



Policy Brief

How Do Digital Technologies Improve Sustainable Performance Among Smallholder Farmers?

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Key Messages

- An increased global population is a major threat to food sustainability, particularly in Sub-Saharan Africa (SSA).
- It is critical for stakeholders to pursue sustainable agricultural performance that is based on achieving a balance between environmental protection, economic growth and social development.
- Leveraging digital technologies in agri-food supply chain has achieved many successes in the food supply chain of developed economies.
- Despite the potential benefits of digital technologies to the agri-food supply chain, adoption rate among smallholder farmers in SSA remains low.
- A clear understanding of the low adoption of digital technologies in the agricultural context in SSA would help formulate policies to enhance the diffusion of digital technologies among smallholder farmers.

This policy brief investigates how digital technologies could help improve the sustainable performance of smallholder farmers.

The issue: Why sustainable performance matters

Global population growth inevitably leads to the question of how mankind can survive, especially given the limited availability of non-renewable resources. The latest UN projections suggest that the world population could reach 8.5 billion in 2030 and 9.7 billion in 2050, peaking at around 10.4 billion during the 2080s¹. The projected population requires a 70% increase in global food production, a task that must happen at an even faster rate in Africa, which will be home to almost 2 billion people by then.¹

However, the pursuit of higher agricultural productivity to meet increasing demand is accompanied by a mounting environmental and social trade-off. To increase productivity, many farmers engage in practices such as using chemical weedicides and pesticides, leading to deforestation and biodiversity loss. While these practices may increase productivity in the short term, their long-term impacts are detrimental to the environment and human health.

Moreover, several agricultural-dominated rural communities still suffer from social problems such as malnutrition, unemployment, and poverty. Consequently, a sustainable agricultural outcome that balances environmental protection, economic growth and social development must be pursued. Achieving this balance will require the involvement of all stakeholders such as farmers, governments, and NGOs, among others.

In light of the COVID-19 pandemic and the ongoing Russia-Ukraine conflict, both of which have implications for the food supply chain, the need for sustainability in economic, environmental and social dimensions is greater than ever.

It is imperative to prioritize sustainable agricultural practices that increase productivity without compromising environmental and social well-being. The focus should be on promoting sustainable farming techniques that conserve resources, protect ecosystems and create economic opportunities for farmers and rural communities.

Why do smallholder farmers matter?

Sustainable agriculture has the potential to ease some of the most severe problems facing African agriculture, especially in sub-Saharan Africa. However, achieving sustainability through agriculture cannot be successful when the smallholder farmers, who make up the largest cohort of farmers, are neglected. In sub-Saharan Africa, smallholders occupy a much larger share of agricultural land than the global average. They also contribute more of the food supply, about 40% compared to the global average of 35%.²

In Ghana, about 45% of the workforce is employed in agriculture, with the largest cohort being smallholder farmers. As a result, the country's ability to promote food security, livelihoods and rural economic development depends extensively on these small-farm owners³. They contribute about 80% of the food produced in Ghana⁴.

Despite these contributions from the smallholder farmers, they are greatly hit by the complexities in the agri-food supply chain. These complexities arise from differences in quality, the perishable nature of some food and unpredictability in demand.

As a result, smallholder farmers find it difficult to sustain their operations. This policy brief sheds light on how smallholder farmers can improve their agricultural outputs while also improving their economic, environmental and social performance.

The role of Information Technology in improving the sustainable agri-food supply chain

In sub-Saharan Africa, smallholder farmers' over-dependence on climate makes them vulnerable to climate change, which affects their yield,⁵ especially when they are not informed of climatic changes. For decades, African governments have used many policy instruments to improve farm productivity; however, most farmers are only marginally improving yields. Some continue to use traditional processes that depend heavily on historical norms.⁶ The sections below discuss some digital platforms that are transforming agricultural systems.

Sharing economy

The sharing economy has emerged in the agricultural and food (agri-food) systems, particularly in small-scale and locally based systems with limited use of information technology as compared to other sectors.⁷ It includes emerging technology platforms that link farmers to multimedia advisory content, farm inputs and buyers. Through these platforms, farmers are able to share important inputs, labour services, spraying machines, tractors and more via digital platforms to enhance their production. They build on their collaboration efforts and generate income or other benefits from shared idle resources, promoting individuals' performance towards sustainability.

Moreover, this platform enhances easy access to markets through advertisement, which is particularly important for perishable produce. For instance, in Ghana, various online platforms such as Esoko, Farmerline, and Troto Tractor provide farmers with essential services concerning various farm practices. These platforms have included voice messages and SMS extension advice, which help farmers to obtain information about how to access markets and extension services.

