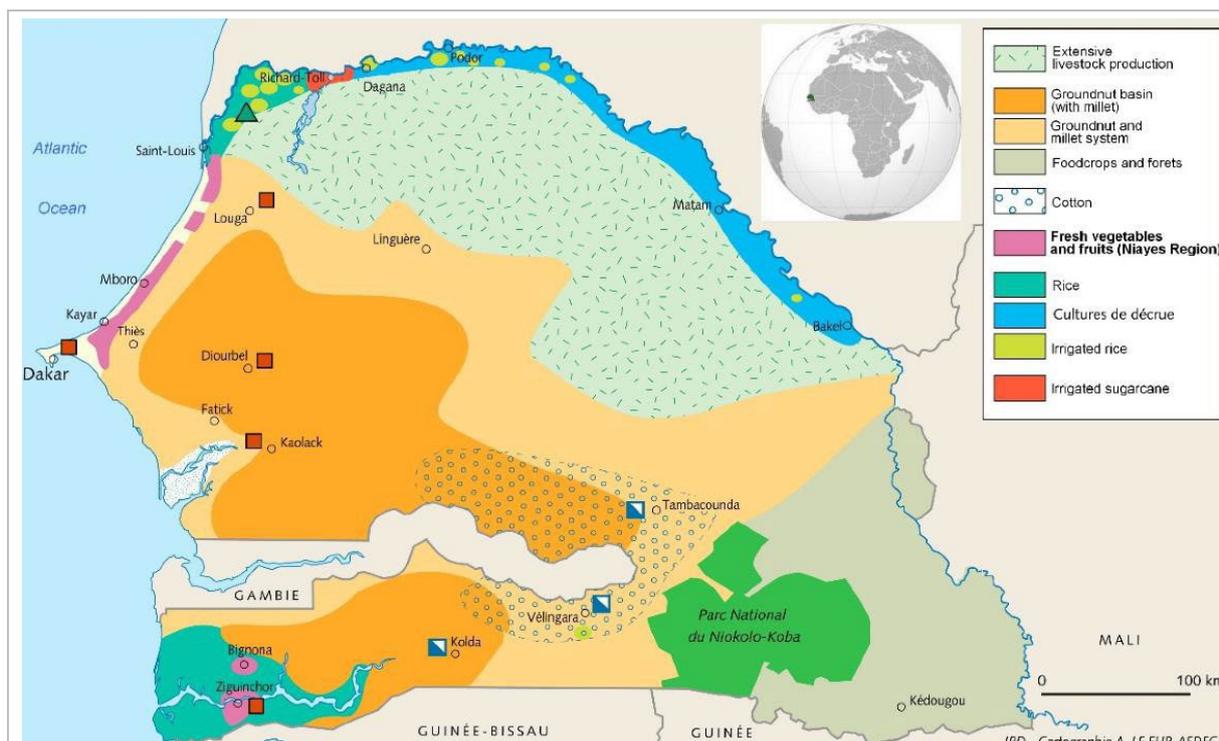


Figure 12: The main agricultural regions of Senegal, including the Niayes region. Source: Fare et al. (2017)

Changing rural employment resulting from urbanization

Urbanization leads to a greater demand for vegetables and therefore for labour for their production. This dynamic is transforming rural areas in terms of labour opportunities, market linkages and cropping patterns. As a result, rural areas that can produce a crop in the dry season become areas of arrival of migrants. Rural-rural migration enables rural households to diversify their sources of income. With urbanization and increasing demand for food, the development of irrigated areas offers new employment opportunities for rural people, often youth. Investing in sustainable water control, the structuring of value chains and providing information regarding opportunities and support for young migrants will be new challenges for the national and local Senegalese government.

5. Foodsheds: potential regional production responses

Section 4 discussed how urbanization, in combination with other drivers, affects food preferences, diets and rural opportunities. Towards 2050, urban and rural food demand is expected to rise, which implies that productivity has to increase, or the cropped area has to expand. This section provides insights into where food for the growing urban population could come from, without harming rural access to food, under a “middle-of-the-road” population scenario and accounting for the effect of climate change. It also shows where and to what extent improved productivity through agronomic and water conservation measures could enhance the production of food from within a city’s foodshed.

5.1 Defining foodsheds

Foodsheds are a way to visualize the “localness” of food production and the extent to which cities can rely on the surrounding rural areas to fulfil their food demand. Foodsheds have been defined as self-sufficient areas with internal dependencies, i.e., where supply matches demand. This emerging concept (see also Kinnunen et al. (2020) and Karg et al. (2016)) links supply and demand and defines the area on which a city

depends for its food supply. Where cities lie close together or food production is low, and foodsheds of individual cities are hard to delineate, a foodshed represents a cluster of cities within the surrounding rural area. In the most extreme case, excess food production would be nowhere near sufficient to meet urban demand, and the region, both its urban and rural areas, becomes part of the global foodshed, linked through international trade. Here, our foodsheds do not represent full self-sufficiency, but indicate the potential region of influence of cities, and we show the extent to which demand can be met by supply from within a foodshed.

The foodsheds in this analysis are based on two main principles that underpin the Gravity model (Isard, 1954) with which bilateral trade is explained:

- Trade increases with economic size: larger cities attract food first (but only the excess amount of food, after correcting for the needs of the rural population in each location).
- Trade tends to fall with distance: food is sourced as close by as possible, limiting travel time and related costs. Here, we use open-source data on travel time from each location to the nearest cities. Crossing international borders adds additional delay; here assumed to be 24-hours.² This prioritizes domestic food supply, but regional trade is not excluded.

