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The Role of Urban–Rural Connections in Building Food System Resilience

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Abstract: This paper investigates food system resilience—conceptualized through the four dimensions of agency, buffering, connectivity, and diversification—from the perspective of rural–urban relations. We consider three cases that capture distinct actor and policy foci in the wider literature on urban–rural interactions. These are secondary cities and their development potential as central nodes in urban–rural food systems, the role of digital infrastructure in shaping food systems resilience, and finally, street food vendors as a particularly vulnerable yet crucial group of actors linking rural food supply with urban demand. We review existing literature within these themes, with a particular focus on the impact of the COVID-19 pandemic on the food systems in middle- and low-income countries. This allows us to examine the relationship between rural–urban connectivity and food system resilience and to identify possible trade-offs. We formulate recommendations for research and policy around the notions of new localities (i.e., considering the interconnectedness of rural and urban food systems across administrative boundaries), smart development (i.e., context-specific approaches building on local strengths), and network governance (i.e., inclusive decision making engaging with diverse stakeholders across multiple scales).

Keywords: food systems; resilience; urban–rural connectivity; secondary cities; digitization; e-commerce; street food vendors

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1. Introduction

The COVID-19 pandemic and immediate policy responses have had pronounced impacts on food systems in developing countries [1–3]. Lockdowns and mobility restrictions led to the scaling down of food processing, and workers often experienced immediate losses in income and consumption [4,5]. It is now understood that increases in hunger due to COVID-19 are primarily due to losses in income and, to a lesser degree, due to price movements or supply disruptions [1]. Nonetheless, temporary border closures did restrain the movement of both agricultural inputs and produce, affecting prices and leading to temporary shortages of food items in some places [6].

For many households in the developing world, the most direct and notable impact of COVID-19 has been a loss of income due to imposed mobility restrictions and subsequent (temporary) losses of jobs or businesses, while in some instances, physical access to food became restricted due to closed food markets [1]. In addition, various studies highlight the resulting differential impacts of the COVID-19 pandemic on rural and urban settings [1,7–10], with income losses more pronounced for households in urban areas. However, how urban–rural connectivity, and changes thereof, shape food system resilience is less well understood.

The impact of COVID-19 on food systems and livelihoods has reignited a debate on the resilience of food systems in the wake of shocks [11–13]. The disruptions caused by

COVID-19 have motivated inquiry as to whether current food systems are resilient and, if not, how this can be enhanced and at what costs. This paper focuses on strengthening urban–rural connectivity as a means to enhance food system resilience in the wake of shocks or disruptions [14]. By advancing knowledge on this topic, we seek to discern effective ways to strengthen food system resilience.

The resilience of food systems is often defined as the 'capacity over time of a food system and its units at multiple levels, to provide sufficient, appropriate and accessible food to all, in the face of various and even unforeseen disturbances' [15] or 'ability of food systems to anticipate, prevent, absorb, and adapt to the impacts of shocks and stressors' [16].

Food systems in developing countries witnessed profound changes even before the onset of the COVID-19 pandemic due to, among other factors, changes in urbanisation. An increasing number of citizens now live in urban areas, a share that is projected to increase further [17] with implications for the nature and organisation of food systems [18]. The rising demand for processed foods spurs the development of the processing sector and associated employment opportunities [18]. However, greater processed foods consumption also implies greater reliance on market purchases for daily consumption and, thereby, more complex and spatially elongated trade between zones of production and consumption. The dependence of cities on food imports is, thus, also a potential vulnerability [19].

While strengthening urban–rural connectivity is seen as a means to enhance food system resilience, a distinction between urban and rural realms remains a complex debate to which this paper aims to contribute. Furthermore, the ways in which changes in (specific types of) rural–urban connectivity might affect resilience are not well understood. As Maredia et al. [10] observed, enhanced rural–urban connectivity could extend shocks as much as they absorb them.

To better understand how urban–rural connectivity shapes food system resilience, this paper considers food system resilience in three case studies describing distinct moments of rural–urban interaction. These are (1) second-tier or mid-sized cities, (2) infrastructure with a particular focus on digitalization, and (3) the plight of street food vendors. While these cases by no means present an exhaustive overview of all forms of urban–rural interaction, they allow for considering different scales and levels of rural–urban food system integration, as well as policy implications, as argued in Section 2.

This study is inspired by the COVID-19 pandemic and its impact on food system resilience, particularly in low- and middle-income (LMIC) countries. However, our treatment is more general in uncovering the elements constituting food system resilience in the face of diverse possible disruptions. In many LMICs, the COVID-19 pandemic is just one of the many threats food systems are facing, and actors' resilience is increasingly tested by shocks and stressors related to climate change, poverty, diseases, or political unrest.

The organisation of this report is as follows. Section 2 introduces the conceptual framework and further motivates the choice of themes as well as the research approach followed. Then, Sections 3–5 each provide an in-depth discussion of the themes of second-tier cities, infrastructure and connectivity, and street food vendors, respectively. Section 6 concludes.

2. Conceptualisation and Methods

By 2050, 7 out of 10 people are estimated to live in cities, jointly generating about 80% of global GDP [20]. The rise of megacities, particularly the plight of inhabitants living in their slums, has captured the popular image of urbanisation in the developing world. However, megacities only tell one part of the story of developing country urbanisation. In fact, mid-sized cities are the urban agglomerations with the fastest population growth [21], while 85% of the global population lives in or within 3 hours of travel to an urban area of more than 20,000 inhabitants [22]. For many rural inhabitants, the closest urban settlement is only a small one, particularly in Africa [23,24].

Definitions (and changes thereof) have thereby played an important role in shaping the debate about urbanisation in the developing world [25,26]. Urban areas are often categorized solely by a combination of administrative boundaries and additional crude

definitions. Some of the presumed urban growth results from the reclassification of rural to urban areas, capturing endogenous growth rather than migration [27,28]. At the same time, satellite data reveals hundreds of 'urban' agglomerations in Africa classified as rural by national statistics [24]. Using administrative boundaries or definitions based on population densities is insufficient to fully characterise urban or rural spheres. In the wake of increasing mobility, livelihoods span a number of different places and economic activities, increasingly blurring distinctions between urban and rural [29].

Investigating the role of urban–rural connectivity in shaping food system resilience thus requires a conceptualisation of urban and rural beyond administrative boundaries or population densities. These traditional conceptualisations are connected to modernist thinking and are historically grounded in a European or North American context [30]. These categories, while often implicit, have real-life repercussions on spatial planning, economic development, and governance structures. Nonetheless, their relevance is being questioned as cities and the countryside develop into diverse hybrid blends through processes such as counter-urbanisation, suburbanisation, and so forth. Particularly, political economy scholarship (pioneered by [31] or [32], among others) has revealed rural and urban as categories that are socially constructed through relations of power. Furthermore, the increasing urbanisation of the Global South creates a diversity of contexts for which traditional notions of city and countryside lose relevance.

