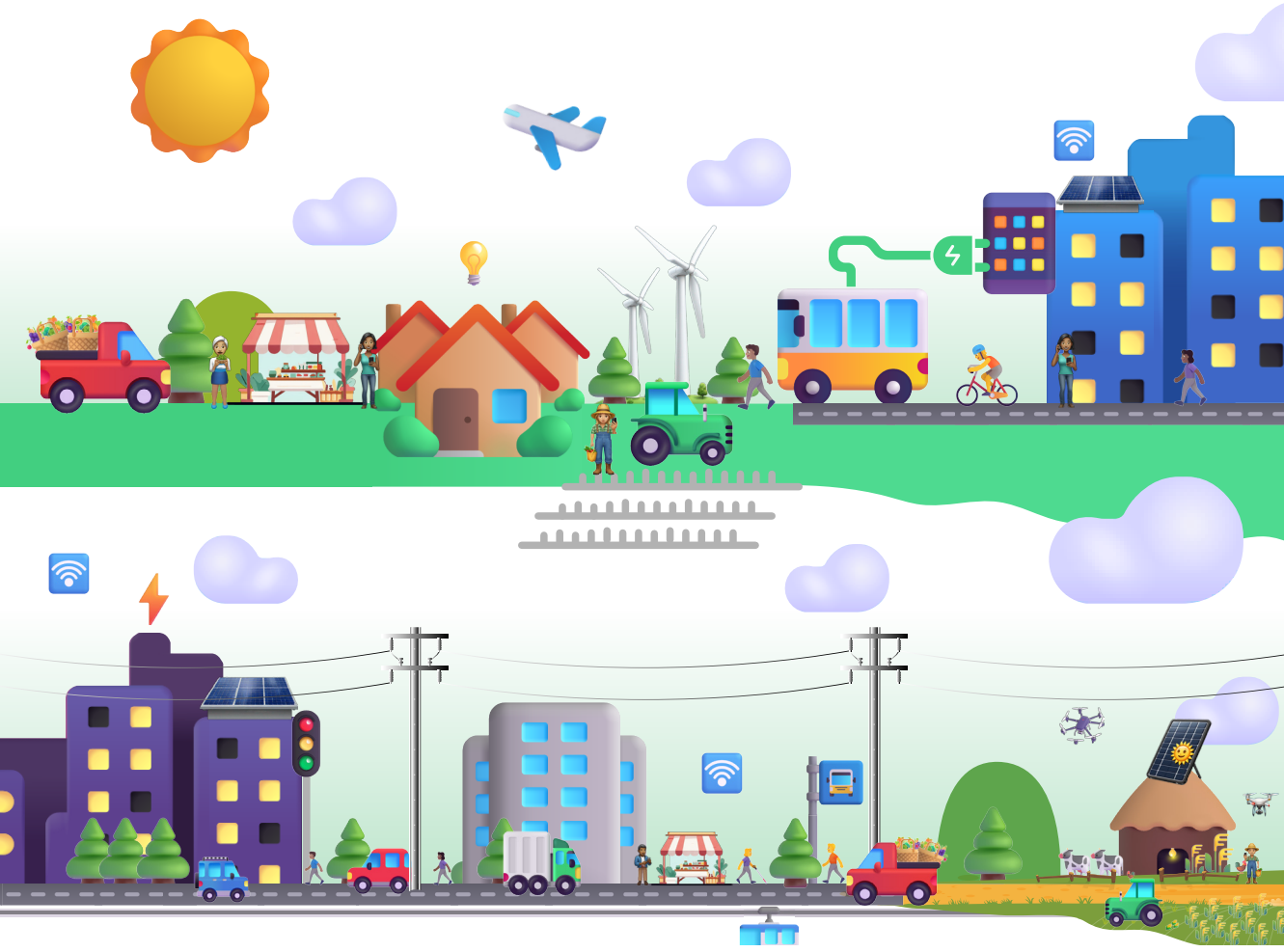
Advancing Urban-Rural Linkages

Digital Technology and Innovative Solutions for Food Flows and Territorial Resilience in East Africa

A STRATEGY PAPER



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Centre for Urban-Rural Linkages in Africa
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Advancing Urban-Rural Linkages: Digital Technology and Innovative Solutions for Food Flows and Territorial Resilience in East Africa

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Foreword

Urban-rural linkages are fundamental to sustainable development, shaping the flow of people, goods, services, and resources across territories. These linkages underpin food security, economic stability, environmental sustainability, and social cohesion. As East Africa continues to urbanize at an unprecedented rate, the need for resilient and integrated food systems has never been more urgent. Intermediary cities serve as critical hubs, facilitating the movement of food from rural producers to urban consumers, yet persistent inefficiencies in supply chains, weak infrastructure, and market fragmentation continue to pose significant challenges.

Digital technologies have the potential to transform food systems by improving connectivity, enhancing transparency, and creating more equitable access to markets. From mobile-based advisory services for farmers to e-commerce platforms that reduce transaction costs, digital innovation is revolutionizing how food is produced, distributed, and consumed.

However, despite their promise, barriers to digital adoption—including infrastructure gaps, digital literacy challenges, and policy constraints—must be addressed to fully harness the benefits of technology in strengthening urban-rural food systems.

This strategy paper provides a framework for integrating digital technology and innovative solutions into food and market systems, ensuring territorial resilience and sustainable development.

Through detailed case studies, it highlights real-world examples of how digital platforms, mobile finance, and smart agricultural solutions are already making a tangible impact in Kenya, Tanzania, and Uganda. It also presents policy insights and strategic recommendations aimed at guiding governments, development partners, and the private sector in designing and implementing effective digital interventions.

By offering a roadmap for digital transformation in food systems, this report serves as a valuable resource for policymakers, practitioners, and researchers. We extend our sincere gratitude to the experts, organizations, and institutions that contributed to this work and hope it inspires collaborative action toward building more resilient, inclusive, and sustainable urban-rural linkages in Africa and beyond.

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Abbreviations and Acronyms

AGRA	Alliance for a Green Revolution in Africa
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
I-cities	Intermediary cities
ICT	Information and communication technology
IoT	Internet of Things
KALRO	Kenya Agricultural and Livestock Research Organization
MNO	Mobile network operators
SDGs	Sustainable Development Goals
SIDA	Swedish International Development Cooperation Agency
SSA	Sub-Saharan Africa
UCLG	United Cities and Local Governments
UN-HABITAT	United Nations Human Settlements Programme
URL-GP	Urban-Rural Linkages Guiding Principles
URL	Urban-rural linkages
USAID	United States Agency for International Development
WTO	World Trade Organization

Executive Summary

The rapid urbanization of East Africa is reshaping food systems and market dynamics, creating both opportunities and challenges for food security, economic integration, and territorial resilience. Intermediary cities play a crucial role in linking rural food production to urban consumption, yet inefficiencies in value chains, weak infrastructure, and limited access to digital tools often prevent smallholder farmers and food entrepreneurs from fully benefiting from market opportunities. Digital technologies, including e-commerce platforms, mobile payment systems, and smart agricultural solutions, offer transformative potential in bridging these gaps by enhancing efficiency, transparency, and market inclusivity.

This strategy paper provides an analysis of the current status of digital technology and innovation in East Africa's food systems. It explores how information and communication technologies (ICT), data-driven decision-making, and digital financial services can strengthen food value chains, reduce post-harvest losses, and improve territorial resilience. The report presents a SWOT analysis to assess the strengths, weaknesses, opportunities, and threats associated with integrating digital solutions into food systems, offering insights into the barriers and enablers of digital transformation.

A key component of this paper is its case study section, which documents examples from Kenya, Tanzania, and Uganda, showcasing innovative digital tools that improve food distribution and market access. These cases illustrate how digital platforms have successfully linked smallholder farmers to urban markets, reduced transaction costs, and provided access to financial and advisory services.

Building on this analysis, the report outlines policy recommendations and strategic interventions for enhancing digital adoption in food systems. It proposes concrete actions for governments, development agencies, and the private sector, including investing in digital infrastructure, fostering inter-city collaboration, improving regulatory frameworks, and promoting financial inclusion for small-scale producers and market actors.

Finally, the paper presents an implementation framework, detailing key stakeholders, resource mobilization strategies, risk assessment measures, and monitoring and evaluation mechanisms. By adopting the strategies outlined in this report, policymakers and practitioners can harness digital technology to build resilient, efficient, and inclusive food systems, ensuring that urbanization contributes to food security and sustainable economic growth across the urban-rural continuum.

CHAPTER

01

Introduction

1.1. Overview of Intermediary Cities in East Africa

A large proportion of the world's population resides in urban centres, including those in the global South. It is projected that approximately 68 per cent of the global population will live in urban settings by 2050 (Bocquer, 2005), largely because of rapid urbanization in Africa and Asia, regions where there will be a doubling of city sizes and numbers (Kamana and others, 2023). In Africa, the urban population almost doubled from 290 million in 2000 to 570 million by 2020, with a growth rate of 35 per cent to 45 per cent (UN-Habitat, 2022). In East Africa, the urban population accounts for 31 per cent, 38 per cent and 28 per cent in Kenya, Tanzania and Uganda respectively.[1,2,3] Africa's Urbanization Dynamic Report 2020 estimated a much higher urbanization level for Kenya and Uganda at 65 per cent and 39 per cent respectively (OECD/SWAC, 2020). Generally, the cities' population growth is driven by a combination of factors, including a surplus of births over deaths in urban areas, migration from rural to urban areas and the urbanization of formerly rural areas (DESA-UN).

1 United Nations Department of Economic and Social Affairs (2022). World Population Prospects. The 2022 Revision. https://population.un.org/wpp/.

2 Tanzania, Ministry of Finance and Planning, Tanzania National Bureau of Statistics and President's Office – Finance and Planning, Office of the Chief Government Statistician, Zanzibar. The 2022 Population and Housing Census: Administrative Units Population Distribution Report; Tanzania, December 2022.

3 Kenya National Bureau of Statistics (2019). Kenya Population and Housing Census: Volume II.

Urbanization plays a key role in sustainable development by impacting economic, societal and environmental factors in the area. Properly managed, urbanization can harness the benefits of population growth in cities, while minimizing negative impacts, particularly in low-income countries, including countries in East Africa.

On the other hand, uncontrolled urban expansion coupled with unsustainable production and consumption, and insufficient management of urbanization has led to urban sprawl, pollution and environmental degradation (Florida, 2017). The situation can lead to the loss of biodiversity and the dilapidation of ecosystems in rural and peri-urban areas, thus threatening their agricultural resilience (UN-Habitat, 2022a).

Strengthening the connections between the major cities, intermediary cities and the surrounding rural areas can support sustainable development by improving services, infrastructure and job opportunities for both urban and rural residents. Intermediary cities are essential for linking rural and urban areas by providing access to basic services and have populations ranging from 50,000 to 1,000,000 residents (United Cities and Local Governments). The intermediary cities display characteristics that combine elements of urban and rural areas and serve as centres for economic, social and cultural activities in East Africa. Examples of the intermediary cities in the region are the following: Nakuru, Machakos and Kiambu in Kenya; Arusha, Mwanza and Moshi in Tanzania; and Jinja, Mityana and Mbale in Uganda.

Arusha, Tanzania © Hugo Ramos/Unsplash

1.1.1. The complexity of urban-rural linkages

The rapid population growth lately witnessed in intermediary cities has caused their edges to expand into peri-urban and rural areas in an unplanned and uncoordinated manner. This growth, exacerbated by poor governance and various natural and human-made factors, has led to a glaring difference between urban and rural areas that manifests in disparities in infrastructure, education, healthcare and economic opportunities. In East Africa, the economic interdependence within the countries is marked by the intricate connection between urban and rural dimensions (UN-Habitat, 2017).