Demand from rural and urban areas is based on a standard of 2,000 kilocalories (kCal) per person per day for the vegetable component of an average diet (without the meat, fish and dairy components, which are not included in this analysis). We thereby ignore possible changes in diets linked to increased urbanization and changing lifestyles and welfare, generally leading to greater consumption of animal proteins and vegetables. FAO data on dietary composition shows the calorific content of the total vegan part to be fairly constant across countries, ranging from 1,800 to 2,500 kCal per person per day for the vast majority. Supply is based on detailed modelling of all major food crops, with yields and cropped area calibrated at country level to ensure our baseline 2010 situation matches FAO national statistics.³ Losses at harvest, in storage and in consumption are accounted for, as well as the fraction of produce used for livestock feed and biofuels. At the global level, food production in this analysis matches demand within a 5 per cent uncertainty margin. The possible expansion of agricultural area is not included in this analysis. Cities above 100,000 inhabitants were selected as the starting points for our foodsheds (330 cities in sub-Saharan Africa and 196 in India).⁴

While based on well-known principles, foodsheds are meant to showcase and visualize the regions that may need to import more food or those that may have the potential to reach high self-sufficiency levels by investing in enabling conditions. Being hard to verify/validate beyond the principles that underlie them, they represent a hypothetical situation. Earlier studies have estimated that globally, about 30 per cent of food can be fully locally sourced (radius of 30 km) under current conditions (Kinnunen et al., 2020). Foodsheds give an indication of where that food can be sourced from, and in which regions the urban-rural connectivity is strongest.

5.2 Foodsheds today and by 2050

In sub-Saharan Africa, West Africa has the capacity to be fully self-sufficient in food demand in the 2010 baseline (Figure 13). In addition, parts of Eastern Africa (Ethiopia, Sudan) and southern Africa, with the regions around Johannesburg in South Africa being very productive, come close to providing food crop demand from their local foodsheds. Overall, sub-Saharan Africa produces 84 per cent of its overall (non-meat, -fish and -dairy) crop food demand; the rest must be supplemented by imports from outside the region. In particular, densely populated Eastern Africa (Burundi, Rwanda, Uganda) lacks sufficient local crop production. This gap reflects findings by Van Ittersum et al. (2016), which focused on cereals, and shows that particularly Uganda faced low self-sufficiency levels (< 60 per cent) in 2010. The foodsheds of Hargeisa and Mogadishu in Somalia can rely on crops produced locally for only about 10 per cent of the

² This number is derived from African Development Bank (2012) stating that: "The waiting time for a container/truck to cross a border post in Africa can range from 3 minutes to 2.8 days".

³ For a detailed description of the model, see Siderius et al. (2021).

⁴ Only cities of over 100,000 are selected in this analysis, decreasing the urban share compared with the United Nations Department of Economic and Social Affairs (UNDESA) definitions.

demand. On the west coast of Africa, Libreville in Gabon obtains only 25 per cent of its crop food demand from the surrounding foodshed, with oil income paying for food imports.

India's food self-sufficiency – the potential crop food demand supplied from within a city's foodshed – is higher, at 92 per cent overall, according to our analysis. In reality, India exports some cash crops such as Basmati rice while it imports much of its food oils. Individual foodsheds differ greatly in size. In the densely populated Indo-Gangetic plain in the north and north-east, high urban demand is surrounded by rural areas with high population density and relatively low productivity. The modest excess production leads to large, clustered foodsheds around the primary cities like Delhi, Kolkata and Lucknow. In the coastal foodsheds to the south-east, those around Chennai and Visakhapatnam remain somewhat lower in crop self-sufficiency (close to 70 per cent) than the surrounding foodsheds of Bangalore and Hyderabad, which because of the size of demand of their cities and surrounding areas have a strong pull on food produced in the countryside.

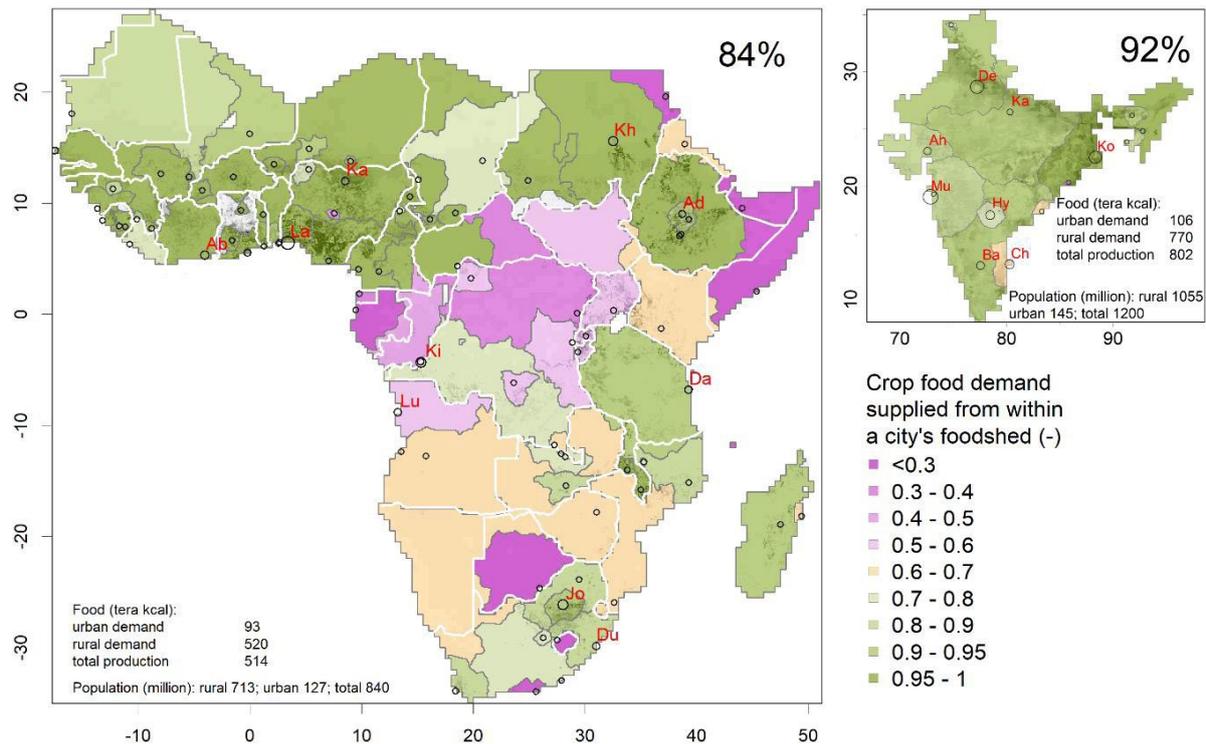


Figure 13: Sub-Saharan Africa and India's foodsheds based on the 2010 population and food production derived from the LPJmL global crop hydrology model, with losses based on FAO estimates. Colour shading and grey boundaries show individual foodsheds (with the main city of each foodshed indicated with an open circle). Food production (in kCal) is displayed in the map by the intensity of each colour. For the abbreviations of city names (in red), see Table 3. Sub-Saharan Africa has an over all potential food self-sufficiency of 84%. South Asia has a potential food self-sufficiency of 92%.