Current research on rural and urban spaces is aware of their intersection and interconnectedness. More recent conceptualisations (e.g., [33]), therefore, serve to grasp the complexities of rural–urban interactions in order to foster synergistic and mutually beneficial developments of both sides of the rural–urban continuum. The framework by Woods et al. [33] is guided by a number of assumptions, most importantly that: (1) Rural and urban spaces, societies, and economies are not discrete, separate entities but interact with each other and are inherently blurred and entangled in multiple, complex ways; and (2) There is no essential definition of either the rural or the urban that can be quantified and precisely delimited on a map. Rather, rurality and urbanity are socially constructed categories that have different meanings for different people but which serve a purpose in informing the ordering and regulation of land, landscape, economic activity, and social relations.

On these premises, this study investigates the construction of food system resilience in three distinct cases capturing different aspects of rural–urban linkages (Table 1). While not exhaustive, these cases allow us to contribute to the urban–rural development literature by focusing on different levels of aggregation and hierarchy, provide different focal points for policy-making, unpack the complexity of urban–rural connectivity, and analyse how this shapes food system resilience.

Table 1. Choice of featured themes in this study, capturing different moments of rural–urban integration.

	Section 3	**Section 4**	**Section 5**
Key theme addressed	Secondary cities and the urban–rural food systems continuum in which they are nested.	Digitalization and e-commerce in agriculture and food systems as a means to stimulate urban–rural integration.	Street food vendors as important but vulnerable actors in leveraging urban demand with rural supply.
Policy-level focus	High level of aggregation: focus on investments to enhance the resilience of secondary city regions.	Medium level of aggregation: addressing the needs of specific actors against broader digital infrastructure development.	Low level of aggregation: focusing on practical governance solutions to enhance resilience in a specific group of actors.
Understanding food system resilience	How is food system resilience constructed in secondary city regions, and which are the most promising avenues to enhance resilience?	How do interventions in the realm of digitalization and e-commerce shape food system resilience?	What are the coping strategies of street food vendors, how do they evolve, and how can they be strengthened?
Actor focus	Households and migrants in secondary cities, as well as local governments.	Food producers and consumers, delivery intermediaries.	Street -food vendors as a group of actors in the informal sector in urban areas.

Section 3 focuses on so-called second-tier or middle-sized cities, particularly relevant in Sub-Saharan Africa. While many of the headlines on urbanisation are grabbed by megacities, the vast majority of Africa's urbanites, in fact, live in small- to medium-sized towns [24]. Such towns bridge and integrate urban and rural functions, and studies argue that prioritising secondary towns offers a more inclusive development trajectory [34]. However, are such towns also better able to weather the COVID-19 pandemic? Moreover, will continued policy focus on these towns lead to more resilient food systems?

Section 4 addresses the role of digital infrastructure and connectivity between urban and rural food systems. Various studies document the economic benefits of improved rural infrastructure (most notably roads) on agricultural productivity and access to markets [35–37]. Apart from these physical infrastructures, we see increased interest in the role of digitalization and IT infrastructure in rural–urban connectivity and the agri-food sector in particular. According to some early reflections [38–40], the mobility restrictions imposed to tackle the COVID-19 pandemic caused a jump in the development of e-commerce. What does the steep increase in online food sales imply for longer-term food system resilience? How can early insights into the use of e-commerce inform digitalization policies and the development of more resilient food systems?

In Section 5, we focus on informal food vendors in urban areas specifically. While such vendors play an important role in providing affordable and nutritious food to urban consumers, their role is often poorly understood. Street food vending is an urban job predominantly taken up by migrants from rural areas, the profits from which are an important source of remittances flowing back to rural areas. Did informal street food vendors benefit from their existing coping strategies when facing extra risks due to COVID-19 restrictions, or were they put in an even more fragile position? Were vendors in more connected regions better able to weather COVID-19 and the policy responses? Which options exist to improve the resilience of such vendors?

For developing the cases in the next sections, we conducted a semi-systemised literature search in two scientific databases, complemented with grey literature of major international development organisations (see Supplementary for details). Even though the focus of our treatment is on understanding food system resilience in LMICs, we present insights from high-income countries where relevant. In each case on a specific moment of urban–rural interaction, we use the identified studies to develop an understanding of the impact of the shock, specifically COVID-19, on food system resilience. The preliminary results of this study were discussed with key experts, leading to the identification of additional relevant studies.

We operationalize food systems resilience using the framework by de Steenhuijsen Piters et al. [16], considering four elements of resilience: Agency, Buffering, Connectivity, and Diversity. These four elements are useful in disentangling and structuring the discussion around resilience, even though multiple but closely related frameworks exist (e.g., [11,13,15,38]) (Table 2).

Table 2. Four elements of food system resilience based on de Steenhuijsen Piters et al. [16].

Food System Resilience Component	Description
Agency	The means and capacities of people to mitigate risks and to respond to shocks, whereby greater agency renders actors more resilient.
Buffering	The access to sufficient resources to fall back on in the face of shocks and stressors, whereby greater levels of resources render actors more resilient.
Connectivity	The interconnection of and communication between actors and market segments, whereby greater levels of connectivity are assumed to enhance resilience. It can be interpreted as both physical as well as social connectivity.
Diversity	Diversity at different scales and in different places, from production to consumption and from farm level to regional diversity, is assumed to increase food system resilience.

In the final section (Section 6), we draw key conclusions on how urban–rural connectivity is structured in these three cases, how it shapes food system resilience, and how the latter can potentially be strengthened. Tying this discussion together with recent conceptual approaches to rural–urban relations, we structure this discussion by means of three concepts developed within a project studying rural–urban synergies in Europe [33]: new localities, smart development, and network governance. New localities interrogates the ways in which established and popularly recognised representations of locality are brought into being. The concept offers a hybrid spatial model that integrates the need for administrative boundaries with how these are crossed in practice. Smart development is a strategy for regional growth that involves targeting development policies according to regional strengths. Smart does not mean technology (although technology can enable smart development) but rather prioritisation and entrepreneurial discovery, through which regions adapt policies and resources to take advantage of competitive strengths. Finally, network governance is a model for deciding together, emphasizing stakeholder participation through multi-scalar partnerships. It stems from a recent tendency to shift from a predominantly top-down, centralised state to more distributed and collaborative models of decision-making theorised as 'governance'. Thinking through these three conceptual tools allows us to highlight that a context-sensitive approach to rural and urban areas is vital in fostering food system resilience.

3. Secondary Cities and the Urban–Rural Food Systems Continuum in Which They Are Nested

3.1. Small- and Medium-Sized Cities as Urban–Rural Bridges

Various policy platforms and think tanks have called for a stronger development policy focus on second-tier cities [39–42]. Such cities are hypothesized to form natural bridges between the rural agricultural surroundings and more non-primary economic sectors in urban areas. In addition, they harbour a considerable part of Africa's urban population and urban poor in search of more productive employment. Synergetic relations between agriculture and processing in such cities are expected [43], leading to potentially more inclusive growth patterns in secondary towns [34,44].