However, patronage has been extremely low, and the majority of individuals who utilize these services are literate farmers who are primarily engaged in large-scale agriculture. A focus on smallholder farmers (who are largely illiterate) necessitates digital tools with fewer technical requirements.

Precision farming

In recent times, information-intensive and knowledge-based precision farming techniques have become a requisite for sustainable agricultural production. This suggests the need for smallholder farmers to reorient themselves towards the use of emerging digital technologies for their farming business. The significance of precision farming, as a safeguard food security for the global economy⁸ and as a key component of sustainable agricultural systems⁹, has come to light in the 21st century.



Drone checking leaf colour and soil quality, producing reports on the crop's health

Precision Farming (cont'd)

Precision farming refers to the adoption of modern information technologies, software tools, and smart embedded devices for decision support in agriculture.¹⁰ Emerging technologies, such as remote sensing, drones, global positioning systems (GPS), geographic information systems (GIS), Internet of Things (IoT), Big Data analysis and artificial intelligence (AI) are promising tools being utilized to optimize agricultural operations, to determine crop development and inputs aimed to enhance production and reduce inputs and yield losses.¹¹ These advanced tools help in decision-making by giving valuable, accurate and timely information on planting periods, crop soil quality, leaf colour, crop health, innovative production techniques, market information, extension services, and financial services, among others.

The advanced tools also give accurate information on the volumes of water, fertilizer, pesticide, herbicides, seed, fuel, labour and other factors which enhances productivity. These informed decisions from digital technologies help mitigate the threats from disruptions and uncertainties in demand and supply that most smallholder farmers battle with.

Fintech – A supply chain finance solution

Fintech as a supply chain finance solution, is a technological platform that improves and automates the delivery and use of financial services. In the agricultural context, it offers a convenient way for farmers to manage their financial operations and expand their financial inclusion through apps that manage payments, lending and investments.

Fintech – A supply chain finance solution

For instance, farmers can now use their mobile phones to make payment for inputs purchased and also receive payments for sale of their produce. In most rural areas where the traditional banks and financial institutions are not available, fintech provides banking services for this population to sustain smallholder farmers. Fintech also helps to fight fraud by leveraging information about payment history to flag transactions outside the norm.¹²

As a supply chain finance solution, fintech offers an opportunity for business partners (suppliers, including farmers) to secure financial assistance to supplement their cash flows. For instance, smallholder farmers who do not have the financial strength to pay for inputs purchased can now leverage fintech to make payment on their behalf.

Similarly, a smallholder farmer can easily be paid from the sale of farm produce through a fintech arrangement between two parties (smallholder farmer and the buyer). Nowadays, the function of supply chain finance is not limited to relieving suppliers' cash-flow pressure to achieve economic sustainability. Supply chain finance can help suppliers to be more environmentally friendly and optimize social sustainability along the entire supply chain.

IT adoption constraints of smallholder farmers

Most smallholder farmers are faced with IT adoption constraints, which discourage them from the relevance of adopting digital technologies. Most of them do not understand the digital tools and how they can successfully deploy them to enhance their farm business. For instance, because of low digital savvy.

Low digital savvy

Low digital literacy among smallholder farmers is a significant obstacle to the adoption and use of digital technologies in their farm operations. Most smallholder farmers lack the necessary skills to use these technologies and the complexity of existing systems exacerbates the problem. Additionally, low education and income levels have a strong influence on how these farmers use information technology.

Our field study in June 2022 revealed that 80% of smallholder farmers do not use digital technologies in their businesses due to low IT literacy. Many farmers we interviewed were unaware of the available technologies that could improve their farm operations. Despite owning mobile phones, only 15% of these farmers had a smartphone and most use their phones for basic voice calls, SMS, and USSD-enabled mobile banking services. Even among those with access to smartphones, few used farm-based mobile applications. The result is that farmers' low digital literacy is impeding their ability to explore and adopt available technologies that could improve their business operations.

Overall, addressing low digital literacy among smallholder farmers is essential to increasing their uptake of digital technologies. Improved digital skills training programs can empower these farmers to access and effectively use available technologies, which could transform their farm businesses and livelihoods.

Table 1: IT adoption constraints

Core Constraints	Issues
Low digital savvy	Lack of IT literacy, low level of awareness of digital technologies for farming business
Technological infrastructure (Resources)	Digital divide (poor cellular network/internet connectivity), low level of ownership of basic digital devices such as internet-enabled, multimedia phones.
Culture	Resistance to change

The way forward

Culture

Culture is a critical factor that affects the adoption of digital tools by smallholder farmers. In many sub-Saharan African countries, farmers reserve certain days for non-farming activities as part of their cultural practices to honour the gods of the land. Consequently, even if their crops are rotting, farmers are not permitted to engage in farming activities on these days. This cultural practice presents a significant constraint to farmers' ability to utilize digital technologies in their farming activities.