5.2.1 Nutrition in foodsheds

While these foodsheds have been determined solely on the total energy content of the food crops produced, the dietary diversity can be examined by looking at the cropping pattern on which this energy content is based. We have grouped the food crops into six major food groups with distinct dietary characteristics: grains, soybeans and pulses, fruits and vegetables, starchy vegetables (e.g. potatoes and cassava), oil crops and sugar crops. The World Health Organization (WHO) recommends a vegetable and fruit intake of at least 400 grams per person per day, which corresponds to a minimum of 80 kCal for vegetables (4 per cent of daily kCal demand) and almost 200 kCal for fruits (almost 10 per cent of daily kCal demand). With the exception of Delhi, Johannesburg and Kanpur, all foodsheds easily reach this lower limit. Foodsheds of several African cities have a high proportion of fruit, nuts and vegetables. Delhi's foodshed has a lot of sugarcane, equalling 15 per cent of total production, which is one and a half times the 10 per cent recommended by WHO. However, sugarcane is produced at the expense of other crops (apart from

grains, i.e. rice and wheat). While most foodsheds consist of a diverse range of food crops, with different proportions reflecting local growing conditions and dietary preferences, some are less diverse. Johannesburg's foodshed is one of the least diverse, as it is dominated by grains (mainly maize). Also, Kolkata's diversity is limited, being dominated by rice.

Table 3

Nutritional characteristics for selected foodsheds (average 2006-2016)

Foodshed	Country of origin	Primary city population (millions)	Foodshed population	Foodshed supply/demand ratio	Food group proportions (%)						
					cereals	pulses and soybeans	vegetables, fruits and nuts	starchy vegetables	oil crops	sugar	
SUB-SAHARAN AFRICA											
Lagos	La	Nigeria	8.9	35.5	0.96	26	6	16	50	2	0
Kinshasa	Ki	DR Congo South	5.3	29.7	0.75	24	3	12	54	6	1
Johannesburg	Jo	Africa	5.2	13.8	0.94	89	2	4	0	4	0
Khartoum	Kh	Sudan Ivory Coast	4.6	23.6	0.98	46	3	31	0	13	6
Abidjan	Ab	Coast	3.7	19.6	1.00	22	1	27	47	2	2
Luanda	Lu	Angola	3.1	8.2	0.59	28	9	9	45	7	1
Dar es Salaam	Da	Tanzania	3.0	45.1	0.93	49	12	7	19	13	1
Kano	Ka	Nigeria South	3.0	72.7	0.96	60	11	9	8	12	0
Durban	Du	Africa	2.8	13.4	0.86	68	5	14	0	8	5
Addis Ababa	Ad	Ethiopia	2.6	13.1	0.93	66	13	7	0	14	0
INDIA											
Mumbai	Mu	India	17.2	121.5	0.84	56	17	7	0	6	15
Delhi	De	India	14.2	196.9	0.94	68	4	4	0	9	15
Kolkata	Ko	India	12.0	201.5	0.98	88	3	5	0	3	0
Chennai	Ch	India	6.7	30.8	0.69	52	7	11	3	14	12
Hyderabad	Hy	India	6.4	20.5	0.77	56	18	13	1	5	7
Bangalore	Ba	India	5.5	193.9	0.90	58	9	12	3	10	8
Ahmedabad	Ah	India	4.7	52.4	0.89	59	7	11	0	19	4
Kanpur	Ka	India	3.2	341.4	0.95	77	9	4	0	4	6

Source: Authors' calculations with the LPJmL global crop hydrology model

5.2.2 Water use in foodsheds

Table 4 provides insight into the agricultural water use of selected foodsheds. The table illustrates the difference between water use in India and sub-Saharan Africa in terms of rain-fed (green water) and irrigated (blue water) crops. Foodsheds in India, especially Delhi, are more depending on irrigation than those in sub-Saharan Africa. This generally mirrors the higher average productivity of Indian farmers, but also the vulnerability in terms of (ground)water overuse. The limited amounts of irrigated crops in sub-Saharan Africa mirrors the high dependence on rainfall, and therefore the potential impacts of changing weather patterns.

Table 4

Average green and blue water use in selected foodsheds (1987-2016)

<i>Foodshed</i>	<i>Green water consumption in km³</i>	<i>Blue water consumption in km³</i>	<i>Fraction blue water of total water consumption in %</i>
SUB-SAHARAN AFRICA			
Lagos	17.0	2.7	0.0
Kinshasa	14.4	0.0	0.0
Abidjan	6.4	263.0	3.9
Khartoum	9.5	1827.9	16.1
Johannesburg	9.1	65.0	0.7
Luanda	3.3	26.2	0.8
Dar es Salaam	16.3	79.3	0.5
Kano	65.4	132.8	0.2
Durban	5.6	262.1	4.5
Addis Ababa	2.6	26.1	1.0
INDIA			
	<i>in km³</i>	<i>in km³</i>	
Mumbai	39.1	10.0	20.3
Delhi	41.2	37.3	47.5
Kolkata	46.4	4.7	9.2
Chennai	4.7	2.9	38.1
Hyderabad	4.3	1.4	24.6
Bangalore	45.0	15.0	25.0
Ahmedabad	12.9	4.5	25.8
Kanpur	85.9	30.0	25.9

Source: Authors' calculations with the LPJmL global crop hydrology model

5.2.3 Towards 2050

Population growth towards 2050 is expected to increase food demand in sub-Saharan Africa by almost 250 per cent and in India by almost 50 per cent (keeping diets constant). Without additional measures to increase food production, food crop self-sufficiency will decrease drastically (Figure 14a), as Van Ittersum et al. (2016) showed for cereals. Individual foodsheds can be clustered into larger regions covering West, Southern and Central Africa and the Horn of Africa, all with less than 50 per cent of food crop demand being provided by the surrounding foodsheds. With agronomic and water conservation measures (Figure 14b), productivity growth in parts of south-eastern Africa parallels or even overtakes population growth, with the foodsheds of Bulawayo and Harare in Zimbabwe, Lusaka in Zambia and Maputo in Mozambique being able to supply most of the cities' food crop demand, which has a wider effect in the region. In West Africa and parts of the Sahel, population growth outstrips increases in productivity. Foodsheds in Nigeria have reduced potential crop self-sufficiency, with Lagos just managing to supply a bit more than half of its demand for food crops from its foodshed. We have simulated a low implementation scenario (Jägermeyr et al., 2016), whereby water conservation measures to reduce soil evaporation and harvest water are implemented on 25 per cent of the available rainfed area, and irrigation improvements such as drip irrigation are introduced on 50 per cent of the irrigated area, recognizing that uptake of such measures has been modest in the past decades. Wider implementation seems both essential for and could well be stimulated by increased urban demand.