Conversely, Vandercasteelen et al. [37] show that agricultural opportunities (prices and intensification) are greater in the vicinities of primary cities compared to secondary cities. This suggests a trade-off: secondary cities may witness more inclusive and poverty-reducing development but with overall levels of economic output that are smaller [34]. The latter could be explained by policy neglect and lower levels of public investment in secondary cities [21]. This raises the question as to whether, for instance, the COVID-19 crisis had profoundly different impacts on different urban settlements. Are food systems in specific types of urban or urban–rural agglomerations more or less resilient, what are the causes of such differences, and what lessons can be drawn?

While studies (e.g., [1,7–10]) have observed the differential impact of COVID-19 across urban and rural zones, virtually no studies have investigated the heterogeneous impact of COVID-19 across different types of urban agglomerations. The study by Ruszczyk et al. [45] is, to the best of our knowledge, the only study that explores the differential impacts of COVID-19 on secondary cities. The study considers two secondary cities in Bangladesh in comparison to the capital city, suggesting inhabitants in secondary cities were more resilient to the COVID-19 crisis. First, food markets were less affected due to greater reliance on peri-urban agriculture (also observed by [46] in Benin) and also because rural producers found it easier to continue selling produce in second-tier cities' markets. Second, the authors observe that the distance between the local government and its citizens is smaller in secondary cities, allowing them to act more promptly and decisively. However, when and where such findings can be generalized remains for investigation.

Another avenue for understanding the impact of COVID-19 on different types of cities is to consider patterns of migration. Various studies document (temporary) migration flows from primary cities to both rural areas as well as secondary cities. This is well

documented in India [47–49], but evidence is also emerging from other regions [50,51]. COVID-19-induced migration in India originates from reduced economic opportunities as well as health concerns. This is evidenced by the migration of agricultural labourers from India's breadbaskets (Punjab and Haryana) to their hometowns, causing agricultural labour shortages, reducing agricultural output, and increasing food prices [48,49]. Reverse migration also put a strain on the economies of secondary cities, which had to cope with reductions in labour mobility and transport, disrupting agricultural production and value chains, but also needing to accommodate many migrants returning from primary cities [51].

3.2. Food System Resilience across Different Types of Cities

Despite scarce empirical insights on the impact of COVID-19 on food system resilience in secondary cities, we seek to understand how resilience is shaped in more general terms, considering four elements (Section 2) that constitute food system resilience: Agency, Buffering, Connectivity, and Diversity.

3.2.1. Agency

When taking a food systems perspective, agency and the other elements constituting resilience should be considered for the various actors involved. In the case of secondary cities, this consists of the minimum of households, often engaged in multiple enterprises, as well as local governments.

To start with households living in (or moving to) secondary cities, Henderson and Kriticos [52] suggest that urban premia can be explained both by access to better amenities and infrastructure (schooling, health care) and also from the fact that urban areas allow families as a whole to diversify into multiple employment types. For the rural population, nearby small towns offer the first point where farmers, traders, and processors exchange knowledge on emerging opportunities [53], including new types of employment. The latter may be particularly relevant for women for whom employment in rural areas is limited. Employment in the food system, often informal in nature (agricultural processing, food transport and storage, street food vending), is the dominant type of employment arising in such smaller towns. These activities are pivotal in developing the food system as well as reducing poverty [54,55].

During COVID-19, most local governments were required to follow national policies on lockdowns and mobility restrictions, primarily aimed at containing the spread of the virus. At the same time, they had limited options to counter the economic challenges emerging locally [56]. This further aggravated the precarious situation of many of these towns: even though smaller town governments were more approachable and perhaps more responsive in adapting policies to local circumstances, their agency was constrained [45].

3.2.2. Buffering

In the most direct interpretation, buffering implies having financial savings or physical assets to compensate for temporary shortfalls in income. Past periods of rapid urbanisation, for instance, in the wake of the Green Revolution in various Asian countries in the 1960s, were closely matched by episodes of economic growth and enhanced income and stimulated migration from rural to urban areas [29,57]. Novel agricultural technologies and simultaneous technological development in manufacturing created new employment opportunities for a rural labour surplus. Greater income in urban areas, be it secondary or primary cities, thus, often translates to greater savings and assets and, as a consequence, greater buffering capacity.

However, in Sub-Saharan Africa, non-farm labour opportunities in urban agglomerations, particularly the smaller ones, remain largely absent [58]. Nonetheless, in Tanzania, flows of migration to smaller towns and cities are larger than to metropolitan areas despite smaller per capita gains in expenditures and poverty reduction [59], suggesting that smaller towns offer advantages other than large economic gains. Another study by Christiaensen et al. [34] highlights the greater poverty reduction potential of secondary cities. This may

stem from the fact that smaller towns are poorer to begin with [60], and many of the rural poor find their way to such secondary towns. Even though relatively more migrants settle in secondary cities, the gains in income and increases in buffering capacity- remain small, and advantages for households lie primarily with the other elements constituting resilience, such as connectivity and diversity.

Actual empirical analysis of differences in buffering capacity and how these are used to weather shocks are scarce. Ruszczyk et al. [45] found that in secondary cities in Bangladesh, there were fewer distress sales than in the capital during COVID-19, either signalling that the impact of the shock was smaller in these places or that buffering capacity was much smaller to begin with.

Various studies that call for strengthening secondary cities within food system development highlight the paucity of capacities and means of local governments. Secondary cities are more vulnerable to environmental shocks and hazards due to poor infrastructure, governance capacities, and emergency preparedness, despite decentralisation policies that lead to devolved responsibilities [21,56,61,62].

3.2.3. Connectivity

Two types of connectivity matter in explaining why secondary cities are a destination of first choice for many migrants. First, the transport and transaction costs of migration and resettlement are lower when considering a nearby urban agglomeration compared to a more distant primary city. Being closer to major agricultural production areas, nearby urban agglomerations are more familiar, and migrants can relocate with the entire family more easily by relying on existing social networks, and few have aspirations to move to more distant cities [53]. Many households living in small towns are found to rely on food gifts through informal social networks [63]. Secondary cities can be considered central nodes in a wider urban–rural agricultural landscape facilitating the flow of inputs, agricultural commodities, and ideas [40,64].

While the closeness is the lure for many migrants, many secondary cities can still be remote and disconnected from national economies. The broader literature discusses the economic implications of remoteness on agricultural prices (e.g., [37,65,66]), signalling how incentives for intensifying agricultural production rise with shorter distances to major metropolitan areas. Conversely, investing in physical infrastructure to strengthen the connection between secondary cities and the broader (inter)national economy is found to lead to increased opportunities in both off-farm and non-farm employment [37,67–69].

3.2.4. Diversification

One main advantage of living in secondary cities compared to neighbouring areas is a larger diversity of labour opportunities for multiple household members outside of the realm of primary production (see also above under agency), with members sometimes even commuting to farms [53]. Many households are found to be spatially stretched, with household members living and working at different times in different locations [63]. However, while options to diversify livelihoods are a central feature of migration to small and mid-sized cities, the economies of these cities as a whole are typically not particularly diverse.