Urban centres serve as hubs for commerce and industry, while rural areas contribute significantly to agriculture. The flow of goods, services and labour between urban and rural areas creates a symbiotic economic relationship. Agriculture plays a crucial role in this interdependence, with urban centres demanding a constant supply of products from rural farmers. Infrastructure development, social and cultural exchanges, environmental conservation and technology transfer all play a key role in enhancing the overall economic and societal development of both urban and rural areas in East Africa.

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1.1.2. Weak food value chains

In recent years, the landscape of food production, distribution and consumption in East Africa has experienced notable shifts as a result of uncontrolled urban expansion. This transformation has created challenges in adopting the standard food value chains, primarily due to constraints such as limited infrastructure, encroachment into fertile production land, information asymmetry, exploitation by intermediaries, and insufficient storage and processing facilities.

The use of these fragile food value chains has frequently resulted in food wastage, diminished incomes for smallholder farmers and restricted access to diverse markets; these stem from the food value chains' inherent inefficiency, lack of transparency and vulnerability in intermediary cities.

Food value chains in East Africa play a critical role in driving economic growth and therefore must be robust. A robust food value chain enhances resilience to external shocks, such as climate change and economic fluctuations, by diversifying supply chains and creating adaptive networks.

These networks ensure that food reaches its destination in the right quality and quantity. The link between players in the value chain should be precise to establish a strong connection, resulting in better prices for both producers and consumers. Furthermore, a robust food value chain supports community development and inclusion, and integrates the informalities to ensures the equitable distribution of wealth among all actors.

This is achieved through the adoption of innovative technologies, which boost productivity, reduce waste and streamline operations. Adherence to quality controls also plays a vital role in ensuring the safety and nutritional value of food products, thereby enhancing the reputation of East African agricultural products.

The key players in this value chain include smallholder farmers, agribusinesses, processing organizations, logistics providers, wholesalers, distributors, retailers, consumers, government agencies, research institutions and financial institutions. Together, they contribute to economic growth, market access, quality standards and technological innovation in the agricultural sector.

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1.1.3. Limited territorial resilience

The intermediary cities in East Africa are dynamic hubs of economic activity and cultural diversity, showcasing rapid physical growth and vibrancy. However, one of the important issues facing these cities is their limited territorial resilience. Territorial resilience refers to the ability of a community, city, or institution to prevent, resist, absorb, adapt to, respond to and recover from a wide range of risks, while maintaining an acceptable level of functioning and without compromising long-term prospects for sustainable development, peace and security, human rights and well-being for all (FAO and others, 2023). The rapid population growth in these intermediary cities has outpaced the development of physical and technological infrastructure, resulting in congested roads, inadequate public services and overburdened utilities. This lack of preparedness for population growth exposes the cities to risk during crises, hindering effective response and recovery efforts.

Furthermore, rapid urbanization and lack of effective planning have led to the increase of informal settlements within and around the urban centres. These settlements are characterized by substandard housing and limited access to basic services, leaving the communities vulnerable to natural disasters and public health crises, thus underscoring the importance of addressing socioeconomic disparities. In addition, developing countries such as Kenya, Tanzania and Uganda face challenges in predicting weather patterns and managing waste, exposing residents to floods and environmental degradation that threaten both infrastructure and public health.

These issues are exacerbated by poor governance marked by corruption, bureaucratic inefficiencies and fragmented decision-making, which can impede swift and coordinated responses during emergencies.

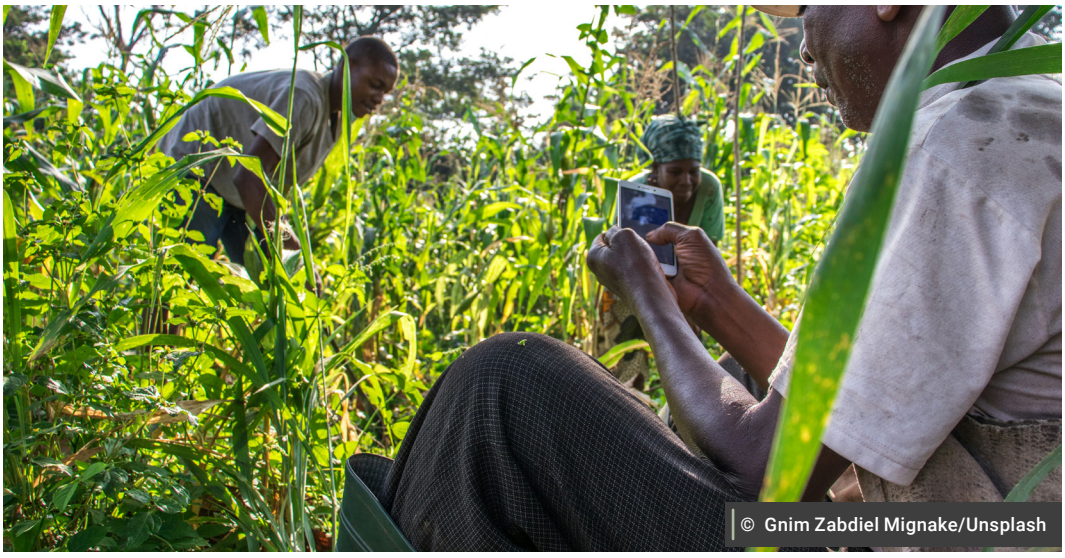
Smallholder farmers in East Africa often operate in risky production environments characterized by a variety of biophysical and socioeconomic constraints. The increasing population pressure has led to smaller land sizes and intensive cultivation, resulting in soil degradation and reduced yields (Ochieng and others, 2019). Additionally, the situation is worsened by unpredictable rainfall patterns and the continuous use of a limited range of crops and livestock breeds that have low tolerance to prevalent pests and diseases. As a result, the region is vulnerable to fluctuations in seasonal yields and food insecurity. The inadequate food supplies in these areas can potentially escalate into civil unrest.

1.2. The role of digital solutions in enhancing food flows and territorial resilience in East Africa

"Innovation has both a rate and a direction" (Mazzucato, 2018). Innovation has continually evolved to meet the increasing demand in various sectors such as agriculture, education, healthcare and finance, and benefits both urban and rural communities by providing access to information, services, and opportunities. Social platforms, e-commerce platforms, e-learning programs, telemedicine services and digital financial solutions bring diverse resources and services closer to rural populations, reducing disparities and promoting connectivity and collaboration between urban and rural areas (Galholtra and Dewan, 2020).

With the twenty-first century increasingly marked by efforts to achieve sustainability, food systems are increasingly susceptible to global challenges such as climate change and supply chain disruptions, amidst other global economic shocks and stresses. These challenges are intricately interconnected requiring insights from diverse perspectives to meet them. By harnessing the direction of innovation, this paper explores the potential of e-commerce strategies for linking food producers to markets in order to break barriers, reinforced by poor governance to meet wider social and economic aims along the urban-rural continuum. The role of food systems extends beyond addressing issues of food access; it includes achieving local economic gains along the urban-rural continuum both in the short-term and long-term.

In the ever-evolving character of food systems, where innovation is key to resilience, promoting short supply chains while strengthening rural-urban linkages has become a significant strategy at the forefront of ensuring access to food for all (FAO, 2020).



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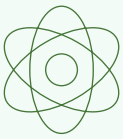
The role of research and innovation in steering food systems towards resilience, efficiency and sustainability also gained prominent recognition at the follow up to the United Nations Food System Summit held in Rome in 2023. Furthermore, analysing existing and potential initiatives carried out within similar contexts has a key significance when exploring alternative pathways for establishing sustainable food supply value chains.

Amidst an era marked by the increasing adoption of technologies to solve emerging challenges, an innovation strategy should encompass continuous analysis, learning and adaptation (see figure 1) (Pisano, 2015). Such an endeavour will serve to unravel effective strategies in the pursuit of sustainable and equitable urban-rural food systems and markets, thus contributing to the achievement of various Sustainable Development Goals, including those related to zero hunger (Goal 2), decent work and economic growth (Goal 8), sustainable cities and communities (Goal 11), and partnerships for the Goals (Goal 17).

Additionally, the G20 2023 Action Plan to Accelerate Progress on Sustainable Development Goals also recognizes the importance of promoting innovative approaches and finding new ways to meet the basic needs of all while addressing climate and environmental challenges. It includes encouraging investments in sustainable and resilient food systems, underpinned by technological advancements and inclusive supply chains, as one of the ways of achieving inclusive and sustainable development for all. Such an approach paves the way for equal and meaningful participation in agriculture and food systems, whether on-farm or off-farm, ensuring decent incomes for all (G20 Information Centre, 2023).

Urban-rural linkages include various functions such as facilitating movement of people and goods, improving food security, addressing environmental impacts, creating governance structures, and encouraging inclusive financial investments (Urban Policy Platform, undated). Strengthening urban-rural linkages can offer a promising strategy for highlighting the transformative impact such connections can have on economic growth, social cohesion, and overall regional prosperity based on food flow and territorial resilience.

Adopting a sustainable innovative strategy that embeds improved urban-rural linkages, territorial resilience and food systems would bring benefits such as:



Economic synergy: Strengthening urban-rural linkages in East Africa can create economic synergy by connecting urban hubs with rural sources of raw materials and agriculture. This integration can lead to a balanced distribution of resources, skills and opportunities, fostering sustainable economic growth in both urban and rural communities.

Agricultural integration: The agriculture sector is vital for East Africa's economy and connecting rural and urban areas is important for optimizing this sector. Urban markets provide customers for rural products, while rural areas provide essential goods for urban populations. Improving transportation and market access can make agricultural supply chains more efficient, benefiting both farmers and urban consumers.

Skills transfer and innovation: Urban centres and rural areas in East Africa all possess unique strengths, with urban areas excelling in innovation and technology, and rural areas holding traditional wisdom and unique skills. Strengthening connections between these regions allows for the sharing of knowledge and expertise, leading to innovative solutions for common challenges and propelling East Africa towards sustainable development.

Job creation and livelihood opportunities: Robust urban-rural connections can benefit both areas by supporting diverse economic activities, creating jobs, and improving livelihoods. Urban industries can invest in rural development projects such as agribusiness or ecotourism, providing employment and income for rural communities. Additionally, rural areas can supply skilled labour to urban industries, fostering a cycle of economic growth.

Infrastructure development: Improving infrastructure between urban and rural areas is crucial for connecting people and promoting social cohesion. Upgraded roads, transport and communication systems facilitate the movement of goods and services, reducing isolation and fostering a sense of shared identity and mutual benefit.

Resilience in the face of challenges: Strengthening connections between urban and rural areas helps to build resilience against economic and environmental challenges by diversifying economic activities and sharing resources. This interconnectedness fosters collaboration and mutual solidarity in response to common challenges such as climate change, economic downturns, or pandemics.