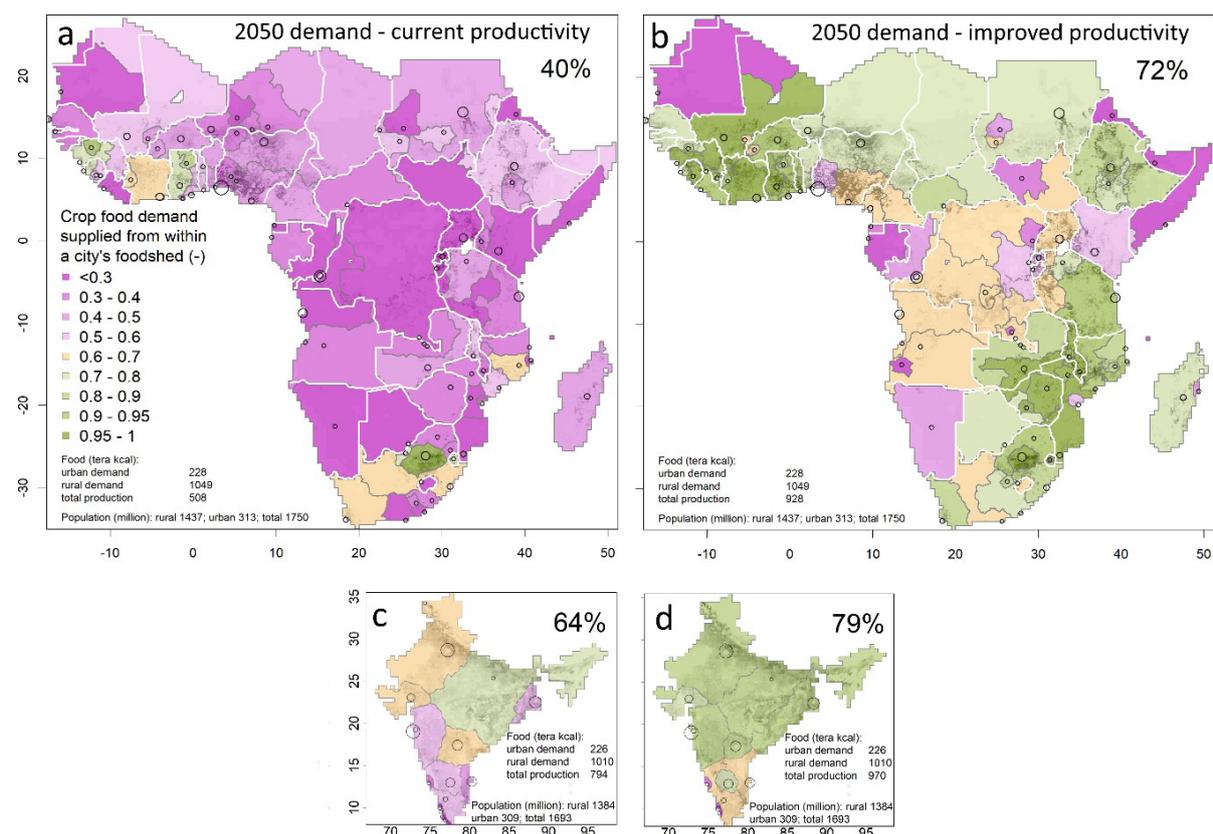


Figure 14: Sub Saharan Africa and India's foodsheds in 2050, without (left, a and c) and with (right, b and d) water management and agronomic measures to close the yield gap

In India the reduction in potential crop self-sufficiency leads to further merging of foodsheds into only a few larger clusters, with lowest crop self-sufficiency levels found around the large megacities in the south and east (Bangalore, Chennai, Kolkata, and Mysore). The other foodsheds covering large parts of the country in the north could cover 80 per cent or more of their crop demand locally, after improving agricultural practices and water conservation. The smaller coastal cities in the south (Alappuzha and Kochi), with supply to demand ratios of less than 25 per cent, are too small to compete for food produced in the surrounding countryside with the larger cities of Bangalore and Coimbatore and in the east, which both have a stronger pull on crops produced, but they are also too big to be absorbed by them (see methodology on assumptions and thresholds used by Siderius, Velde and Biemans, 2021). In reality, a city only 50 per cent self-sufficient might pull stronger than a city which is reaching 100 per cent, in that case, some food now going to Coimbatore would go to Kochi and differences would be smoothed. Water management and improved practices could bring the country to provide almost 80 per cent food self-sufficiency in terms of crop food demand domestically.

The expansion of urban areas, encroaching into agricultural land, does not significantly affect the production capacity in the applied scenarios. Production in sub-Saharan Africa reduces by 10 tera kCal as a result of loss of agricultural land by urban sprawl in 2050. Although this is a just over 1 per cent reduction of total production, it is equivalent to the food supply of 13.5 million people. In India, numbers are similar. However, in reality, encroachment is likely to have a bigger impact, as discussed by d'Amour et al. (2017) (see section 3.1.4). Our analysis only took into account high-density inner-city expansion, explicitly classified as "urban", thereby likely to under-represent the increase in low-density urban sprawl, which is especially important in sub-Saharan Africa.

To illustrate the potential additional effect of climate change, projections from five different global circulation models (Hempel et al., 2013) have been performed. The chosen projections show a largely similar pattern of change over sub-Saharan Africa, though with some regional differences (Figure 15). In all projections, food production reduces by 10 to 15 per cent in 2050 compared with 2010 (all with agronomic and water management measures as in Figure 14b). The UK Met Office's Hadley model (Figure 15 left above)

projects more favourable circumstances in parts of Eastern Africa with food supply in Addis Ababa's and Ethiopia's other foodsheds being close to crop food demand. South Africa remains the breadbasket of much of Southern and Central Africa. In all scenarios, climate change exacerbates the impacts of population growth on potential food self-sufficiency in West Africa and in countries struggling with (political) crises such as parts of Somalia and South Sudan.