Recent publications provide more data (Figure 1) on the structure and nature of urban and rural employment, as well as various zones in between [58,70]. Figure 1 shows that in Latin American economies, consumption and production are more separated, even in smaller cities, with employment in the non-agricultural and non-food sectors dominating in urban and peri-urban zones. In Sub-Saharan Africa and, to a lesser degree, Asia, the large share of employment in primary agricultural production in peri-urban zones (28%) and even in the urban zones (7%) stands out. Other studies find similarly high rates of rural employment within urban areas [52].

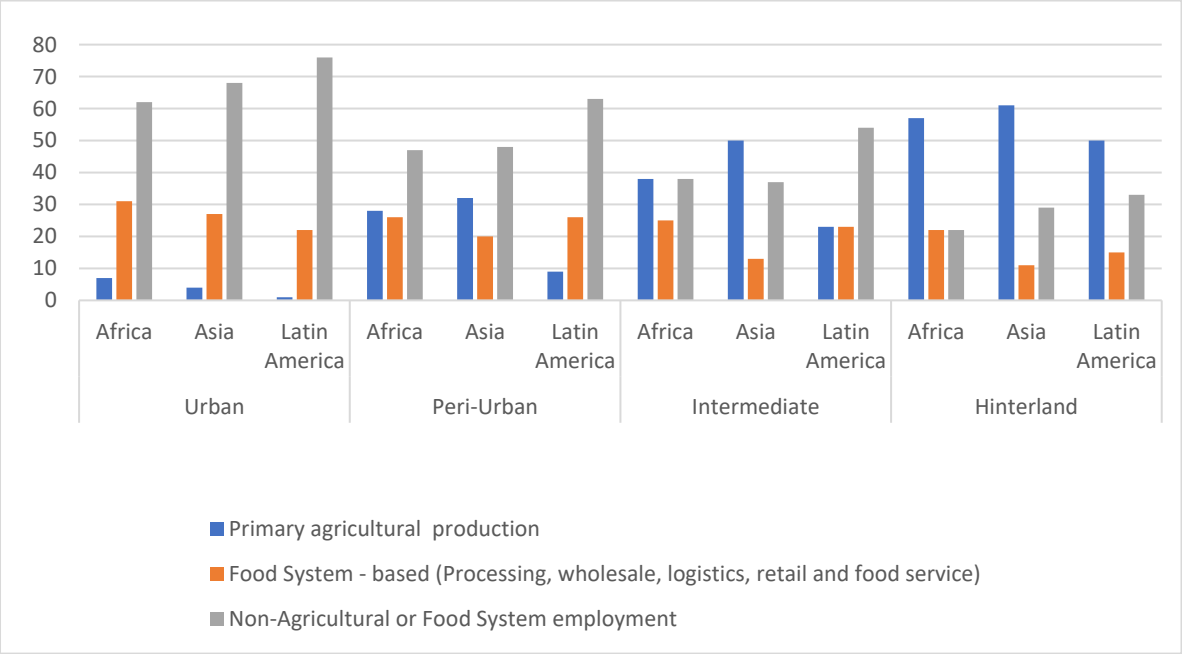

Figure 1. Share of employment by sector across urban and rural settlements. Figure based on data from Dolislager et al. [58].

Figure 1 suggests towns are much more reliant on employment within the broader food system, much of it likely small-scale or informal in nature. Such findings have inspired a debate about urbanisation without growth [17,71]. As argued by Christiaensen et al. [71], "the road of out of agriculture runs increasingly through a path of increasing labour productivity in agriculture". This implies a need for small- and medium-sized towns to diversify the base of their economic activities to enhance resilience.

3.3. Recommendations for Further Research and Policy

While observed reverse migration from primary cities to secondary cities suggests the latter are more resilient, the true picture is more complex. Small- and medium-sized cities offer advantages in terms of agency, connectivity, and diversification, at least compared to surrounding rural areas, but the overall economic opportunities remain limited. Few empirical quantifications of the effects of COVID-19 on resilience indicators exist, let alone for different types of urban agglomerations. Indeed, the scope exists for quantifying and comparing food systems and economic activities in different types of urban agglomerations, for instance, using novel data such as satellite night-time lighting [44].

This section also makes clear that opportunities exist to enhance resilience in secondary cities, notably by improving connectivity, diversifying local economies, and providing greater support to local governments. Various studies show the scope of using network governance approaches in governing new localities, such as landscapes in which secondary cities form a node in a wider urban–rural continuum [56,64]. Such governance approaches recognize the need to coordinate activities for resilience building across actors and administrative boundaries within the region, given that the food system and economic activities are intrinsically interlinked.

As Imai et al. [72] illustrate, many questions about effective allocations of public funds remain. For instance, should the available budget be used to build a road to improve linkages between secondary and primary cities, or should it be used to strengthen the links between the secondary city and its hinterlands? Empirical quantifications can aid such tricky policy decisions, although questions regarding the impact of different types of investments on food systems' resilience remain. These also include specific sectoral

approaches such as digitalization (Section 4) that can aid resilience building in secondary cities, as well as options to assist specific actors such as street food vendors (Section 5).

4. Digitalization and E-Commerce in Agriculture and Food Systems as a Means to Stimulate Urban–Rural Integration

4.1. Connectivity, Infrastructure, and Rural Market Failure

Lack of infrastructure is a major hindrance to rural development. The 2009 World Development Report [73] states that settlements located closer to main (which often means urban) markets have an economically advantageous position. Proximity is not only a matter of physical distance but, more broadly, of the ease or difficulty of travel of people, information, and goods.

The term "rural market failure" refers to a situation in which providing a particular service in a rural area is not economically viable, and this exacerbates the pre-existing inequality between rural and urban areas. Infrastructure and transportation is a prime example of such failure. With rural populations being often dispersed throughout remote or difficult-to-access geographies, providing economically viable transportation services is challenging. This disincentive, together with low-quality infrastructure, leads to social exclusion and further marginalisation of rural areas [74].

In addition to physical infrastructures, digital connectivity has increasingly become a debated topic, not least due to mobility restrictions brought about by the COVID-19 pandemic. While digitalization is seen as a possible tool to amend rural–urban inequalities and enhance and quality of life in rural areas [75], it also mirrors the inequalities encountered in access to physical infrastructure. Even in the context of the Global North, people living in rural areas have less access to the internet than urban inhabitants [75,76]. Urban areas often have better-developed 'digital ecosystems' in terms of resources, skills, and networks. In comparison, the development of IT infrastructure in rural areas is more costly and, therefore, lagging, which leads to the so-called digital divide [77]. Combined with global trends of urbanisation and middle- and high-income classes settling in cities, there is a risk of digitalization exacerbating existing disparities [75].