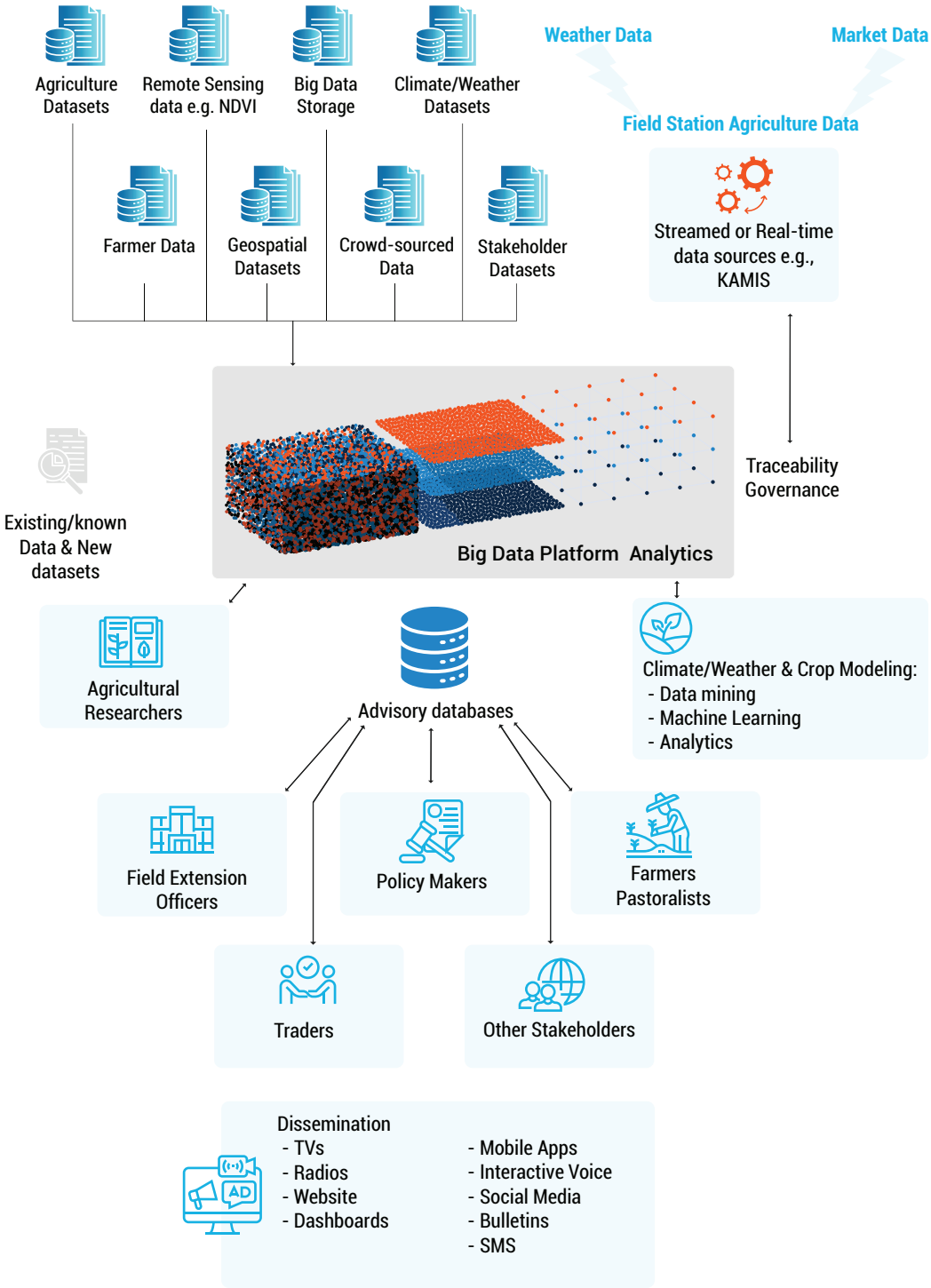


Figure 1. Agricultural Digital technology and innovative solutions ecosystem[4]

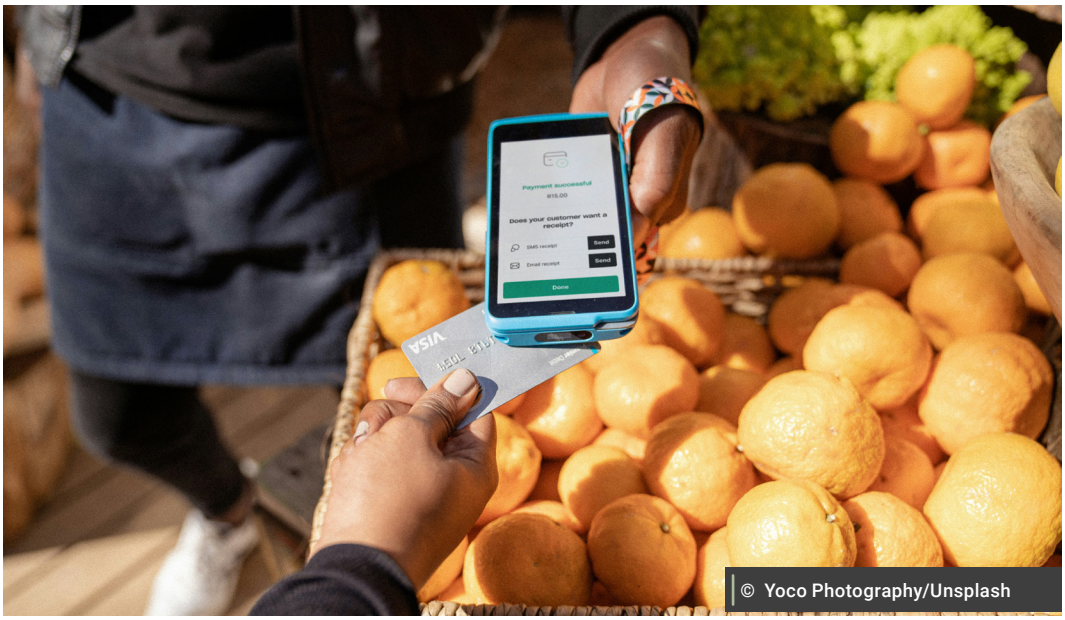
4 Adapted from KALRO. The Big Data Platform. (State Corporations Data Collection and Management Workshop. Machakos University, 7th June 2022).

1.3. Scope and purpose objectives of the paper

The purpose of the strategy paper on digital technology and innovative solutions is to provide policymakers, local and national governments and other stakeholders – including young people, entrepreneurs, and other actors – with case-based strategies to optimize digital solutions. These solutions can strengthen food value chains and conserve biodiversity in the flows of goods, services, capital, information and people along the urban-rural continuum. The paper also aims to contribute to local resilience and adaptation to the climate crisis in East Africa.

This paper explores the potential for digital technology and innovative solutions to address the complex challenges faced by urban-rural linkages, food flows and value chains, and territorial resilience in selected intermediary cities in East Africa.

A comprehensive analysis of selected intermediary cities in Kenya, Tanzania and Uganda was conducted to analyse food value chains and territorial vulnerability. The analysis identified obstacles to effective urban-rural linkages, resilient food value chains and sustainable territorial development. Through in-depth exploration of best practices, local case studies and global examples, key learnings and actionable recommendations were identified and documented. The aim was to provide evidence to empower stakeholders with innovative strategies to optimize digital solutions for sustainable development in the region. The analysis also provided insights into the potential of digital technologies to drive positive change and enhance the socioeconomic fabric of the region.



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The paper's contests promotes dialogue, knowledge exchange and transformative action to build resilient communities, strengthen food value chains and improve territorial governance in East Africa.

It aims to empower various stakeholders, such as government entities, civil society organizations, academia, entrepreneurs, and digital innovators, with a focus on young people and women.

Furthermore, it provides a roadmap for these stakeholders to engage and create targeted solutions for different markets and contexts. For example, strategies for marketing can be developed to connect small farmers with local or national markets.

A simple presentation format was adopted to provide a deeper understanding of the interconnected nature of urban-rural dynamics, food systems, and territorial resilience.

This was intended to catalyse informed decision-making, foster collaboration and inspire innovative approaches that promote equitable growth and environmental sustainability in the region.

1.4. Methodology

A team of experts was assembled to author and spearhead the development of the strategy paper and a concept note was prepared with a road map for developing the paper. The first draft had the results of desktop research and in-depth interviews and surveys. The draft was then subjected to an online "writer's workshop" by the author and advisors. A second draft that synthesized the background information from the research and case studies was created with strategies for the applications of digital technologies for food flows between urban and rural communities and to enhance territorial resilience. Revision of the paper based on the advisors' input and further synthesis led to a third draft (a full first draft) which was then shared with peer reviewers in advance of an Expert Group Meeting. Received comments and recommendations were incorporated into the full draft to have the final strategy paper ready for publication.

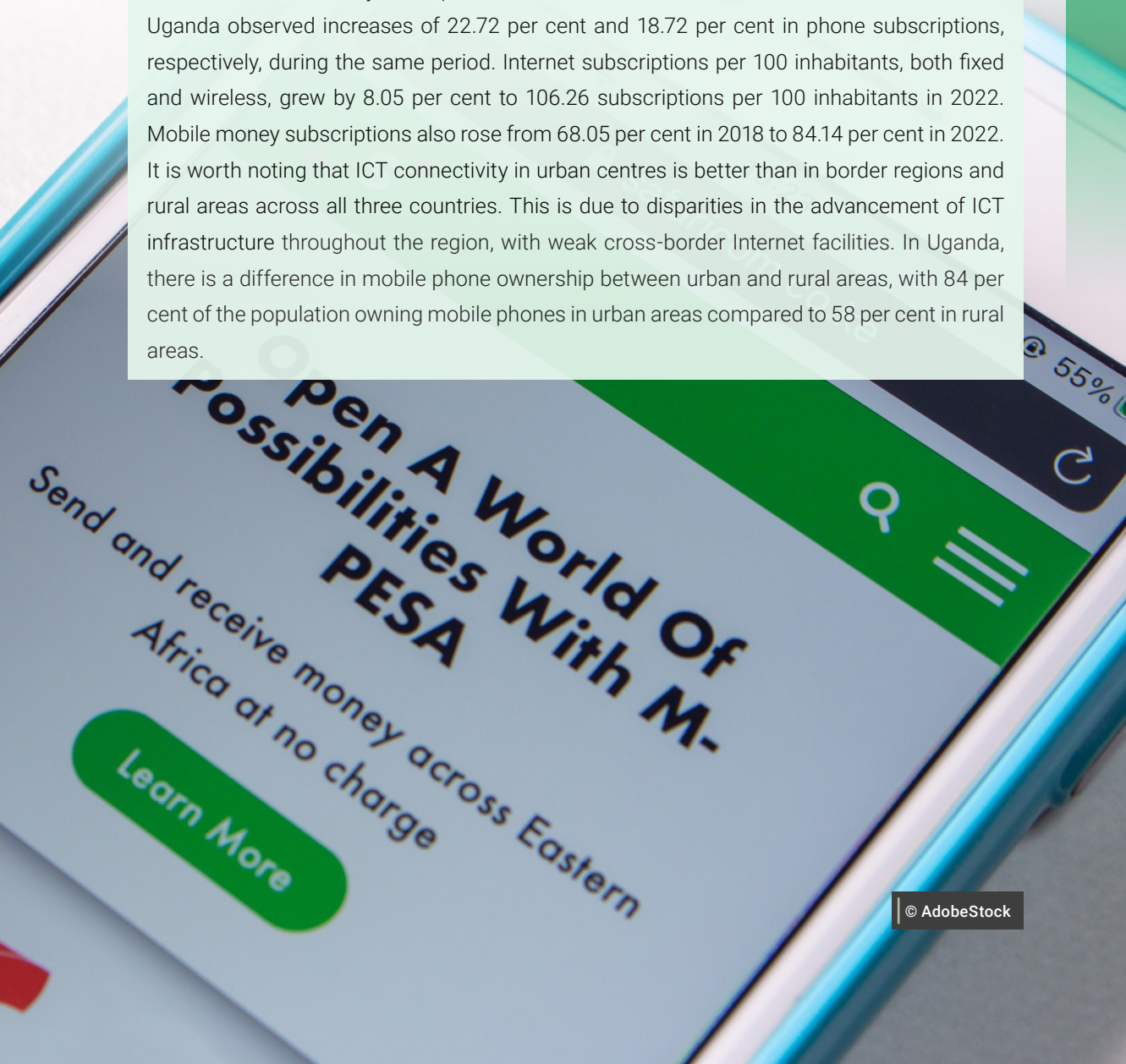
CHAPTER

02

Current status of digital technology and innovative solutions

2.1. Overview of the information and communication technology sector

Over the years, the information and communication technology (ICT) sector in East Africa has developed to meet the growing demand for connectivity, social platforms, e-commerce, remote working solutions, online training, meetings and financial services. Mobile phone-based financial services are notable across Kenya, Tanzania, and Uganda. Better Internet access, a growing mobile market and an increase in the use of smartphones and other devices have been driven by the rise in Internet and digital technology usage. According to the 2023 Kenya Economic Survey, mobile-cellular telephone subscriptions per 100 inhabitants increased by 34.34 per cent from 106.52 in 2018 to 143.1 in 2022. Tanzania and Uganda observed increases of 22.72 per cent and 18.72 per cent in phone subscriptions, respectively, during the same period. Internet subscriptions per 100 inhabitants, both fixed and wireless, grew by 8.05 per cent to 106.26 subscriptions per 100 inhabitants in 2022. Mobile money subscriptions also rose from 68.05 per cent in 2018 to 84.14 per cent in 2022. It is worth noting that ICT connectivity in urban centres is better than in border regions and rural areas across all three countries. This is due to disparities in the advancement of ICT infrastructure throughout the region, with weak cross-border Internet facilities. In Uganda, there is a difference in mobile phone ownership between urban and rural areas, with 84 per cent of the population owning mobile phones in urban areas compared to 58 per cent in rural areas.