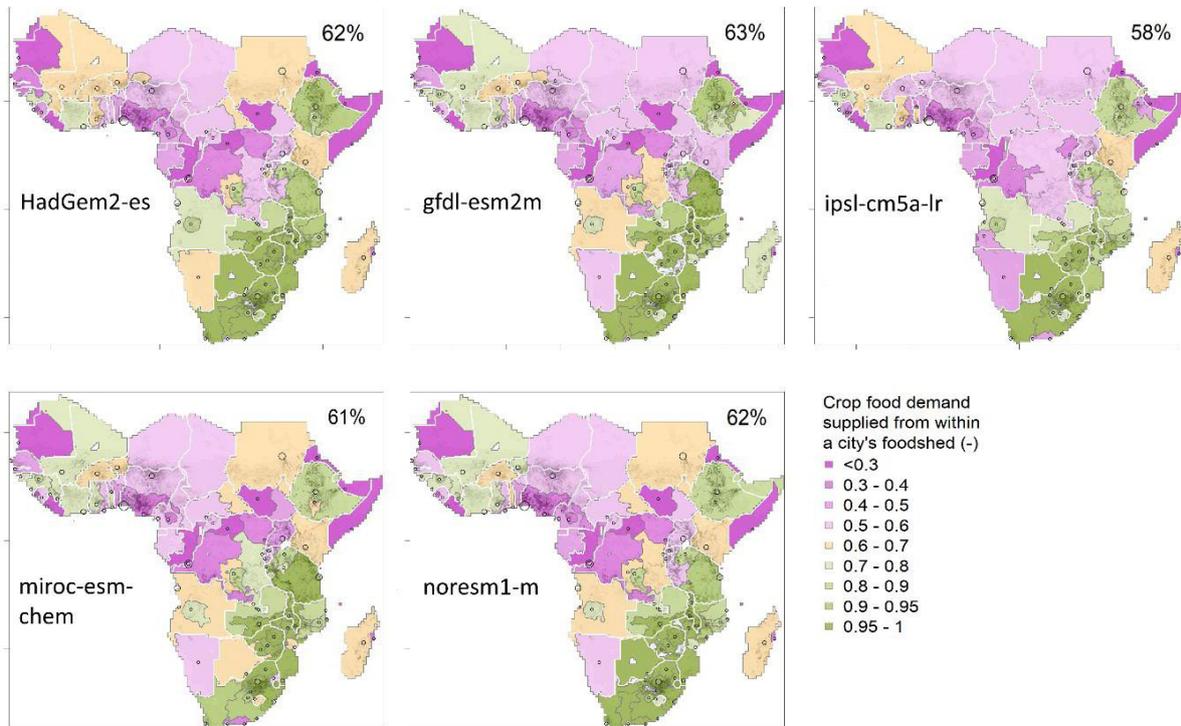


Figure 15: Illustration of projected impact of climate change (2050) on Africa's foodsheds, according to five global climate models, including agronomic and water management improvements. Percentages indicate the potential food self-sufficiency of the whole region

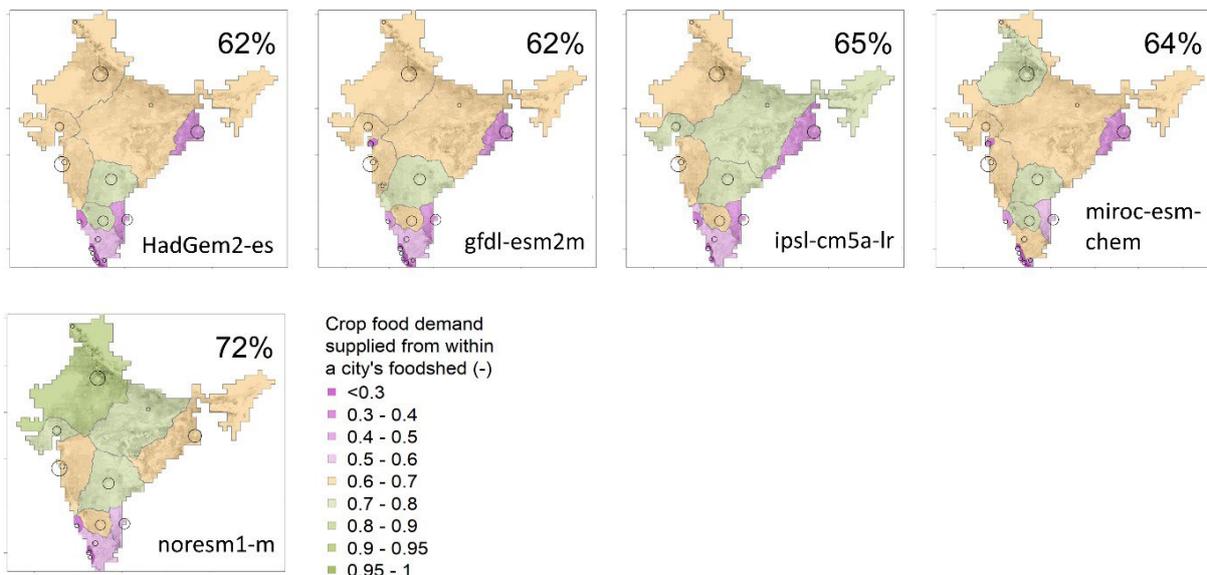


Figure 16: Illustration of projected impact of climate change (2050) on India's foodsheds, according to five global climate models, including agronomic and water management improvements. Percentages indicate the potential food self-sufficiency of the whole country

In India, four out of five climate models project similar reductions in production of about 15 per cent due to climate change, while the norESM1-m projection is somewhat more favourable with only around a 7 per cent reduction. In general, food self-sufficiency conditions remain more favourable in the north-west and the Hyderabad foodshed than in the coastal south and east.

It should be noted that the maps shown in Figures 15 and 16 are illustrative, as they show the results of only five models out of many, and therefore do not show the full uncertainty in climate projections. Moreover, as climate models are under continued development, newer versions of climate forcing⁵ are becoming available. For a more in-depth analysis, a larger and newer forcing dataset can be used.