These disparities are even more severe in middle- and low-income countries. Although 90% of people globally live in areas covered by internet networks, only one-third of rural populations in the least-developed countries receive coverage [76]. In addition to gaps in coverage, many developing countries have large usage gaps in internet services: people live in areas covered by mobile broadband networks but do not use them. In the case of Sub-Saharan Africa, for instance, the coverage gap represents 19% of the population, and the usage gap is 53% of the population, with 28% of people being internet users [78]. Across the Asia Pacific region, the coverage gap is only an issue for 7% of the population, but 51% of the population falls into the usage gap [79]. Illiteracy and high costs of smartphones and internet services present key thresholds, particularly for Sub-Saharan Africa [80]. E-literacy and gender inequality in internet access are other concerns in both Sub-Saharan Africa and the Asia Pacific region [79].

In the agri-food sector, digitalization dates back to the 1980s [77] and includes the use of diverse technologies throughout the agri-food chain, e.g., remote-sensing, computing, and modelling in production but also platforms facilitating access to inputs, market, finance, and training [75,77]. Most developments in the digitalization of agriculture are currently foreseen in rural communities in middle- and low-income countries. The hopes put in these developments are based on the experience of increased mobile phone usage, which facilitates farmers' insights into price formation, thus improving their bargaining position and contributing to higher supply efficiency [80]. Mobile banking also enables access to finance in rural communities lacking conventional banking institutions [81]. This gives grounds, in developing economies, for "leapfrogging" older technologies in favour of digital tools [75]. In this section, we focus on the role of a particular case of digitalization that has received attention during the COVID-19 pandemic: e-commerce or online food retail.

4.2. E-Commerce as a Contribution to a Resilient Food System

The mobility restrictions and social distancing measures most governments imposed to tackle the spread of COVID-19 limited the options to sell and buy food in brick-and-mortar stores as well as outdoor markets. Early reflections [82–84] hoped that digitalization would open new avenues for food supply, particularly in middle-income countries in Asia and South America. In June 2020, ACI Worldwide [85] reported that online purchases increased by 31% compared to the same month in 2019. Nonetheless, these figures are inflated by sales of leisure and luxury items in the Global North.

A geographical bias remains in research on e-commerce during COVID-19. As noted by Nguyen et al. [86], most studies present evidence from high-income countries such as Italy [87], Germany [88], and Taiwan [89] or middle-income countries witnessing e-commerce booms before the pandemic, e.g., China [90]. Nguyen et al.'s [86] study from Hanoi, Vietnam, is, to our knowledge, the only peer-reviewed, empirically based study on food e-commerce in lower- and middle-income countries. Other cases are documented anecdotally and through references to media accounts (see particularly [2]) and merit further investigation. Another limitation of current knowledge on e-commerce stems from the difficulty of conducting research during COVID-19. With in-person data collection being impossible, most studies recruited participants via online platforms, creating an inherent bias in their samples [86]. Despite these limitations, insights into the functioning of online food sales during the pandemic indicate promising avenues for future research on the role of digitalization in food system resilience.

4.2.1. Agency

Access to digital retail channels is a key issue related to agency. For e-commerce to contribute to a more resilient food system, equal access needs to be ensured for diverse producer and consumer groups. While Reardon and Vos [2] describe the growth of e-commerce mostly in terms of market processes, other experiences show that government facilitation is required to ensure access for more vulnerable actors on both supply and demand sides. FAO and ECLAC's [82] report on digitalization in Latin America shows that despite relatively high rates of internet penetration, the adoption of digital technologies among small producers is low, threatening their exclusion from the post-pandemic recovery. The solution is seen in public policies, increased connectivity, and advisory services enhancing e-literacy—steps that require action of (local) governments.

Guo et al. [90] confirmed the relevance of such interventions in the Chinese example. Enhancing internet access as well as other infrastructures have been key goals in projects aiming to tackle urban–rural connectivity. The government promoted the establishment of e-commerce for agricultural products, developing a national e-commerce platform. Chang and Meyerhoefer's [89] account on Taiwan confirms the importance of training and government support in the development of digital supply chains benefiting small producers.

The Chinese experience also shows the limitations of large-scale projects run by the government. While providing complex solutions, the nationwide e-commerce platform operated at a large scale, including long-distance transportation and logistics, which became cumbersome with increased mobility restrictions. At this point, locally organized supply, often relying on informal social networks, complemented state-wide channels. In these unofficial channels, farmers used their personal accounts to post products in online shops on social platforms, thus attracting friends in social circles to place orders online and make use of crowdsourced logistics for distribution. Guo et al. [90] contend that these platforms were only able to provide limited diversity of products, and quality monitoring was difficult due to their informal nature. However, the short supply chain and localized logistics made the food supply fast, safe, and efficient. The authors further highlight that food sold through direct, informal channels typically has a price advantage, particularly relevant for low-income households. Their case, thus, confirms the importance of network governance which includes diverse sets of actors and contributes to smart development building on local strengths.

Consumer agency is discussed in studies from Vietnam [86] and Germany [88], and both accounts are critical of the accessibility of e-commerce for lower-income groups. According to Nguyen et al. [86], internet access is limited among low-income Hanoi households. The most vulnerable consumers, thus, cannot make use of e-commerce and are forced to continue shopping in person, despite the health risks this might pose. In Germany, Dannenberg et al. [88] add that online shopping typically includes direct or indirect delivery costs, which can hamper financial availability.

In sum, if e-commerce is to become a part of a more resilient food system, equal participation and agency for diverse actors need to be ensured in terms of internet access, e-literacy, and affordability. While governments can play a substantial role in these efforts, community involvement can facilitate the process from the bottom up.

4.2.2. Buffering

Online food sales can act as a buffer when conventional supply chains are disrupted. The FAO and ECLAC report from Latin America and the Caribbean documents a sharp increase in both business-to-business and business-to-consumer platforms during the COVID-19 pandemic, which "filled the gap in essential food supplies" [82] (p. 9) and helped with the distribution of perishable products. Guo et al. point out that compared with traditional food supply models, e-commerce has the advantage of "extensive consumer distribution, a larger sales radius, shorter transit time, higher circulation efficiency, lower circulation costs and a smoother information feedback flow" [82] (p. 447). Chang and Meyerhofer [89] add that a direct farmer-to-consumer platform can act as a valuable buffer for small farmers who lack the means of financial insurance afforded to larger agribusinesses.

The buffering potential of e-commerce is limited by the capacity of the supply chains, namely storage and delivery. The demand for buying food online exceeded the suppliers' capacities in China and Germany [88,90]. In one of the German cases, up to 22% of potential new customers could not place an order because the desired products or delivery dates were not available [88] (p. 553). Nguyen et al. [86] note that case studies conducted among the customers of online food shops cannot capture the surplus demand and, thus, only give a partial picture of the sector's ability to address peaks in orders.