The ICT sector provides opportunities for employment, investment and revenue generation. In Kenya, the number of direct employees in the sector increased by 44.3 per cent from 2018 to 2022. The employees include mobile network operators, mobile virtual network operators, and Internet service providers. Similarly, in the same period, annual investment and revenue increments of 25.2 per cent and 33.2 per cent respectively were realized.

ICT plays a significant role in the Logistics Performance Index (LPI), which assesses countries' performance in various dimensions of logistics, including the efficiency of customs, quality of infrastructure, ease of arranging shipments, competence of logistics services, ability to track and trace consignments and timeliness of shipments. In the 2018 World Bank Logistics Performance Index, out of 167 assessed countries, Kenya ranked sixty-third with a score of 2.93 out of 5. Tanzania ranked sixty-seventh with a score of 2.88, and Uganda ranked seventy-second with a score of 2.79.[5] These LPI scores were slightly higher than the global average, indicating that East Africa had relatively competent logistics performance compared with other regions in Africa. However, there is still room for improvement in terms of logistics services and infrastructure in East African countries.

[5] https://lpi.worldbank.org/international/aggregated-ranking.

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2.2. The status of digital and innovative solutions in food flows and territorial resilience

Most economic sectors worldwide, including in East Africa, are currently undergoing a technological shift driven by the rapid development of information and communication technologies. These advancements enable new functionalities for products and services, creating value in the process. Digital connectivity plays a crucial role in establishing effective linkages, supporting efficient food systems, and fostering territorial resilience. However, their adoption is inconsistent across different regions and demographics.

Agriculture in East Africa is mainly small-scale and contributes to 75 per cent of the total agricultural output and 70 per cent of the marketed agricultural produce. The supply of agricultural commodities is heavily reliant on rainfall patterns, leading to fluctuations in food supply and exacerbating the impact of climate change.

Technologies and digital solutions for climate-smart farming are being innovated, though their adaptation, adoption and use in the smallholder systems is slow. Some examples of climate-smart technologies include adopting drought-resistant crops and livestock breeds, implementing integrated water management practices aimed at optimizing resource use, promoting sustainable agricultural productivity, and the use of conservation agriculture that is geared towards biodiversity conservation and fosters food systems' synergy.

The current practice of transporting agricultural commodities in East Africa often involves the use of general-purpose commercial vehicles that do not meet the necessary specifications and facilities for ensuring quality and safety. This issue is particularly prevalent in rural areas, where access roads are in poor condition with limited transport logistics, leading to delays in collection and delivery, decreased value of productivity, and increased transport costs that are ultimately passed on to consumers. The inadequate state of cross-city transport networks, including roads, railways and ports, further exacerbates the challenges faced in agricultural produce marketing logistics.

A significant amount of food is lost or wasted along the supply chain from production to consumption in sub-Saharan Africa, East Africa included. Estimates suggest that post-harvest losses can account for up to 30 per cent of cereals, 40 to 50 per cent of tubers, fruits and vegetables, and 20 per cent of oilseeds, meat and dairy products. The reasons for this food loss and waste are poor transportation systems, inadequate storage facilities, inefficiencies in processing and packaging technologies, ineffective handling infrastructure (such as refrigeration), inefficiencies in market access and distribution networks, as well as inadequate policies and regulations to address food loss and waste. It is also important to embrace the circular economy in which food waste is recycled and transformed into organic products, such as biogas and compost manure.[6]

6 "Transition towards circular economy in the food system." www.mdpi.com/2071-1050/8/1/69.

Most marketplaces in the intermediary cities in East Africa are poorly designed and lack necessary facilities such as storage, water, electricity and ICT. Market layouts lack designated areas for different types of goods, leading to waste, congestion and difficulty in accessing goods and services. Sanitation is inadequate, and facilities are often not accessible for people with special needs. In response to the challenges faced by physical markets, alternative non-conventional marketing channels have emerged for agricultural produce and products. In East Africa, digital and virtual marketing platforms have become key forms of alternative agricultural markets. These platforms facilitate the matching of buyers and sellers, reducing time and transaction costs.

The adoption of these alternative markets was accelerated during the coronavirus disease (COVID-19) pandemic, highlighting the limitations of traditional marketing methods that rely on physical presence and interaction at trading points.

In Kenya, additional alternative markets in the agricultural sector include structured platforms such as the Warehouse Receipt System, commodity exchanges, futures and derivatives markets, and auctions. These alternative markets offer opportunities for producers and buyers to engage in trade more efficiently and effectively, contributing to the overall growth and development of the agricultural sector.

Conversely, the growth of some digital and virtual marketing platforms, including online groceries, has contributed to a notable increase in overweight and obesity rates. This is particularly evident among the upper-class population; people have adopted a preference for processed and fast foods and these dietary choices present challenges to human health due to the lack of access to nutritious foods.

Some of the markets are overseen by committees that are deficient in operational resources and capacity. In some cases, the infrastructure is controlled by institutions that lack the technical expertise necessary to ensure efficient maintenance and operations.

Also, small and medium enterprises along the food value chain often face challenges in developing and implementing effective marketing strategies to enhance their market share and competitiveness. Unfortunately, existing marketing organizations face challenges in collective marketing and establishing linkages with upstream value chain actors, largely due to poor governance and inadequate technological support. Furthermore, the high cost of capital and insurance credit hinders the ability to invest in marketing activities.

The intermediary city market players, including aggregators and traders, often use unstandardized units and minimal quality checks, leaving small-scale producers and consumers vulnerable to exploitation. Standardization is crucial for regulating quantity, quality and safety, ensuring fair prices for producers and value for consumers. The stringent traceability requirements with respect to sanitary and phytosanitary and food safety standards including maximum residue limits demanded by markets, pose major challenges for small-scale producers. Also, mandated authorities have inadequate capacity to carry out awareness-creation on market requirements as well as sampling and testing for agricultural produce. Certifications such as halal, Rain-forest Alliance and Fair-trade guarantee sustainable practices and premium prices, and support for producers and communities.

Ultimately, these standards aim to protect both producers and consumers in the agricultural value chain.

Currently, there are collaborative efforts by public, private, civil society and international development organizations to enhance agricultural research, intelligence and innovation. A robust agricultural research, intelligence, and innovation system is essential for enhancing food production and market access to commodities. The aim of the system is to provide comprehensive, accurate, timely and actionable data and information to producers, agripreneurs and policymakers, enabling them to make informed decisions (see table 1). However, there are several challenges that still need to be addressed to avoid information asymmetry.

These include low prioritization and limited public funding for agricultural market intelligence and research, significant information asymmetry among players in agricultural value chains, segmented market data and information that hinder access, limited sharing and exchange of market research findings that impede use in agricultural marketing, and inadequate systems for nurturing innovations leading to low commercialization rates. Efforts are currently underway to address these challenges and enhance the effectiveness of the agricultural market intelligence, research, and innovation system in East Africa.

Table 1. Digital solutions in East Africa based on reviewed literature

Country	Agricultural extension	Advisory	Financial access	Supply chain	Market linkages	Weather
Kenya	M-Farm, iCow, Farmers Pride, Wefarm, Kenya e-Extension Platform (Keep)	Wefarm Digifarm, M-Farm, Sunculture	FarmDrive, Apollo, Tulaa, Connected Farmer Alliance	Twiga	Farmshine, iProcure, KAMIS	Gro-Intel, KAOP
Tanzania	Wefarm	e-Kilimo, Agritechs	Connected Farmer Alliance	Tigo Kilimo	Ninayo	-
Uganda	Wefarm, Agro Supply	Jaguza	Harvesting	Grainpulse	Agro Supply	Gro-Intel

Source: Authors' compilation based on a review of the literature.

The Governments of Kenya, Tanzania and Uganda have established statutory frameworks to promote technology and innovation in the agricultural value chain. These frameworks include the Agricultural Sector Transformation and Growth Strategy, Vision 2030, Agricultural Marketing Strategy, the Bottom-Up Economic Transformation Agenda, and the Science, Technology and Innovation Act, which recognize the importance of data, digitization and innovation in transforming the agricultural sector and achieving sustainable development.

Additionally, the Data Protection Act was enacted to regulate the ICT sector, promote competition, safeguard consumer rights and ensure cybersecurity. However, there is a lack of a specific legal framework to address informal and complex interconnections within food systems and e-commerce through digital solutions. Furthermore, the existing regulations are not standardized across East African countries, despite the high volume of online cross-border trade. There is also a need to develop policies to promote access to nutritious foods such traditional wholegrains and vegetable meals by the digital food outlets.

In most areas of East Africa, the growth of the urban population has led to inadequate access to healthcare, safe water and sanitation. This exacerbates health and nutrition disparities, especially for slum dwellers, highlighting the failure of both formal and informal safety nets to protect the most vulnerable urban populations. Furthermore, the expansion of cities leads to the conversion of agricultural land into urban areas, decreasing the space available for food production.

Resource-constrained smallholder farmers living on the outskirts of intermediary cities often operate in risky production environments. They continuously practice intensive cultivation due to their small land sizes, resulting in soil degradation and reduced yields. The situation is worsened by unpredictable weather patterns that contribute to a significant decline in biodiversity and traditional farming methods that are integral to sustainable and resilient food systems. It is essential to implement interventions such as integrated land-use planning and innovative approaches to urban agriculture and peri-urban farming in order to avert these effects.

Inadequate physical infrastructure, such as poor Internet and roads, undermines transportation and communication between urban and rural regions; it also limits market access for agricultural commodities. There are attempts from the private sector and governments to improve infrastructure and logistics between rural areas and urban centres, but insufficient or uncoordinated investment in infrastructure development and lack of market access initiatives are still major challenges limiting rural producers from reaching consumers and participating effectively in the broader food economy.

Kenya, Tanzania and Uganda often face multiple natural and human-made hazards, including landslides, droughts, epidemics, floods and conflicts. The effectiveness of their disaster management systems varies depending on the country's infrastructure, governance and resource availability.

These countries have Disaster Management Frameworks which comprise of policies such as the Kenya National Policy for Disaster Management and the National Disaster Management Act, the Tanzania National Disaster Management Policy and the Uganda National Policy for Disaster Preparedness and Management.

These policies provide guidelines for disaster preparedness, response and recovery. Additionally, there are responsible offices, such as the National Disaster Management Authority in Kenya, the Disaster Management Department in Tanzania and the Office of the Prime Minister in Uganda, which are responsible for coordinating disaster risk reduction and management activities.