5.3 Main observations

Regional crop self-sufficiency is under threat in both sub-Saharan Africa and India. At present, rural areas could provide close to all the crop food demand of India's urban centres. In Africa, there are strong regional differences with the west, north-east and part of the south largely able to supply food crops locally to meet the demand, while Central and Eastern Africa remains vulnerable. Agronomic and water conservation measures are essential to maintain current levels of food crop self-sufficiency in both sub-Saharan Africa and India under population growth. However, a "low" ambition scenario as explored here, whereby water conservation measures and irrigation improvements are implemented on only part of the cropped area, and with agronomic measures leading to only a modest yield gap closure, will not be enough. A wider implementation, or growing land use for agriculture, is needed. The cost of implementation of such measures is found to be a barrier for farmers (Siderius et al., 2020). A larger and more affluent urban population, willing to pay for healthy food, could provide a necessary stimulus, making farming economically viable.

Changes in the diversity of local food produced need to be factored in as urban consumers will require more vegetables, dairy products and meat. At the same time, climate change is likely to worsen the ability of both sub-Saharan Africa and India, and the wider South Asian region, to rely on local food production. The crop self-sufficiency of foodsheds in countries already vulnerable, such as that of Mogadishu in Somalia, is projected to fall even further.

6. Enabling conditions for inclusive rural transformation

Urbanization is transforming food systems by raising and diversifying demand and land use changes, affecting what, how and where food is produced, and how it is processed, distributed and marketed. These changes shape rural opportunities and challenges, potentially reducing rural poverty and strengthening rural economies, or widening economic gaps, resulting in winners and losers. Whether urbanization indeed offers opportunities that are socially fair to rural communities for an inclusive rural transformation, depends on a range of conditions. This section provides an overview of the social, physical, spatial, economic and institutional enabling conditions required to make sure that urbanization contributes to inclusive rural transformation.

The issue of inequality overarches the conditions discussed below. Reducing inequalities in terms of access to education, services and resources, income and employment requires continuous consideration in policies, development projects and investments.

6.1 Social enabling conditions: norms, behaviour, knowledge

Many of the enabling conditions that can help rural economies benefit from urbanization are social: the social bonds that connect people in rural and urban areas, norms and knowledge that shape the behaviour of urban consumers and the knowledge and skills that allow farmers to respond to this urban demand.

⁵ Climate forcing is the change in atmospheric energy flux caused by natural or anthropogenic factors of climate change. This is measured in watts/m².

Strong social networks and communication flows between urban centres and rural areas are vital for rural economies to respond to a changing urban demand. These connections allow farmers to adequately adjust their production to what is required by the growing group of urban consumers (de Bruin and Dengerink, 2020). Migration flows to nearby cities can result in strengthened rural-urban social networks, connected with each other through social relations, remittances and businesses (Crush and Caesar, 2017). Urban-rural social networks support a flow of information between cities and rural areas, as urban and rural dwellers communicate with each other physically, by phone or digitally, and exchange information on employment opportunities, access to markets, services and new technologies. As a result, households can more easily access employment, market their crops and improve their production practices. Stimulating, or at least not hindering, (temporary) rural-urban migration can contribute to the connection rural areas have with the outside world.

Increasing (urban) awareness and knowledge about the economic and health advantages of buying local vegetables, fruits and cereals, can contribute to make sure that surrounding rural areas benefit from a growing and changing urban demand. Evidence from Kenya and Tanzania shows that the promotion of indigenous vegetables has the potential to boost rural economies and improve health and environmental outcomes (Bizzotto-Molina et al., 2020; Rampa and Knaepen, 2019). This implies a shift in the norms about which foods are preferred, and the status they have in the city.⁶ Increasingly, norms about preferred foods are determined by the media and advertising, often steering urban consumers towards unhealthy food options (Pingali et al., 2019). To counterbalance these messages, governments have an important role to play to inform their citizens about healthy and affordable food choices. Ideally, they promote healthy products that also have the potential to stimulate local production and thus contribute to rural development. The increasing demand for processed foods and a larger diversity of food options require rural producers to update their knowledge and invest in new types of products to satisfy the urban market. This requires investing in knowledge and skills of farmers (de Bruin and Dengerink, 2020) by providing training and courses run by private actors, non-governmental organizations or the public sector.

6.2 Physical enabling conditions: road and market infrastructure

Whether urbanization contributes to promote inclusive rural transformation depends largely on physical enabling conditions: the infrastructure that connects rural and urban areas and the infrastructure around food markets supporting the modernization of value chains. Accessibility to urban food markets for farmers or traders depends on the quality of roads connecting cities with their rural hinterlands, which in turn affect the transaction costs for rural actors and urban food prices (Berg, Blankespoor and Selod, 2016; Storeygard, 2016).

Investments in rural infrastructure can play a key role in bringing down the price and improving the quality and freshness of local produce, while stimulating productivity (Hussein and Suttie, 2018). Sections 3 and 4 stressed the importance of infrastructure to lower transaction costs, as illustrated in the Indian case study and by Tadesse (2012). Alongside the physical connections between rural and urban areas, infrastructure linking secondary cities to the larger cities is of pivotal importance to optimize the functionality of these smaller cities (Christiaensen, Weerdt and Todo, 2013; Mainet and Racaud, 2015). However, the downside of investing in new infrastructure is the potential harm to natural areas, which are already under threat around cities, and beyond (Meijer et al., 2018).

The opportunity that comes with diversifying food demands requires investments in modernizing value chains, including logistics, packaging, storage, cooling and processing facilities as well as the physical marketplaces in towns and cities (Reardon et al., 2015). The physical food markets play a key role in connecting rural production with urban demand. Across sub-Saharan Africa, cities are building marketplaces or upgrading existing ones with proper sanitation, storage and lighting (Minten, Reardon and Chen, 2017). While these formalized markets have advantages in terms of efficiency and food safety, fees for stalls in upgraded markets are often expensive, decreasing accessibility for all producers. Nearly all smallholder farmers, most traders in agri-commodity markets and many micro- and small-scale food processors and food retailers are not part of the formal food economy in sub-Saharan Africa (Robinson and

⁶ For an extensive study in this series regarding the promotion of local food, see Matera et al. (2021).