Early accounts of adaptation strategies point to both large actors and grass-roots efforts as the most promising. On the one hand, as Reardon and Swinnen [84] remark, globalized and capital-intensive supply chains are more resilient, as they have larger financial buffers and can source labour flexibly (although this might have negative effects on employment security). On the other hand, Dannenberg et al. [88] argue that decentralised storage locations and a multi-channel approach offer more flexibility than centralized logistics. Guo et al.'s [90] accounts from China further show that unofficial and locally embedded channels can operate quickly and effectively meet the needs of communities in small- and medium-sized cities. Extended delivery times and preorder systems with longer waiting times were other adaptation strategies mentioned in both German and Chinese studies [88,90]. In sum, the buffering potential of e-commerce can only be seized with well-developed infrastructure and organization of the supply chain.

4.2.3. Connectivity

Apart from the obvious need for good internet connectivity, digitalized food sales also bring questions about the organization of the supply chain and delivery. Many hopes are put in digitalization for shortening supply chains, thus providing more direct producer–consumer relations and more value for primary producers [82]. According to Chang and Meyerhoefer [89], this has been the case in Taiwan, where e-commerce provided a new distribution channel for small farmers. However, there are also signs of a new intermediary sector taking hold in the domain of logistics and distribution [2]. In long supply chains, this could lead to a further squeeze in farmers' incomes [88].

It is also important to consider what type of labour relations such flexible supply chain solutions facilitate. Synergies between e-commerce and platform-based deliveries point to

a system that is highly adaptable [2] but also precarious for its workers, who are typically recruited from vulnerable groups. Chang and Meyerhoefer [89] raise the issue of workers' safety in motorcycle-based deliveries in Hanoi. They argue that while e-commerce could improve Hanoi's problems with traffic congestion, it could also aggravate them if deliveries are organized without coordination. Their case reveals the importance of smart policies, particularly in cities that are already facing high levels of motorized traffic and the related issues of transportation delays, road safety, and air pollution.

The organization of physical goods delivery brings further questions in relation to rural–urban connectivity. Insights from China [90] show that e-commerce is best organized at short to medium distances. Although local e-commerce platforms (with transportation below 300 km) offered less variety of food, this was outweighed by simpler logistics and higher resilience to disruptions of transportation routes. Cooperation with local communities (through both formal and informal channels) allowed for targeting the needs of both producers and consumers, including sales of regional products.

At the same time, research from Germany revealed that the comparatively high transport and logistic requirements resulted in most online sellers targeting larger urban areas. Rural areas often lacked infrastructure such as warehouses or pick-up points, and the dispersed buying power was not attractive for sellers, especially considering the already low margins. Peripheral areas were mostly left out, even by larger online grocery providers [88]. These findings suggest that although e-commerce can present a tool to mend the rural–urban inequalities, in reality, this type of food supply faces similar challenges as brick-and-mortar retail. Interventions, particularly in lower-income countries, thus, need to bear in mind that digitalization cannot replace the development of physical infrastructure. This type of supply chain seems to be best suited for dense and interconnected areas, particularly when delivery logistics are organized in a synergistic way.

4.2.4. Diversification

E-commerce as a new distribution channel diversifies the options of both producers and consumers, thus increasing their resilience. All reviewed studies point to a growth of e-commerce during the COVID-19 pandemic, documenting how this avenue becomes more established even for actors who are not typically pioneering new technologies [87]. For instance, Nguyen et al. [86] observed that many shoppers in Hanoi either used e-commerce for the first time or used it more than before during the COVID-19 lockdowns. They argue that after overcoming the entry barrier, customers may normalize e-commerce even after the lockdown measures are lifted, thus diversifying their provisioning options.

On the producer side, studies show that e-commerce has become a new delivery option for traditional retailers as well as producers [2]. In Germany, many large retailers started or strengthened online orders as an option for their consumers [88], and Reardon et al. [2] refer to similar developments in China, India, and the USA. This relates to the question of who benefits from the growth of e-commerce. According to Reardon et al. [2], bigger and international players with extensive infrastructure and flexible logistics are better positioned to reap the benefits of retail digitalization. These companies are often able to expand on their existing capacities and organize logistics and delivery without intermediaries, taking a bigger share of the market.

The Taiwanese case documented by Chang and Meyerhofer [89] provides a counter-example in which an online producer-to-consumer platform helped small farmers to sell their produce during the pandemic. As the authors point out, this channel can also be used for other types of disruptions, including changes in demand. The Ubox platform, thus, fulfils much of the hopes for e-commerce to diversify the distribution options of smallholders and capture value streams by avoiding intermediaries.

4.3. Recommendations for Further Research and Policy

Although empirical data on e-commerce during COVID-19 are scarce, and we are only beginning to understand the implications of digitalization on food system resilience,

some lessons can be drawn across different contexts. First, in regions such as Sub-Saharan Africa, the development of basic and affordable IT infrastructure is the first step toward inclusive food e-commerce. However, rural areas will still face difficulties when the physical infrastructure for transportation, storage, and distribution is not in place, which limits the potential for "leapfrogging". The development of digital infrastructure, thus, needs to build on already existing resources and address local needs.

Currently, retail food digitalization seems to be more relevant for middle-income countries which already have developed basic IT infrastructure and in which internet access is affordable for a large share of the population. In these contexts, smart policies are needed to increase e-literacy and support the uptake of e-commerce, particularly by small-scale producers and consumers disadvantaged by their educational level, age, gender, or other factors. Some concrete incentives are proposed by FAO and ECLAC [82] (p. 2), including (i) smart demand and supply subsidies; (ii) support for incubators, accelerators, and innovation clusters; and (iii) better access to appropriate financial products for new enterprises and service providers.

De Steenhuijsen Piters et al. [16] note that interventions aiming to increase food system resilience need to consider socio-political differentiation and economic inequality and the resulting unequal distribution of positive and negative outcomes. This holds particularly true for the development of digital infrastructures. Although we see evidence of e-commerce benefiting more vulnerable actors such as small-scale farmers, there is also a clear risk of exacerbating existing power differentials on multiple levels, e.g., international corporate actors vs local entrepreneurs, rural vs urban consumers, delivery service intermediaries vs precarious workers, etc. Commitment to network governance inclusive of a diverse range of stakeholders can be a way of negotiating the trade-offs between different food system actors.

While the COVID-19 pandemic represented a catalyst for food system digitalization in some areas, questions remain about the longevity of these changes. Dannenberg et al. [88] remain sceptical, pointing to experiences from previous pandemic events which led to a temporary upswing of digital markets but did not result in permanent changes on the food system level [91,92]. Such a longer-term perspective will be needed to recognize whether a sudden surge of e-commerce can indeed provide a buffer and foster food system resilience across the rural–urban continuum or whether it mostly presents a temporary market niche seized by the best-positioned actors.