The countries have made significant strides in disaster management, however they still experience challenges such as resource constraints, coordination issues and inadequate infrastructure. Strengthening early-warning systems, improving community-based disaster risk reduction and enhancing regional cooperation are crucial steps towards more effective disaster management in East Africa.

The fragmented policy frameworks and governance systems in East African countries pose significant challenges to territorial resilience and urban-rural linkages, impeding the implementation and coordination efforts of these frameworks. To improve digital connectivity and support the growth of the digital economy, the Government of Kenya launched the Digital Master Plan 2022–2032, however it lacks a specific legal framework for urban-rural connections. It is also important to note that despite the high volume of rural-urban-cross-border trade, the existing regulations are not standardized across East African countries. Furthermore, the weak enforcement of the available frameworks is due to poor relations between responsible agencies. In these situations, it is essential to promote integrated policy approaches and strengthen governance mechanisms that foster multisectoral collaboration, stakeholder engagement and participatory decision-making processes in enhancing urban-rural linkages and territorial resilience.

2.3. SWOT analysis for using digital solutions in East Africa

S Strengths

i. High Global System for Mobile Communication penetration in rural and urban areas.
ii. High-quality agricultural produce.
iii. Developed digital infrastructure and hubs.
iv. Adequate technical knowledge and capacity for digital solution development.
v. Availability of institutions and policies for managing digital farm produce.
vi. Well-established analogue food flow models to guide digital solution development.
vii. Rapid population increase, large youthful population.

W Weaknesses

i. Low prioritization and limited public funding for agricultural market intelligence and research.
ii. Significant information asymmetry among players in agricultural value chains.
iii. Segmented market data hindering access.
iv. Limited sharing of market research findings.
v. Inadequate systems for nurturing innovations, resulting in low commercialization rates.
vi. Infrastructure constraints in some areas/ regions.

O Opportunities

i. Increasing competition and disruption for businesses relying on digital solutions.
ii. Cybersecurity measures to protect sensitive information.
iii. Potential for market innovations through technology.
iv. Attempts to address disparities in technology access for inclusivity (increased literacy).
v. Collaborative market-shaping initiatives for business opportunities.
vi. Globalization of technology.
vii. Decreasing cost of accessing some transaction mediums.

T Threats

i. Vulnerability to disruptions in case of technology failures or outages.
ii. Disparities in technology access worsening inequalities.
iii. Cyber-attacks such as data breaches posing threats to information security, such as hacking and fraud.
iv. Inadequate legal frameworks (regulations) for urban-rural connections and digital solutions, both within and across borders.
v. Weak enforcement of existing legal framework.

2.4. Summary of strategic issues affecting the future of digital solutions in East Africa

Following a comprehensive analysis of digital and innovative solutions in food flows and territorial resilience, along with a detailed SWOT assessment, several strategic issues were identified. These issues were then harmonized and prioritized, resulting in nine key strategic issues outlined below.

Information gaps among participants in agricultural value chains hinder decision-making and market access.

Challenges with infrastructure, such as an unreliable power supply and limited Internet connectivity, present obstacles.

Inadequate policies and regulations impede innovation in the digital solutions industry.

Insufficient digital skills hinder the effective use of digital solutions.

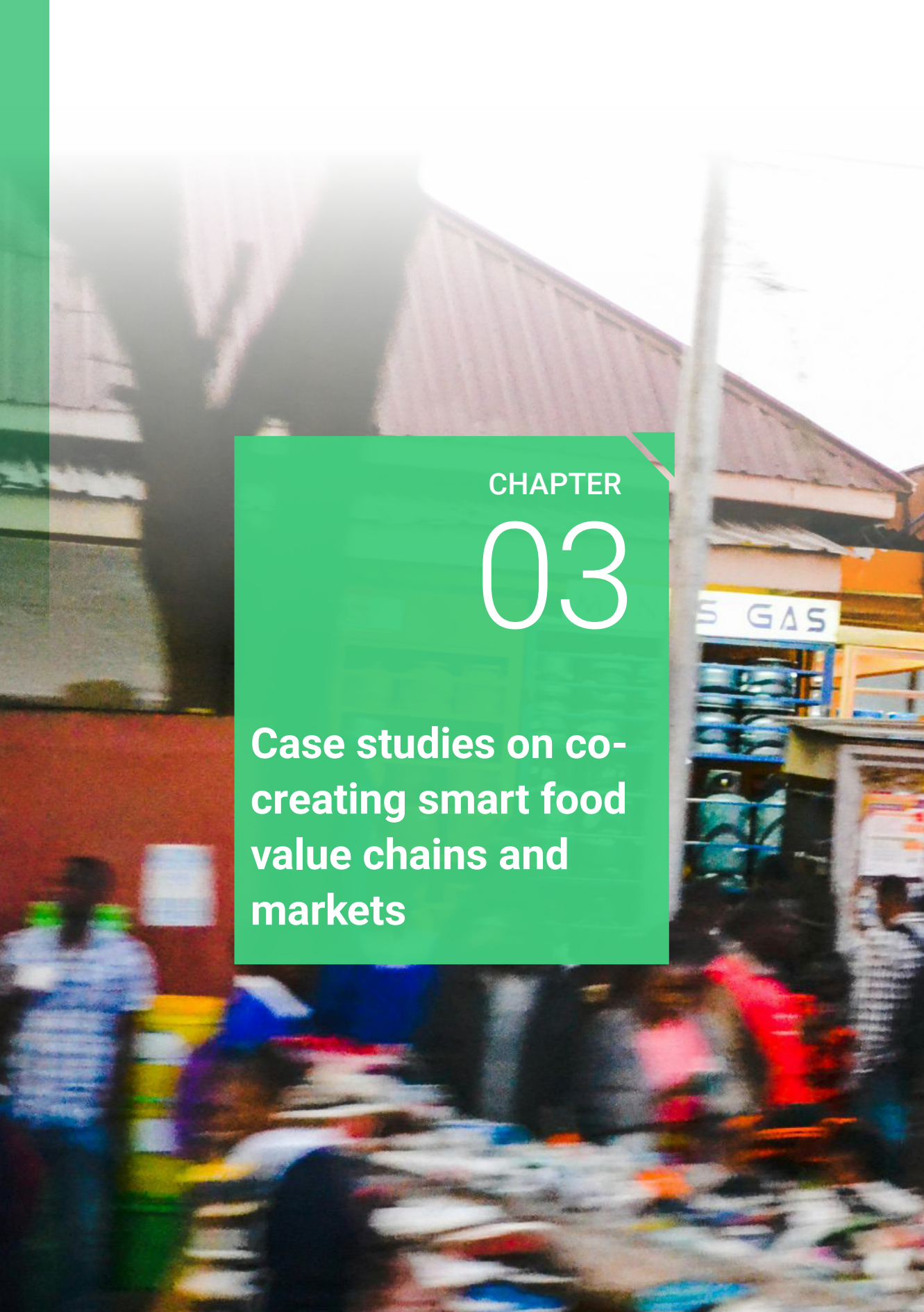
Inadequate systems for nurturing innovations result in low rates of commercialization.

Limited public funding for agricultural market intelligence and research is an issue.

Lack of mechanisms to drive technological advancements and market innovations is a challenge.

Limited sharing of market research findings hampers their use in agricultural marketing.

Limited access to technology and the Internet hinders inclusivity and equal opportunities for all stakeholders.



CHAPTER

03

Case studies on co-creating smart food value chains and markets

3.1. Country-based case studies

A case-based, exploratory approach was taken for this paper to identify initiatives for strengthening urban-rural linkages through the co-creation of smart food value chains and markets. Historically, mainstream marketing has been premised on the idea that markets already exist within predefined conditions, and which entrepreneurs enter to find opportunities. This view holds that entrepreneurs respond to the demands of predetermined market conditions over which they have little control. However, the challenges of the twenty-first century have led to some questioning of this traditional view of markets and consequently the focus has shifted from understanding markets as pre-existing with fixed settings to recognizing them as entities produced through a multi-actor process (Kaartemo and Nyström, 2021). This new development has led to the emergence of market shaping – a concept in which market actors intentionally or unintentionally influence markets in ways that work to their benefit, rather than just accepting the limitations of the market.

With the emergence of market-shaping processes, market innovations may occur if there are significant shifts in market structures or practices. Nonetheless, it is crucial to note that market shaping does not always involve the creation of completely new markets; instead, it entails incremental shaping intended to alter the behaviour of existing markets (ibid.). In this view, the context of this case-study analysis, particularly the role of technology and its impact on food distribution practices, provides an interesting empirical context for understanding food market innovations along the urban-rural continuum. The extent to which technology can be used to incrementally innovate and shape food market structures or practices along the urban-rural continuum underlines the importance of this case study analysis.

It is important to note that markets do not exist in a stable state but rather are continuous processes (Kjellberg and others, 2015). The case studies presented here therefore highlight the evolving strategies employed by various actors in co-creating market innovations that continue to shape food supply chains in East Africa, particularly in Kenya, Tanzania and Uganda.

3.1.1. Case study 1 (Uganda): Village agent model

Uganda represents a relatively modest sector in the e-commerce landscape, with an anticipated revenue of USD 122.8 million by 2023. The revenue is projected to have a compound annual growth rate (CAGR 2023–2027) of 5.6 per cent, leading to an estimated market size of USD 152.8 million by 2027. In 2023, the e-commerce market in Uganda was expected to contribute to the global growth rate of 8.7 per cent, showcasing a 2.6 per cent increase. This reflected the broader trend of rising e-commerce sales worldwide. The e-commerce Insights (ECDB) identifies seven key segments within the e-commerce market in Uganda. Electronics emerges as the dominant sector, constituting 25.3 per cent of the total e-commerce revenue. Other sectors include hobby and leisure at 22.9 per cent, fashion at 18.9 per cent, furniture and homeware at 11.2 per cent, care products at 8.2 per cent, and do-it-yourself at 7.5 per cent. Notably, food makes the smallest contribution, accounting for the remaining 6.2 per cent of the revenue.[7]

It is also crucial to note that the food supply chains in Uganda are characterized by a lack of strategy and capacity in terms of physical infrastructure and skills. Markets are not generally inclusive, with few incentives to invest in sustainability, and very few reliable services exist to integrate the value chain and foster business development, particularly for young people and women (Ajambo and others, 2023).

It is also important to acknowledge the pivotal role that social networks play in shaping the dynamics of innovation and technology adoption within the country. Recent research revealed that support from social networks influenced technology uptake in food systems (D'Exelle and Verschoor, 2023). Such findings highlight the fact that to enhance food supply chains, innovation development must be inclusive, considering users' diverse needs.

7 https://ecommercedb.com/markets/ug/all.

Box 1. Village agent model

The theory of change for this model generally includes the following fundamental components: traders or buyers of farm produce select a village agent from their pool of trusted farm producers → village agents undergo training on subjects such as the use of agricultural inputs, record keeping and sustainability agricultural practices → village agents share information with farmers → farm producers receive improved farm inputs from village agents and undertake sustainable practices → an increase in farm produce is realized → farmers sell the produce to village agents on a commission basis → both farmers and village agents realize increased incomes as buyers and traders obtain improved quality (Scheer and Ariko, 2019).

Key impacts emerging from the village agent model were identified through a critical review of studies on the village agent model in Uganda. Some of the impacts highlighted include:

Self-efficiency: Village agents enjoy a reliable network of farmers, owing to their agricultural background and initial experience as farmers. By ascending the value chain — transitioning from their role as farmers to facilitating the connection between farmers and a variety of actors within the food systems — village agents address certain structural constraints, such as limited access to markets, information, and agroinputs. An example in which the village agent model was used to increase its efficiency is the Uganda MorePork II Project (see box 2)

Entrepreneurship training: The implementation of the village agent model saw various actors within the food value chain gain basic entrepreneurial skills, for example bookkeeping and management of stock (Koleros, 2016).