Yoshida, 2016). Thus, solely investing in formal markets would not transform rural economies, but rather enforce the status quo in which most actors in the informal economy struggle. This subject touches upon a larger discussion regarding the dynamics between the formal and informal economies. Skinner (2018) shows that policies and practices of national and local African governments tend to exclude, evict and relocate informal food markets or sellers, impacting urban food security and access to urban markets for rural actors. Investing in facilities and spatial planning for informal markets is therefore at least as important as investing in formal markets. Understanding how these informal value chains could best be sustained is therefore of critical importance; however, this knowledge is often lacking (Crush and Young, 2019; Resnick, 2017; Skinner, 2018).

6.3 Spatial enabling conditions: rural-urban connectivity, proximity, dispersion

The spatial configurations of cities, smaller towns and rural areas are additional enabling conditions important for the degree to which rural areas benefit from urbanization processes. The degree of rural-urban connectivity, the proximity of urban areas and the spatial patterns all play a key role.

The contribution of urbanization to inclusive rural transformation depends in part on the connectivity between urban and rural areas. These linkages can be physical, such as the roads connecting cities and rural areas, or the phone and internet networks enabling urban and rural dwellers to connect. However, they also include the digital transfer of financial remittances or family connections and business relations. Strengthening these rural-urban connections can improve the flow of information and trade between urban and rural areas. Improved rural-urban connectivity contributes to the functioning of food systems and supports rural growth and job creation. Modern communication technologies can strengthen rural-urban linkages by providing up-to-date market information. Recent evidence shows that mobile phone and internet adoption have been key factors driving economic growth in sub-Saharan Africa (Bahrini and Qaffas, 2019).

Another key factor that can boost the potentially positive impact of urbanization on inclusive rural transformation is the spatial pattern of urbanization. Spatial development policies should focus on stimulating dispersed urbanization patterns, as these are more likely to contribute to inclusive growth and poverty reduction than urbanization in rapidly growing megacities (Christiaensen, Weerdt and Todo, 2013; Henderson, 2010). Section 4 showed that food systems and rural economies benefit more from dispersed urbanization, as finance, inputs and markets become accessible to more rural households, making both food systems and rural transformation more inclusive. Urban development policies should support the development of small cities and towns, as they are attractive locations for businesses in agricultural services, food processing, storage and value addition, which generate off-farm employment for rural households. Migration from rural areas to secondary cities and towns is more likely to improve economic well-being than migration to megacities. It is, however, no silver bullet. Much of the potential benefits from migration to urban areas depend on other enabling conditions, including the right conditions to start a business (access to inputs and services) or off-farm employment available in these urban areas. Coordination at multiple policy levels is of importance to develop harmonized urbanization policies.

6.4 Economic enabling conditions: investments, incentives and trade policies

Depending on the bottlenecks in the food system, different economic enabling conditions can play a role in maximizing the potential of urbanization to contribute to rural transformation. Investments in supply chains, targeted food subsidies and taxes as well as trade and wealth (re)distribution policies can influence rural-urban dynamics.

Changes in diets require investments in more industrialized and lengthy food supply chains, as indicated in section 6.3. Investments in transport, storage and processing facilities can accelerate the development of modern food systems and strengthen rural economies. Evidence from across sub-Saharan Africa shows that access to credit, affordable inputs and labour, and well-organized storage and transport are critical for farmers to be able to provide the quantity and quality demanded by urban retail markets (van Berkum et al., 2017). Adopting food taxes and subsidies can play a role in steering consumer behaviour towards more healthy and nutritious food options. The effectiveness of these measures is confirmed by a systematic

review of a large body of studies investigating the impact of food taxes and subsidies on consumer behaviour (Thow, Downs and Jan, 2014). Today, subsidies on staples contribute to unbalanced diets by keeping market prices low compared with other products, resulting in relatively high levels of cereal consumption (Micha et al., 2020). Ideally, food options promoted by taxes and subsidies are the same food options that stimulate local rural development.

Another economic enabling condition is an inclusive trade policy, which can help ensure that urbanization benefits the domestic agricultural sector and strengthens rural development. For example, import restrictions can be used to encourage a supply response and diminish the extremes of international price volatility. Some interesting large-scale experiments, such as Nigeria's Agriculture Transformation Agenda, are using border measures alongside other instruments to give a stimulus to domestic production and manufacturing (Vorley and Lançon, 2016a). However, while protecting national agricultural sectors can improve domestic production, it could lead to higher consumer prices when domestic products struggle to compete with imported products (Clapp, 2017). The balance between the advantages and disadvantages of substantial import dependence and working towards food self-sufficiency, while complying with trade agreements, will remain a critical and context-specific balancing exercise (Clapp, 2017; Moseley, Carney and Becker, 2010; Van Weezel, 2016).

6.5 Institutional enabling conditions: policies, services, governance

Good governance and the presence of stable institutions play a key role in making sure that rural communities benefit from urbanization (Candel, 2014; Trebbin, 2014). Conflict, lack of institutional capacity, poor policy design and slow implementation can seriously harm the production, distribution and consumption of healthy food (Candel, 2014). Institutional characteristics differ widely between countries and therefore deserve tailor-made responses as a lasting part of projects that contribute to food system transformation (Vink, 2017).

Government services play a role in reducing risks for rural economies (Kosec and Resnick, 2019; Pingali et al., 2019). Inclusive formalization of land markets, clarifying property rights, effective urban planning, making coordinated infrastructure investments and improving urban transport could help mitigate risks associated with urbanization and facilitate the process of rural transformation (Abdychev et al., 2018). Moreover, government policies that inclusively improve farmer access to credit, inputs and knowledge can play a key role in improving farmers' productive capacity to respond to the increasing and changing urban demand. In many contexts, agricultural policies are very much sector-based and focused on producing sufficient staples. To respond to the dynamics of urbanizing food systems, more integrated food policies are needed. These involve a shift from raising farm productivity of a few staples towards a strategy of meeting urban demand for non-grain products, especially horticulture, livestock and processed foods. These policies will be geographically heterogenous, depending on the level of existing infrastructure, distance to markets and levels of development.