Moreover, some farming communities in the region observe extended periods of no farming activities following the death of a chief or a king. These rigid cultural practices make it challenging for farmers to adapt to change in a digital age. Some farmers are afraid of the consequences of adopting new technologies, similar to the case with the COVID-19 vaccine. They hold superstitious beliefs about the use of technology, with some believing that the use of these technologies has hidden side effects. Others fear that technology is being used by "Whites" to destroy their cultural heritage and the gods of their land.

Action for developers

The actions begin with developers. It is necessary for developers to consider the low literacy rate among smallholder farmers. This challenge can be addressed by developing simple, intuitive, and easy-to-use digital tools. More importantly, developers should involve the smallholder farmers in the product development process. By engaging with smallholder farmers and leveraging their knowledge and experiences, developers can create digital tools that are tailored to their specific needs.



Additionally, developers should also coordinate with farmer cooperatives to increase smallholder farmers' understanding and education regarding how to employ these technologies. This can help increase smallholder farmers' awareness and understanding of how to use digital tools for their farm business. Developers should be mindful of the low literacy rates among smallholder farmers and consider alternative methods of communication such as visual aids or interactive tutorials.

Action for smallholder farmers

Smallholder farmers can leverage digital technologies for sustainable performance by adopting a proactive approach towards innovation. Instead of waiting for technology to be handed to them, farmers should actively seek out and experiment with existing digital tools that can enhance their agricultural practices. By taking a curious and open-minded approach to innovation, smallholder farmers can identify solutions that are tailored to their specific needs and can help address environmental and social issues associated with traditional farming practices.

To further increase their IT savvy, smallholder farmers can participate in extension service training programs. These programs can provide valuable insights and knowledge on how to effectively use digital tools for their farm business. By doing so, smallholder farmers can not only increase their own productivity and economic well-being but also contribute to more sustainable and environmentally friendly agricultural practices.

Action for farmer cooperatives

Farmer cooperatives play a critical role in shaping the knowledge and behaviour of smallholder farmers, making them key players in advancing the digitalization agenda for agriculture. To promote the adoption of digital technologies by smallholder farmers, cooperatives can sensitize them to the benefits of technology and dispel superstitious beliefs that may hinder adoption. Also, can provide training and extension services that focus on digital literacy and the effective use of digital tools. This can help smallholder farmers to navigate the complex landscape of digital solutions and maximize the benefits of technology adoption.

Additionally, farmer cooperatives may establish partnerships with digital solution providers to pilot test new technologies that can improve their members' agricultural practices. By engaging with these providers, cooperatives can help to bridge the gap between smallholder farmers and the digital solutions that can benefit them. Moreover, they can negotiate better prices for their members, thus making these technologies more accessible and affordable. By doing so, cooperatives can contribute to a more equitable and sustainable agricultural sector that benefits smallholder farmers, their communities, and the wider society.



The way forward

Action for policy makers

The potential for digital technologies to revolutionize food production and consumption in Africa is vast and largely untapped. However, to fully leverage the benefits of these technologies, the government must prioritize the development of enabling infrastructure, particularly internet connectivity, in remote areas where smallholder farmers operate. By doing so, the government can facilitate the integration of digital technologies into the agri-food supply chain and drive sustainability across the sector.

Furthermore, the government should invest in training and education programs to equip smallholder farmers with the necessary skills to use digital tools effectively. In addition to training and education, the government could provide smallholder farmers with incentives and subsidies for adopting digital tools. This approach would help to overcome some of the financial barriers that may hinder technology adoption among farmers. With these measures in place, smallholder farmers can benefit from the transformative potential of digital technologies, contributing to a more sustainable and efficient agri-food supply chain in Africa.

Conclusion

In conclusion, the adoption of digital technologies in agriculture is a game-changer that offers great potential for smallholder farmers to increase productivity and contribute to global efforts to tackle food shortage, environmental issues and social challenges. By leveraging the benefits of digital tools, farmers can improve crop management, reduce operational costs and increase their profit margins.

However, to fully realize the benefits of digital technologies, there is the need to sensitize and train smallholder farmers on their benefits and uses. Additionally, it is crucial that developers create user-friendly and customer-centric tools that meet the specific needs of smallholder farmers. Governments also have a role to play in providing incentives and subsidies to support the adoption of digital technologies by smallholder farmers. Moreover, by strengthening the enabling infrastructure, such as internet connectivity, governments can facilitate the smooth operation of digital technologies among smallholder farmers in remote areas and contribute to a more sustainable agri-food supply chain. The future of agriculture is digital and the time to act is now.

END NOTES

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