Increased income – a notable example providing empirical evidence of increased incomes for food system actors through the implementation of the village agent model is the Uganda Feed the Future Value Chain project.

Box 2. Example of the village agent model – MorePork II Project

MorePork II's activities were grounded on the findings of phase I (MorePork I), which identified opportunities and constraints in the pork value chains from which pilot tests of various interventions were done. Phase II saw the implementation of a market system approach, made feasible by digitally-enabled village agents – "an institutional innovation in the form of market arrangements to improve market linkages and relationships to support the value chain system" (Lukuyu and Ouma, 2021). The village agents received production, financial and market information, and underwent training via a mobile app (provided by Single Spark) to facilitate the sharing of information with other farmers. Additionally, self-efficacy was achieved through the PigSmart Platform — a digital extension that tracked "pig production" on the farm and integrated the data with market knowledge. As such, the platform serves as a knowledge hub and an e-commerce platform. The training and active participation aimed at enhancing relationships and building people's capacity within the pig value chain resulted in the co-creation and sharing of production and marketing knowledge. This, in turn, led to the emergence of increased self-efficient arrangements among actors involved in shaping the market processes. The consistent product supply to the market by village agents was based on a reliable network of farmers, contributing to stable market prices.

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3.1.2. Case study 2 (Kenya): M-Farm

The food supply systems in Kenya are primarily dependent on small and medium-sized enterprises (Knorringa and others, 2023). The key challenge in maintaining these food supply chains is providing affordable healthy foods to low-income urban populations while ensuring that smallholder farmers with few resources operate on fair terms. The online platforms are also not a guarantee of access by the urban poor or smallholder farmers who may not have the capacity financially and technically to access them. For example, the recent Kenya National Bureau of Statistics (2022) survey showed that the current smartphone ownership in Kenya was at 61 per cent out of the 94 per cent of the overall population that owned a phone. This still omitted 39 per cent of the 94 per cent of the population who owned a phone without access to smartphone features, which included e-commerce. However, they still had access to e-commerce through calls and short message services. Kenya is the fifty-sixth largest market for ecommerce with a prediction of US$ 2.3 million by 2023.[8] With an expected increase of 15 per cent in 2023, the Kenyan e-commerce market contributed to a worldwide growth rate of 8.7 per cent in 2023.

Seven markets are considered by the e-commerce database (ECDB) within the Kenyan e-commerce market. Electronics is the largest market and accounts for 25.3 per cent followed by hobby and leisure at 22.8 per cent, fashion at 18.9 per cent, furniture and homeware at 11.2 per cent, care products at 8.1 per cent, do-it-yourself at 7.4 per cent, and finally grocery at 6.4 per cent.

A survey was conducted of 20 online grocery stores in Kenya that demonstrated the diversity of the platforms in ownership, operations, coverage, challenges and opportunities, among other things. Some of the online grocery stores in Kenya include Greenspoon Kenya, Pema Groceries, E-mart, Zucchini, Keekapu Greengrocers, Carrefour Kenya, Glovo, Naivas, Copia Kenya, Duka Shop, GroceryPik, Smollan, Chandarana Foodplus, Twiga Foods, Wasoko, Market Force360, Sokowatch, Kiosk, Taimba, Tushop, DohYangu, M-Farm, Kalimoni Greens and Quickmart among others. They sell diverse food commodities that range from fresh vegetables to ready-to-eat meals. Their platforms are a combination of website and social media platforms, with some having exclusive mobile apps.

8 https://ecommercedb.com/.

Box 3. M-Farm

M-Farm is a small to medium enterprise, which operates as a mobile application or SMS service linking farmers and markets. This platform was co-created with rural smallholder farmers different from those platforms made for or by smallholder farmers. The rationale behind this criterion was to identify a case that resulted in win-win outcomes, wherein both rural smallholder farmers and urban consumers were integrated into the food supply chains, realizing mutual benefits. The operation of M-Farm relies on cooperation among various actors – farmers, aggregators and buyers. Before the development of M-Farm, farmers relied solely on potential buyers for market information, resulting in information asymmetry. Consequently, there were low levels of trust between farmers and potential buyers which ultimately led to high transaction costs. The development of M-Farm was motivated by the need to solve high transaction costs and poor access to market information. To implement this, M-farm's theory of change involved using a group selling tool, on which smallholder farmers can pool their resources to achieve a higher volume of food supply as demanded by various buyers. This model involves the following components: an aggregator notifies farmers of a buyers' interest in purchasing specific crops via SMS → farmers, in turn, can signal their willingness to sell by sending an SMS to a designated short code → The details are then posted on the website on buyer approval, the supplying farmer confirms the delivery to a predetermined drop-off point via SMS → aggregator verifies the quality of the produce, and the buyer assumes responsibility for transport (Altamirano and Beers, 2018).

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M-Farm incorporates several key features that embody frugal innovation principles. Recognizing the prevalence of simple mobile devices amongst rural smallholder farmers, the platform uses SMS-based communication for order confirmation, delivery updates, and payments. This accommodates users with limited Internet access, ensuring that even those with basic mobile phones can participate in the system. Furthermore, in an effort to minimize transaction costs for buyers and enhance trust, M-Farm uses its integrated mobile money transfer system, making use of the mobile payment technology known as M-Pesa. The lowered transaction cost and increased food supply, in turn, provide opportunities for affordable access to food for the urban populations.

M-Farm has yielded a spectrum of impacts (Altamirano and Beers, 2018) that includes but is not limited to the following:

a. Empowers farmers with price transparency and market access. Inclusiveness increasing aspects – main barriers to access the market for smallholders are dealt with.

b. Creation of a consistent market. By aggregating agricultural produce from small-scale farmers, M-Farm attracts buyers from large urban areas who would have otherwise opted to buy from large-scale farm producers so as to avoid high transaction costs.

c. Increased international transparency of agricultural supply chains and accountability of food traders to the consumers. M-farm has facilitated the enforcement of international regulations, for instance on the use of pesticides.

3.1.3. Case study 3 (Tanzania): Mobile Kilimo

Tanzania's e-commerce market is forecasted to reach US$ 257.9 million by 2023, positioning it among the smaller markets. Anticipating a compound annual growth rate (CAGR) of 6.1 per cent from 2023 to 2027, the market is expected to expand to US$ 326.9 million by 2027. With a projected 2.8 per cent increase in 2023, the Tanzanian e-commerce sector will contribute to the global e-commerce growth rate that is predicted to be 8.7 per cent.

Mirroring the trend in Tanzanian, global e-commerce sales are expected to rise in the coming years. The e-commerce Insights (ECDB) assesses seven sectors within the country's e-commerce market, with electronics leading at 25.8 per cent, followed by hobby and leisure at 22.4 per cent, fashion at 19.1 per cent, furniture and homeware at 11.1 per cent, care products at 8.0 per cent, and do-it-yourself at 7.3 per cent. Grocery makes the least contribution to the country's e-commerce at 6.4 per cent.With supply chain-related factors exerting a considerable influence, both positively and negatively, on market accessibility for smallholder farmers (Mahuwi and Israel, 2023), it becomes crucial to understand how these dynamics impact the grocery e-commerce market in Tanzania.

Factors such as lengthy marketing and distribution channels, long distances from farms to markets, high transportation costs and intensive competition among actors negatively impact market access. Additionally, several local small-scale firms operating along the food supply chain face stiff competition from local multinational enterprises (Ruteri and Xu, 2009).

On the other hand, the country's current economic conditions have created opportunities for active private sector participation in investment undertakings, in contrast to previous socialist policies that subjected investment activities to state control. The Government of Tanzania is therefore taking an active role in developing strategies for a sustainable food system through mission-oriented innovation policies, in which the role of the state shifts from fixing markets to actively co-shaping them (Mazzucato, 2018).

Box 4. M-Kilimo

Mission-oriented innovation processes seek to address issues that cannot be resolved solely with technological and scientific solutions. Instead, they direct innovation efforts towards integrating understandings of sociology and economics, among other relevant aspects. The Mobile Kilimo Platform (M-Kilimo) is an example of such a case that was developed by the Economic and Social Research Foundation, with the support of the Government of Tanzania. M-Kilimo was created to facilitate farmers' access to markets for their produce. The platform also allows farmers to ask questions and connects them with market prices and news. To analyse the case of M-Kilimo as an innovative platform linking farmers to markets, this paper reviews a recent study conducted in the Bahi and Mvohero districts. The study investigated the factors influencing the use of mobile-based platforms for accessing market information among smallholder farmers. Results of the study indicated that network availability had a significant positive relationship with accessibility to agriculture information farmers. Accessing agriculture market information depends on the network stability in the areas where smallholder farmers reside.

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3.2. Extracting Lessons from and applicability to East Africa

3.2.1. Learning as networks

One noteworthy aspect of the village agent model is how it leveraged the potential of learning as networks a concept that has gained attention in recent research due to its significant role in creating new markets or shaping existing ones. This concept views learning as a series of associations within a distributed multi-actor phenomenon, rather than a solitary cognitive process confined to one individual's mind (Storbacka and Nenonen, 2015). Learning as networks, through an inter-organizational exchange of knowledge amongst actors across the food value chain, facilitated the incremental co-creation and change of Uganda's food supply networks. With the marketing of agricultural produce as the main goal of the model and improving agricultural productivity as a means to that end, technology notably played a pivotal role in enabling village agents to perform their crucial function in transforming Uganda's food supply chain. Various resources were integrated through this market-driving strategy and hence value was created for the participating actors. For instance, new markets emerged, providing increased access to smallholder farmers through village agents. Additionally, traders and buyers enjoyed high-quality agricultural produce. The realization of these mutual benefits sheds light on the fact that "actors wanting to influence the market are likely to focus on learning with the market", and thus incrementally co-develop innovative solutions over time (ibid.). This claim finds support in a study conducted in the Sironko district, an area where this model was implemented. The research revealed that farmers' decisions to embrace new technologies were notably influenced by the knowledge they acquired from fellow farmers who have already employed the technology (D'Exelle and Verschoor, 2023). This emphasizes the significance of co-creation in the design of innovative solutions.

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3.2.2. Improved communication and technology capabilities

A monitoring study on the Uganda Feed the Future Value Chain project, an initiative that used the village agent model, was conducted to assess the impact of market facilitation approaches on driving systemic market changes, particularly in terms of access to quality-differentiated pricing (QDP) within agricultural output value chains. The study showed that the relationship between prices and quality was complex, emphasizing that access to better prices appeared to depend on actors' ability to access markets.

A key finding from the study highlighted the pivotal role that technology played in strengthening the relationship between village agents and farmers. Improved communication facilitated by technology, empowered actors to make better-informed production and business decisions. Although not a direct indicator of QDP, enhanced communication capabilities allowed actors to coordinate decisions related to quality and pricing, resulting in an overall increase in income (Picchione and others, 2022).

3.3. Co-creation and sharing of knowledge

The use of the Kiswahili language on the M-Kilimo platform provides a distinct advantage in effectively conveying marketing information and recognizing and incorporating the cognitive language mastered by farmers. In contrast, while most digital platforms have been designed with a focus on the transfer of knowledge from "expert" to farmer, they often overlook the significance of aligning with the cognitive language understood by farming communities. This approach rests on the assumption that farmers require certain types of information and knowledge, often perceived to be exclusively held and produced by external "experts".

However, a counterargument is presented in this present paper, asserting that such an approach dismisses and undervalues the unique knowledge and practices within farmer communities.

This counterargument finds support from the case study analysed herein, which revealed that farmers' engagement with agricultural information platforms and the influence of their peers played key roles in shaping their perceptions of the benefits associated with using digital platforms in agricultural activities, ultimately leading to increased agricultural profit.