7. Lessons learned: opportunities for inclusive rural transformation

7.1 Conclusions

This study shows that urbanization – in interaction with, for example, welfare increases – changes food systems in several ways. Demand for food is rising and diets are changing, affecting land use, production incentives and off-farm employment opportunities, as well as required finance, inputs, services and skills. Overall food demand is expected to increase by a factor of 2.5 by 2050 in sub-Saharan Africa, and by a factor of 1.7 in South Asia, although these numbers are rather uncertain. This rising demand can, potentially, in some Indian foodshed regions, be largely met with today's production capacity, depending on a range of social, economic and political conditions, including the quality of rural-urban linkages. In sub-Saharan Africa, food demand will be hard to meet locally with today's capacity towards 2050. A more sustainable production scenario, including investments in water-saving measures, is projected to result in

significant improvements in productivity in all regions, and especially in southern Africa and northern India. However, climate change is projected to reduce yields by up to 15 per cent, substantially decreasing opportunities for food self-sufficiency.

Urbanizing food systems provide opportunities for inclusive rural transformation but can also result in the reinforcement of the current system, in which many rural people remain poor and food insecure, and issues of environmental sustainability continue to worsen. The growth and diversification of food markets provide new employment opportunities in the lengthier value chains, which can be enhanced by access to finance, inputs, information and services. For those leaving agriculture, increasing off-farm employment in the expanding value chains can provide new livelihoods. These opportunities are, however, not accessible for all, nor are they by definition providing living incomes.⁷ These rises and changes in demand pose challenges to environmental sustainability. Inclusive rural transformation remains jeopardized by persisting or even rising inequality within and between rural and urban communities. Those most likely to profit are people living in areas that are well connected to growing urban regions and who are in the position – in terms of knowledge and resources – to act on the developing opportunities. Conversely, those most likely to lose out are people at risk of losing their land to urbanization processes or living in areas far away from growing urban food markets. Finally, also within urban areas, inequality is rising; where urban food environments offer more nutritious and diverse foods, this enhancement is not accessible to the urban poor.

How regions urbanize and how well rural and urban areas are connected shape the opportunities for inclusive rural transformation in numerous ways. Dispersed patterns of urbanization provide more inclusive rural transformation opportunities compared with centralized urban growth, as more rural actors benefit from improved access to services, inputs, information and markets, reducing poverty levels. Secondary cities play a pivotal role in providing access to inputs and market opportunities for the rural actors not residing close to the major cities. Consequently, investing in smaller cities can support inclusiveness for rural transformation processes and provide hundreds of millions of people with better livelihoods. At present, however, these smaller cities and towns generally receive less consideration in spatial development plans and urban development investments compared with the primary cities. Strong rural-urban linkages, in terms of trade, knowledge, migration and financial flows contribute to inclusive rural transformation by improving opportunities to send remittances, to access (market) information, services and inputs, and to access non-farm employment. These developments can have major implications for access to and affordability of food in these regions, as this paper’s evidence underlines the importance of urban proximity for agricultural productivity and income diversification.

To stimulate inclusive rural transformation in the context of urbanizing food systems, five enabling conditions are identified in this paper, which are summarized in Table 5.

Table 5

Five enabling conditions for rural transformation

<i>Social enabling conditions</i>	Strong rural-urban social networks Social norms and preferences for local food Improved knowledge of rural food system actors about urban preferences
<i>Physical enabling conditions</i>	Quality of rural-urban and urban-urban roads and transportation networks Modern infrastructure: logistics, packaging, storage, cooling and processing More strategically located and better equipped marketplaces
<i>Spatial enabling conditions</i>	Improved rural-urban connectivity through communication infrastructure Dispersed urbanization patterns; growth of smaller cities and towns
<i>Economic enabling conditions</i>	Trade policies that stimulate local production and trade Investments in more industrialized and lengthy supply chains Financial incentives towards healthy and nutritious food options
<i>Institutional enabling conditions</i>	Expansion of government services in rural areas Agricultural policies towards more diverse production Good governance: stable and inclusive institutions

⁷ For more on living incomes, see Waarts et al. (2021) in this series.

7.2 Recommendations

Urbanizing food systems provide many opportunities for inclusive rural transformation in sub-Saharan Africa and South Asia. However, urbanization can also negatively impact food systems and inclusive rural transformation, through urban expansion on agricultural land, increasing dependence on imports or growing disconnect between urban and rural areas. This paper offers a range of lessons learned to make sure rural actors in the food system will profit from rising and changing urban food demand while minimizing the negative impacts of urbanizing food systems.

- **Invest in inclusive dynamics of urbanization: acknowledge the role of secondary cities and spatially dispersed patterns.** Investing in services and facilities, especially in secondary towns (potentially) having important functions to their hinterlands can contribute to productivity, diversification, local trade and processing activities. These services and facilities include access to inputs, information and knowledge, processing, storage and distribution centres and access to food markets.
- **Strengthen rural-urban linkages.** Investing in rural-urban and urban-urban roads improves access to markets and services available in cities. Investing in means of communication contributes to rural-urban social networks and access to (market) information, strengthening rural knowledge regarding changes in urban demand.
- **Invest in rural capacity to meet changing and rising urban demands.** As the demand for more diverse food rises, rural food system actors must have the knowledge and resources to respond. This requires access to finance and inputs for farmers, and public and private investments in packaging, storage and processing facilities.
- **Critically analyse the needs of a specific region.** Some regions will become largely urban and relatively prosperous, while others will remain primarily rural. While some foodsheds will be largely food self-sufficient towards 2050, other regions will see a rise in demand that is steeper than foodsheds can potentially provide. These divergent developments affect the opportunities urbanizing food systems may provide to rural transformation, affecting the primary local needs to respond to these opportunities.
- **Reduce inequalities between and within rural and urban regions.** The above-mentioned investments will only lead to inclusive rural transformation if low-income households, wherever they live, will benefit from these investments, in terms of proper employment, stable markets and access to finance, inputs and information.
- **Stimulate (urban) consumption of healthy produce from hinterlands.** By providing price and health incentives and by contributing to awareness regarding the value of local food, local and national governments can contribute to the popularity of locally cultivated foods, stimulating local production.

Although regions within South Asia and sub-Saharan Africa are highly heterogenous and face different bottlenecks hindering development, the dynamics of urbanization will continue to shape the future of food systems. Context-specific policies and targeted investments are needed to make optimal use of the many opportunities urbanizing food systems offer for inclusive rural development. The above-mentioned recommendations are complex to execute in turbulent realities. However, it is of pivotal importance to take the dynamics of urbanization towards 2050 into account in aid programmes, investments and policy development shaping food systems and rural development.

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