5. Street Food Vendors as an Important but Vulnerable Actor in Leveraging Urban Demand with Rural Supply

5.1. The Role of Street Food Vendors in Urban Food Systems

Street food vending connects the rural and urban spheres through people, financial resources, and food. First, street food vending plays a key role in the informal employment opportunities for people migrating from rural to urban areas, with street food vendors most often being migrants from rural areas. Second, vendors send remittances back to their families, sustaining their incomes and enhancing their food security. Third, street food vendors form part of networks transporting food toward and within cities. Hence, street food vendors play a key role in moving filling, healthy, nutritious, and affordable food across and around cities, contributing to urban food security. The urban poor especially tend to rely on informal street vendors. Consuming food from street food vendors is convenient due to low prices and the wide availability of food on offer [93–98].

In many urban settings, the majority of workers are employed informally, and informal employment is now recognized as a key driver in economic recovery and employment creation [99]. In Sub-Saharan Africa, the ILO estimates that 80% of the total workers are employed in the informal sector [100], and in urban settings, 25% consist of street vendors. Women especially find employment as street food vendors due to the flexibility of working hours and low requirements for formal education [94,101–104]. The diverse

scale of employment opportunities associated with street food preparation, transport, and vending makes it instrumental in economic development [93,95,105–107].

Despite its importance, street food vending's legitimacy as a formal occupation is rarely made explicit in law or policy, making vendors a particularly vulnerable group in the food system. Vendors are rarely formally registered or possess trade licenses, making it difficult to reach them by policy and leading to exclusion from social benefit programmes. The lack of formality and associated rights excludes or marginalises them in policy design. Finally, vendors are often at risk of being evicted or displaced, a risk that increases with the importance of the place, face other types of harassment from local authorities, and often lack social safety nets [95,98,103,105,106].

In the wake of COVID-19, many mitigation measures had pronounced implications for street food vendors, amplifying some of the risks they already faced [108]. In Zimbabwe, the authorities took advantage of the lockdown to increase the number of shutdowns of street food vendors. In Kenya, residents living in informal settlements increasingly reported human rights violations and harassment of SMEs. Moreover, harassment increased by street-level bureaucrats for the exchange of bribes. Hindering selling food products by street food vendors also affected consumers. In Vietnam for instance, the urban poor lacked the financial means to buy from supermarkets, which remained open during the lockdown. Their only option was to buy products from informal street food vendors who continued selling their food products illegally [108].

In general, national COVID-19 response measures, such as curfews and mobility restrictions, severely affected the livelihood opportunities for many workers in the informal sector [97,102–104,109]. The market environment changed due to COVID-19 restrictions, with vendors struggling to source food supplies due to mobility restrictions. At the same time, they witnessed a decrease in the number of customers due to personal mobility restrictions, with more people staying at home and preparing meals at home. Finally, unemployment also led to reduced purchasing power [97,102].

5.2. Street Food Vending in a Resilient Food System

5.2.1. Agency

Street food vendors are particularly vulnerable due to the uncertain and low daily incomes, exclusion from social security nets, and unsafe and unprotected working conditions. Moreover, street vendors receive little to no support from (local) government in case of crises or are sometimes categorised as criminals who threaten public order and safety [95,105].

Before the COVID-19 pandemic, street food vendors had already adopted coping strategies to work and make a living in a highly uncertain working environment. Keck and Etzold [105] noticed that Dhaka's street food vendors quickly close down their shops, cover their push-carts or flee the scene with their mobile vending units in times of police raids. Others used bribes to convince the police not to bother them or relocated to places less frequently controlled by the police. Another coping strategy mentioned by Hayombe et al. [110] is operating in the late evening to avoid tax officers or police surveillance.

The COVID-19 pandemic has put street food vendors in an even more fragile position by restricting their mobility, with curfews limiting their working hours, and excluding them from financial support from governments. These restrictions, and their unfavourable position, forced them to become creative and also to govern their own safety. For example, street food vendors started to sell products from vehicles as a more robust environment that responds to the challenges imposed by the lockdown restrictions. Vehicles provided the means for a quick get-away when required and served as storage of the daily stock. Moreover, vehicles served perfectly as a trading space since street food vendors were banned from open markets or street corners. Street food vending from a vehicle does not require many resources (capital) and has few barriers to entry, which also enabled newcomers to join the sector [97,102–104,109]. Although these strategies contribute to the

enhanced resilience of street food vendors, they mask the fairly limited level of agency of vendors, constrained by the micro and macro politics of street food governance.

5.2.2. Buffering

A decline or even a complete loss in income has an enormous impact on the livelihood of street food vendors. Vendors may have no choice but to use their negligible business capital for self-consumption, which could lead to temporary or permanent business closure, leading to job losses and a surge in poverty [4]. Before the COVID-19 pandemic, street food vendors relied on financial support from family or close friends to keep their businesses running in difficult times. However, the COVID-19 pandemic had a much broader societal impact, including on families and friends of vendors, reducing the pool of buffering resources that street food vendors normally relied on. On the other hand, due to the COVID-19 pandemic, many newcomers started street food vending jobs when they lost other jobs. For these people, street food vending is used as an extra buffer to generate an income for themselves and their families [104].

5.2.3. Connectivity

Street food vendors operate in a diverse network. They operate informally in an environment of formal authorities, they are connected to producers and intermediate actors in the food system, they are interlinked with other street food vendors, who could be competitors even though at the same time opportunities arise for partnership, and last, street food vendors are connected to consumers through the demand for cheap food options.

Due to their informal position in the labour market, street food vendors are not connected to authorities in place, which causes them to miss out on the social security net which might be offered to formal enterprises in times of crisis [4]. A crisis such as the COVID-19 outbreak may create momentum to strengthen ties between formal authorities and informal street food vendors. For example, in India, the government recognized the difficulties of getting access to food for consumers in case of a strict lockdown. Considering food as an essential good, the Indian government allowed the delivery of fresh vegetables from the wholesale markets by street food vendors to each ward of the city by electric 3-wheel rickshaws. In this case, the COVID-19 lockdown restrictions led to opportunities for informal street food vendors to operate in a formal structure and still make profits during the crisis [109]. However, questions remain on the inclusivity of the selection of wholesale sellers as well as the eventual consumers.

Next to the connection with authorities, street food vendors are connected to producers and/or intermediate actors. As a result of the mobility restrictions, some street food vendors noted a decrease in the availability of food supplies from rural areas [102]. This could lead to a decrease in their sales and income, even forcing them to close their business temporarily or permanently. However, there are examples in which the issue of shortage of agricultural products was overcome during the COVID-19 crisis. Middlemen would use bribes or organise themselves to ensure a sufficient supply for the retail sector. This suggests that a well-connected network of different food system actors is beneficial for all involved [97].

Street food vendors are also connected among themselves. For instance, in Zimbabwe, street food vendors started selling their products in vehicles during COVID-19, and those vendors not in possession of a vehicle would partner up with close contacts to share facilities [104]. The vendors who were better integrated into a network would benefit more from the possibility of partnering up and sharing resources or other assistance.