Also, recognizing that farmers are best positioned to articulate their needs and interests, and simultaneously presenting market trends in a manner comprehensible to them, fosters the co-creation and sharing of new knowledge. This collaborative and inclusive approach is crucial for stimulating incremental co-creation of market innovations aimed at positioning of the market-actors.

CHAPTER

04

Policy recommendations and strategies

4.1. Overview and strategic objectives

From the East African situation analysis and practical examples provided in Sections 2 and 3 on the encouraging prospects of implementing digital solutions in strengthening urban-rural linkages areas (food security and territorial resilience), there are still many unknowns or less-used digital solutions which require more exploration and better understanding. There may also be limitations as to how feasible digital solutions are in some contexts and how effective they will be in enhancing food value chains and improving territorial resilience, for example the well-being of residents of informal settlements. The analysis of research and practical examples identified eight strategic objectives under which recommendations and strategies can be generated to achieve the objectives of the strategy paper. These strategic objectives are the following:

1. Promote inclusive economic development across the rural-urban continuum
2. Facilitate financial inclusion for Indigenous Peoples, women, young people and small- and medium-sized enterprises
3. Improve decision-making for transparency and participation
4. Enhance farm level productivity
5. Strengthen farm-to-market efficiency
6. Enhance territorial resilience for urban, peri-urban and rural communities
7. Promote knowledge-sharing from both formal research and territorial intelligence
8. Infrastructure development for both formal and informal sectors

4.2. Strategic interventions and recommendations

Based on the analysis and examples from East Africa, these are recommendations that may be equally relevant to other regions:

Promote inclusive economic development across the rural-urban continuum

Connect urban centres with rural areas to stimulate economic growth, create job opportunities and foster collaboration between urban businesses and rural entrepreneurs.

a. Create economic incentives for establishing digital start-ups and enterprises in rural areas to stimulate economic growth and job creation.

b. Develop robust innovation ecosystems that include incubators, accelerators and funding mechanisms for startups and small businesses.

c. Increase public and private investment in research and development to support the development and commercialization of new technologies.

d. Encourage collaboration between urban businesses and rural entrepreneurs to foster a mutually beneficial business environment.

e. Develop user-friendly mobile applications providing farmers with access to market information, weather forecasts and expert advice to enhance market access.

Facilitate financial inclusion for Indigenous Peoples, women, young people and small- and medium-sized enterprises

Promote digital banking and mobile payment solutions to enable farmers in rural areas to access credit, manage finances and conduct transactions efficiently.

a. Promote digital banking and financial inclusion in rural areas to enable access to credit, financial services and mobile banking for farmers.

b. Implement mobile payment solutions to facilitate transactions, making it easier for farmers to sell products and manage finances efficiently.

c. Enhance access to financial services such as loans and insurance through digital payment solutions, boosting economic empowerment in rural communities.

d. Include farmers and market actors in the design of new and improved finance mechanisms and programmes.

Improve decision-making for transparency and participation farm management

Use satellite imagery, drones and artificial intelligence (AI) algorithms to monitor crop health, predict yields and provide real-time recommendations to farmers for better farm management practices.

a. Use satellite imagery and drones for real-time crop monitoring to improve surveillance of crop diseases and pest infestations.

b. Develop automated decision support systems providing real-time recommendations to farmers based on data analysis for informed decision-making.

c. Use AI algorithms to provide valuable insights into farming practices, market trends and consumer preferences to help farmers improve operations.

d. Build the capacity of value chain participants to access and use market information effectively.

e. Advocate for increased public funding for agricultural research and market intelligence to provide valuable data and insights for decision-making.

Enhance farm-level productivity

Implement digital solutions to optimize farming practices, improve crop yields and enhance livestock management through the use of sensors, artificial intelligence (AI), and Internet of Things (IoT) devices.

a. Implement sensor technologies for monitoring soil health, climate conditions, and crop status to optimize farm management decisions.

b. Use AI and machine learning (ML) algorithms to predicting crop yields, disease outbreaks, and optimal planting times to improve overall productivity.

c. Deploy IoT devices for livestock monitoring, tracking and feeding systems to enhance productivity and ensure animal well-being.

Strengthen farm-to-market efficiency

Use blockchain technology and smart contracts to enhance traceability, transparency and security in agricultural supply chains, reducing fraud and improving market access.

a. Use smart contracts to automate and secure transactions between stakeholders in the agriculture value chain, enhancing trustworthiness.

b. Develop mobile payment solutions to facilitate digital transactions, especially in areas with limited access to traditional banking infrastructure.

c. Encourage collaboration and market-shaping initiatives to drive market innovations and create opportunities for businesses in the digital solutions sector.

d. Use e-commerce platforms to connect farmers with buyers, streamline transactions and provide real-time market information.

e. Develop mechanisms for the effective dissemination of market research findings to all stakeholders in the agricultural value chain.

f. Implement open access policies to make market research findings freely available.

Enhance territorial resilience for urban, peri-urban and rural communities

Develop strategies for sustainable land-use planning, disaster risk management, and territorial governance to build resilient communities and promote balanced urban-rural development.

a. Develop integrated land-use planning strategies to promote sustainable resource management and support balanced urban-rural development.

b. Use geographic information system (GIS) technology for mapping vulnerabilities, monitoring land use and informing decision-making in disaster risk management.

c. Engage local communities and stakeholders in participatory planning processes to ensure inclusive and sustainable territorial management practices.

Promote knowledge-sharing from both formal research and territorial intelligence

Establish training programmes, workshops and digital platforms to enhance the digital literacy of stakeholders, facilitate technology transfer and foster collaboration in the agricultural sector.

a. Integrate digital skills training into the national education curriculum to prepare future generations for the digital economy.

b. Establish training programmes and workshops to enhance digital literacy among farmers, entrepreneurs and stakeholders in the agricultural sector to keep pace with the rapid evolution of technology and market changes.

c. Facilitate knowledge exchange and technology transfer through partnerships with research institutions, industry experts and government agencies.

d. Strengthen communication channels and information-sharing networks among stakeholders through digital platforms, social media and online forums.

e. Enhance public awareness, knowledge dissemination and stakeholder engagement through digital campaigns, webinars and interactive tools.

f. Encourage the adoption of innovative technologies and best practices through demonstration projects, field trials and peer-to-peer learning networks.

Infrastructure development for both formal and informal sectors

Develop transportation, utilities, social, digital and environmental infrastructure to enhance linkages between urban and rural areas to enable smooth flow of information, people, goods and services.

a. Invest in digital infrastructure such as broadband connectivity, mobile networks and data centres to support the adoption of digital solutions in agriculture.

b. Improve access to storage facilities, cold chain logistics and transport networks to reduce post-harvest losses and ensure the efficient distribution of agricultural products.

c. Collaborate with private sector partners to develop and maintain digital platforms for online trading, supply chain management, and market linkages.

d. Develop robust cybersecurity measures to protect sensitive information and prevent disruptions in farming operations.

e. Develop smart grid technologies and renewable energy sources.

f. Implement policies and programmes that provide affordable Internet access to low-income households and remote communities.

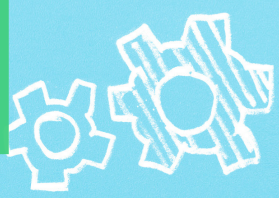
g. Formulate clear policies and regulations to foster innovation and growth in the digital solutions industry by involving stakeholders from the private sector, academia and civil society.

h. Provide tax incentives, grants and subsidies to encourage investment in technological advancements and market innovations.

CHAPTER

05

Implementation plan



The implementation of the identified strategic interventions and recommendations will involve various stakeholders at both the national and subnational levels in each country. This process will require effective coordination among stakeholders, mobilization of sufficient funding, implementation of robust risk mitigation measures, development and deployment of a comprehensive information and knowledge management system, and rigorous monitoring and evaluation of progress. To achieve the strategy's objectives, the strategic options must be tailored to fit each country's specific context. Successful implementation will also depend on political will, adequate resource allocation, prudent resource management, professionalism and enhanced coordination and collaboration between government agencies at all levels, as well as between public and private sector actors.

5.1. Key stakeholders and their roles

National and subnational government ministries, departments and agencies will adopt the strategy and continue their roles in creating a supportive policy environment and regulatory framework. The effective implementation of the strategy will necessitate the establishment and use of regional, national and subnational structures that integrate all stakeholders across the food system and urban-rural continuum. In Kenya, the National Trade Policy of 2017 provides a framework for such structures. Some of the key ministries, departments and agencies that should take lead in the implementation of the strategy include those involved planning, agriculture and livestock development, trade and ICT.

Private sector actors, including producers of various agricultural commodities and other non-State players along the food supply chain, will be crucial in the use of digital technology and innovative solutions in production, processing, transporting and marketing of the agricultural commodities. Similarly, the solutions will be of importance to the general public for planning and building resilience within their regions. The private sector, through cooperatives and community-based organizations, should establish and support umbrella associations to advocate for stakeholder interests, establish codes of practice and improve the provision of services such as market connections and capacity-building.

Development partners will play a key role in providing technical and development cooperation, mobilizing resources and funding development of digital technologies and innovations and related programmes. They will also support capacity-building for stakeholders.

5.2. Resource mobilization and allocation

The national government of each country should fund the implementation of the strategic interventions through its budgetary allocations, national programmes and development partner contributions. Similarly, the subnational governments should also integrate the strategy implementation into their integrated development plans, allocate resources in annual work plans and seek donor funding.

All levels of government should focus on enabling environments and public goods.

The private sector will invest along the urban rural continuum to promote efficient food flows and e-commerce. Coordination resources will be mobilized by national and subnational governments, with support from development partners and non-governmental organizations.

5.3. Risk assessment and contingency plans

To mitigate against the risks that may arise during the implementation of the strategy, the risk assessment matrix provided below, with necessary adjustments, will be used by various actors.

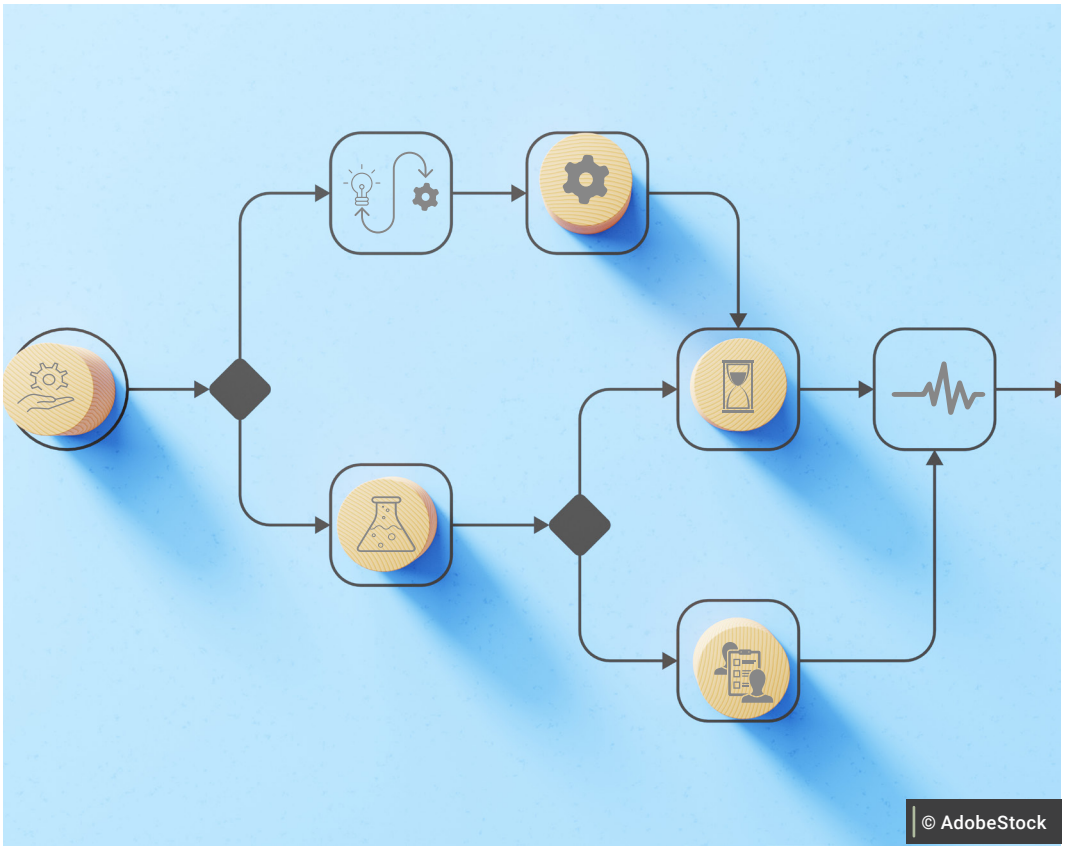
Risk	Category	Mitigation measures
Political influence in resource distribution	 High	Clear criteria for mapping, selection of sites and prioritization of programmes
Social and cultural conflicts	 High	Developing and implementing conflict resolution mechanisms Sensitization of stakeholders
Climate change	 High	Promote climate-smart approaches and technologies to improve resilience
Cross border informal trade	 Medium	Enforcement of regulations and standards

5.4. Monitoring and evaluation

Monitoring and evaluation are essential for supporting the development and adoption of digital technologies and innovative solutions to ensure efficient food flows and enhance territorial resilience. To guide the implementation, monitoring and evaluation of the strategy, the implementing institutions should develop a comprehensive logical framework. This framework should detail the mission, vision, overall objectives, outputs, activities and observable indicators. Key performance indicators for each strategy should be developed by each country and integrated into the overall monitoring and evaluation framework.

Additionally, the logical framework should include a time and cost framework to guide resource allocation and mobilization. This will help inform the government and other stakeholders about the financial requirements for effective strategy implementation.

Implementing agencies will be responsible for conducting regular monitoring and evaluation to assess performance and the achievement of set outputs. Monitoring should be carried out on a regular basis by a multisectoral team composed of representatives of participating partners.



6. References

African Union Commission/Organisation for Economic Co-operation and Development (2021), Africa's Development Dynamics 2021: Digital Transformation for Quality Jobs. Addis Ababa/Paris: OECD Publishing. https://doi.org/10.1787/0a5c9314-en.

Ajambo, S., Ogutu, S., Birachi, E. and Kikulwe, E. (2023). Digital agriculture platforms: Understanding innovations in rural finance and logistics in Uganda's agrifood sector. International Food Policy Research Institute.

Altamirano, M. A. and Beers, C. P. v. (2018). "Frugal innovations in technological and institutional infrastructure: Impact of mobile phone technology on productivity, public service provision and inclusiveness." The European Journal of Development Research, 30, pp 84-107.

BenYishay, A. and Mobarak, A. M. (2019). "Social learning and incentives for experimentation and communication." The Review of Economic Studies, 86(3), pp.976–1009. Oxford University Press.

Bocquier, P. (2005). "World Urbanization Prospects: an alternative to the UN model of projection compatible with the mobility transition theory." Demographic Research, 12, pp. 197–236.

Brown, A. M. (2015). "Sustaining African Cities: Urban hunger and sustainable development in East Africa." International Journal of Environmental, Cultural, Economic & Social Sustainability: Annual Review, 11.

D'Exelle, B. and Verschoor, A. (2023). "Village networks and entrepreneurial farming in Uganda." World Development, 167.

Eyita-Okon, E. (2022). "Urbanization and human security in post-colonial Africa." Frontiers in Sustainable Cities, 4.

Florida, R. (2017). The New Urban Crisis: How our cities are increasing inequality, deepening segregation and failing the middle class, and what we can do about it. United Kingdom: Hachette.

Food and Agriculture Organization of the United Nations (2020). Urban food systems and COVID-19: The role of cities and local governments in responding to the emergency. Rome.

Food and Agriculture Organization of the United Nations, International Fund for Agricultural Development, United Nations Children's Fund, World Food Programme, and World Health Organization (2023). State of Food Security and Nutrition in the World 2023. Urbanization, agrifood systems transformation and healthy diets across the rural–urban continuum. Rome: FAO. Accessible at: https://doi.org/10.4060/cc3017en.

Fransen, J., Hati, B., Nyumba, R. and van Tuijl, E. (2023). "Community vitality and frugal practices in informal settlements in Nairobi: Towards a typology." Cities, 134.

Galhotra, B. and Dewan, A. (October, 2020). Impact of COVID-19 on digital platforms and change in e-commerce shopping trends. In 2020 fourth international conference on I-SMAC (IoT in social, mobile, analytics and cloud) (I-SMAC) (pp. 861–866). Institute of Electrical and Electronics Engineers.

G20 Information Centre (2023). "G20 2023 Action plan to accelerate progress on the SDGs", p. 31. Accessed at: https://g20.utoronto.ca/2023/230612-sdg-action-plan.html.

Kaartemo, V. and Nyström, A. (2021). "Emerging technology as a platform for market shaping and innovation." Journal of Business Research, 124, pp. 458-468.

KALRO. The Big Data Platform. State Corporations Data Collection and Management Workshop. Machakos University, 7th June 2022.

Kamana, A. A., Radoine, H. and Nyasulu, C. (2023). "Urban challenges and strategies in African cities–a systematic literature review." City and Environment Interactions.

Kenya (2019). 2019 Kenya Population and Housing Census: Volume II.

Kjellberg, H., Azimont, F. and Reid, E. (2015). "Market innovation processes: Balancing stability and change." Industrial Marketing Management, 44, pp. 4-12.

Knorringa, P., Schouten, G. and Vellema, S. (2023). "Connecting the concepts of frugality and inclusion to appraise business practices in systems of food provisioning: A Kenyan case study." Journal of Agricultural and Environmental Ethics.

Koleros, A. (2016). Rethinking systemic change: Practical considerations for market system programmes, a case study of NUTEC-MD in Northern Uganda. London: The Beam Exchange.

Lukuyu, B. A. and Ouma, E. A. (2021). Uganda MorePork II project – results and achievements. Nairobi: International Livestock Research Institute.

Mack, J. (2016). "Deprivation and poverty." http://www.poverty.ac.uk/definitions-poverty/deprivation-and-poverty, Accessed 7 May 2020.

Mahuwi, L. and Israel, B. (2023). "Supply chain issues affecting market access among smallholder maize farmers in Mbozi district, Tanzania." International Journal of Food and Agricultural Economics, 11(2), pp. 115–129.

Mazzucato, M. (2018). "Mission-oriented innovation policies: challenges and opportunities." Industrial and Corporate Change, 27(5), pp. 803-815. Accessed from https://academic.oup.com/icc/article/27/5/803/5127692.

Mwageni, T. O., Bundala, A. C. and Mpogole, H. A. (2022). Use of mobile phone services in accessing agricultural market information among smallholder farmers in Bahi and Mvomero districts, Tanzania.

Ochieng, H. O., Ojiem, J. O., Kamwana, S. M., Mutai, J. C. and Nyongesa, J. W. (2019). "Multiple bean varieties as a strategy for minimizing production risk and enhancing yield stability in smallholder systems." ***Experimental Agriculture***, pp.1-11.

Organisation for Economic Co-operation and Development/Sahel and West Africa Club (2020). Africa's Urbanisation Dynamics 2020: ***Africapolis, mapping a new urban geography***. West African Studies. Paris: OECD Publishing. Available at: https://doi.org/10.1787/b6bccb81-en.

Picchione, K., Goentzel, J., Russell, T. and Gralla, E. (2022). Quality-differentiated pricing among agricultural traders. USAID. https://hdl.handle.net/1721.1/142762.

Pisano, G. P. (June, 2015). "Competitive strategy." Retrieved 2 October, 2023, from ***Harvard Business Review.*** Accessible at: https://hbr.org/2015/06/you-need-an-innovation-strategy.

Ruteri, J. M. and Xu, Q. (2009). "Supply chain management and challenges facing the food industry sector in Tanzania." ***International Journal of Business and Management***, 4(12), pp. 70–80.

Scheer, J. and Ariko, J. (2019). Village agent model study: Likely effect on the Ugandan agricultural sector. Developing Local Extension Capacity Project. Washington D.C: USAID.

Sibblye Bui, C. L. (2016). "Sustainability transitions: Insights on processes of niche-regime interaction and regime reconfiguration in agrifood systems." ***Journal of Rural Studies***, 48, pp. 92-103. Retrieved from https://doi.org/10.1016/j.respol.2007.01.003.

Sietchiping, R., Loose, S., Forster, T., Githiri, G., Egal, F., Escudero, A. G., . . . Suri, S. N. (2019). Urban-rural linkages: Guiding principles: Framework for action to advance integrated territorial development.

Storbacka, K. and Nenonen, S. (2015). "Learning with the market: facilitating market innovation." ***Industrial Marketing Management***, 44, pp. 73–82.

Titz, A. and Chiotha, S.S. (2019). "Pathways for sustainable and inclusive cities in Southern and Eastern Africa through urban green infrastructure?" ***Sustainability***, 11(10), p. 2729.

United Cities and Local Governments. Intermediary Cities. https://shorturl.at/jsIQ0.

United Nations (2018). ***World Urbanization Prospects***, vol. 12. doi: 10.4054/demres.2005.12. 9.

United Nations Department of Economic and Social Affairs (DESA-UN) (2019). World Urbanization Prospects: The 2018 Revision (ST/ESA/SER.A/420). New York.

UN-Habitat (2017). Implementing the new urban agenda by strengthening urban–rural linkages – Leave No One And No Space Behind. UN-Habitat.

_____ World Cities Report 2022 – Envisaging the Future of Cities.

_____ (2022a). Managing Urban-rural Linkages for Biodiversity: An integrated territorial approach. Available at: https://shorturl.at/bemwU

Urban Policy Platform (undated). Urban-Rural Linkages. Available at: https://urbanpolicyplatform.org/urban-rural-linkages/.

Advancing Urban-Rural Linkages: Digital Technology and Innovative Solutions for Food Flows and Territorial Resilience in East Africa

Food security and sustainable urban-rural connections are critical to territorial resilience in East Africa, yet many challenges persist. Smallholder farmers, traders, and policymakers face obstacles such as inefficient value chains, poor infrastructure, and a lack of access to digital tools that could optimize food distribution and market participation. As cities grow and demand for food increases, there is an urgent need to integrate digital innovations into food systems to improve efficiency, transparency, and inclusivity.

This strategy paper explores the role of digital technology in enhancing food flows and territorial resilience in Kenya, Tanzania, and Uganda. It presents case studies on successful digital solutions, including mobile applications, e-commerce platforms, and smart agricultural innovations, which are transforming food markets and supply chains. Developed through a collaborative effort involving UN agencies, academia, international NGOs, and government stakeholders, this publication provides a roadmap for implementing digital tools in food systems.

The paper offers actionable recommendations for policymakers, urban planners, and development practitioners, highlighting the need to invest in digital infrastructure, strengthen inter-city collaboration, and promote financial inclusion for smallholder farmers and food entrepreneurs. By leveraging digital transformation, East Africa can create more resilient, efficient, and equitable food systems that benefit both urban and rural communities.

This publication is an essential resource for those working in urban and rural development, food security, and digital innovation. It provides insights and strategies to guide decision-makers in harnessing technology to bridge urban-rural divides and build a more sustainable and food-secure future.

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