Last, street food vendors are connected to their customers. The customers are most often referred to as the urban poor who seek cheap food options. Another reason to consume food away from home is that it is seen as convenient, both time-wise and location-wise. However, there was a decrease in customers who normally would buy readymade meals from street vendors on their way to work or home due to mobility restrictions and

lockdowns. To overcome this decline in customers, street food vendors went into the neighbourhoods to sell their readymade meals [108].

5.2.4. Diversification

The COVID-19 pandemic has increased the diversity of street food vendors and their daily business practices. On the one hand, street food vending appeared to be a suitable backup source of income during the pandemic; hence a lot of newcomers joined the sector. In Zimbabwe, 48% of the traders during the early months of COVID-19 were new vendors who started their businesses as alternatives to their affected businesses or closed workplaces [104]. Selling food products served as a complementary source of income, which was especially important for the newcomers who lost their jobs temporarily or permanently due to the pandemic. On the other hand, street food vendors who were already in business diversified their business practices. Street food vendors opened up new vending sites or moved around into the neighbourhoods to look for more customers, for instance, in vehicles. Vehicles made it possible to expand their territory to search for customers [97,104,108].

5.3. Recommendations for Further Research and Policy

The position of street food vendors is precarious, even without a major disruption such as COVID-19, as they already face various risks on a daily basis. Street food vendors often already apply various coping strategies to operate their businesses under tough circumstances.

One thing that makes the position of street food vendors so fragile is their informal position. There is a clear need to improve the position of street food vendors and entitle them to operate in the formal sector, especially during times of (economic) shocks [98,103]. Formalising the role of street food vending within the urban (food) governance system could potentially strengthen their position by assigning formalised trading spaces or other infrastructure and services [111]. On the other hand, questions remain on the type of governance structure that could accommodate street food vendors: who should be included in formal arrangements, how can this be achieved, or do street food vendors better operate in the informal structures with which they are dealing already?

Furthermore, while this study focuses on the short-term impact of COVID-19, it is important to consider the longer-term effects to fully understand street food vendors' resilience in times of crisis. For instance, seeing that street food vendors live on a daily income, how long will they be able to sustain their business if this daily income becomes very uncertain? Moreover, if street food vendors are forced to stop running their business, what will happen to them and to their families to whom they send remittances, and what will be the impact on their consumers' food security?

Moreover, it would be relevant to investigate if newly adopted coping strategies are still in place after the pandemic. Do these coping strategies become part of the daily business routine of street food vendors? Do the newcomers who joined the street food sector due to a loss in income keep working in the informal food sector, and if yes, what drives people to do so?

6. Key Findings and Recommendations

This study has investigated food system resilience—conceptualized through the four dimensions of agency, buffering, connectivity, and diversification—from the perspective of rural–urban relations. We zoomed in on three cases that, while not exhaustive, capture distinct actor and policy foci in a wider literature on urban–rural interactions. These are the role of secondary cities and their development potential as central nodes in urban–rural food systems, the role of infrastructure and particularly a recent policy focus on digitalization in shaping food systems and their resilience, and finally, a focus on street food vendors as a particular group of actors in linking rural supply with urban demand for nutritious food. This section summarizes the key findings and recommendations for research and policy

by positioning our results against three concepts capturing interdependent rural–urban relations [33]: new localities, smart development, and network governance.

First, this study confirms the relevance of the concept of new localities in studying rural–urban interactions. All three cases show the need to move beyond classifying zones as either rural or urban based on administrative boundaries only. Developing countries' secondary towns are typically a central economic node in a wider agricultural landscape. Inhabitants' livelihoods often stretch across rural–urban boundaries and diverse types of activities in search of higher resilience. This is confirmed in the case of street food vendors who move around and across cities to reach their customers and suppliers. Policies need to take this multilocality and multiactivity into account, for instance, by considering a broader city–region food system and flows of temporary labour migration.

At the same time, some sectors can still benefit from differentiated interventions to address specific challenges of different types of settlements. This is shown clearly in the development of digital as well as physical infrastructures, which are often lagging in rural areas. Additionally, in this respect, the potential of secondary cities as a natural rural–urban bridge merits further investigation.

The concept of smart development describes the need to target development by taking advantage of competitive strengths. There is broad recognition of the need to focus on developing secondary cities as a means to reduce poverty and strengthen food systems. However, the resources and capacities of local governments in secondary cities are often scarce. This limits the means by which locally smart development trajectories can be identified and implemented. This review highlights the potential (or current lack) of policies focusing on improving connectivity to better integrate towns into national economies. Furthermore, diversification of employment opportunities outside of the agriculture sector can strengthen the resilience of small-town economies, although trade-offs may emerge between diversification and specialization.

While digitalization is seen as a way of increasing rural–urban connectivity and enhancing food system resilience, our review shows that e-commerce remains dependent on physical infrastructures facilitating storage and delivery. Since rural areas, as well as many secondary towns, are typically disadvantaged in both physical and digital infrastructures, context-specific synergistic development of both merits particular attention to foster rural development. Finally, smart development policies should consider informal arrangements, which often constitute a significant part of local food economies, as shown by the case of street food vendors, as well as e-commerce organized from the bottom-up through social networks.

Relatedly, network governance entails bringing together groups from different scales and sectors, from government institutions to informal actors, to engage in joint decision-making. Such an approach, rather than top-down policies, is required to navigate complex questions emerging in rural–urban food system interactions. Crucially, our study reveals a need to enhance the agency of stakeholders now excluded from governance mechanisms, such as street food vendors. Their inclusion in network governance not only improves their resilience but also enables policy lessons based on current business and livelihood strategies.

In general, inclusive decision-making ensures that potentially negative impacts for some groups are identified early. For instance, while digitalization has the potential to mend existing inequalities, it can also exacerbate them. Unequal access to digital infrastructure follows the divisions based on rural–urban types of settlement but also income, educational level, and gender. Promoting e-commerce as an integral part of a more resilient food system thus requires equal participation and agency for diverse actors in terms of internet access, (e-)literacy, and affordability. While governments can play a substantial role in these efforts, community involvement can facilitate the process from the bottom up. Indeed, inclusive network governance across localities and stakeholders should underly tricky policy questions on infrastructure development and rural–urban connectivity. Who reaps

the benefits of these developments and which actors have a seat at the table are key questions to consider in debates on increased food system resilience.

We believe that the conclusions summarised above advance knowledge of food system resilience from the perspective of rural–urban connectivity. That said, some limitations of this work should be addressed in further research. Most importantly, the empirical base used to assess the impact of COVID-19 on food system resilience remains. In part, this is a function of the time at which this study was conducted, with the literature reviewed in the second half of 2021 with the pandemic still ongoing. Some geographical bias remains in the literature, especially in situations (such as the COVID-19 pandemic) that make data collection in LMICs particularly challenging. However, this scarcity is also due to the complex nature of food system resilience: few studies have been able to capture the four elements of resilience in measurable indicators. We hope that these gaps will motivate researchers to conduct a more thorough investigation of food system resilience in different settings and as a function of different disruptive events.

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