
SECTOR FOCUS 1

Agriculture

Across the developing world, agriculture sustains the majority of rural livelihoods. Ever since people have grown crops, raised livestock, and caught fish, they have sought information from one another. What is the most effective planting strategy on steep slopes? Where can we buy improved seeds? Who is paying the highest price at the market? Over time, weather patterns and soil conditions change. Epidemics of pests and diseases come and go. Updated information allows farmers to cope with and benefit from these changes.

Providing such knowledge can be challenging. Agriculture is location-specific, and farmers need accurate local weather forecasts, advice on agricultural practices and input use, and real-time information about prices and market logistics. Harnessing the rapid growth of the internet and associated digital technologies such as mobile phones is critical to helping farmers obtain the information they need and to promoting transformative agricultural development. Interest is especially keen in increasing access to extension services, improving marketing of outputs, and arranging logistics. The body of rigorous, quantitative evidence on the ways in which digital innovations can help improve the lives of rural people is growing steadily.

Enhancing on-farm productivity

Agricultural productivity varies dramatically around the world. While credit constraints, missing insurance markets, and poor infrastructure account for some of

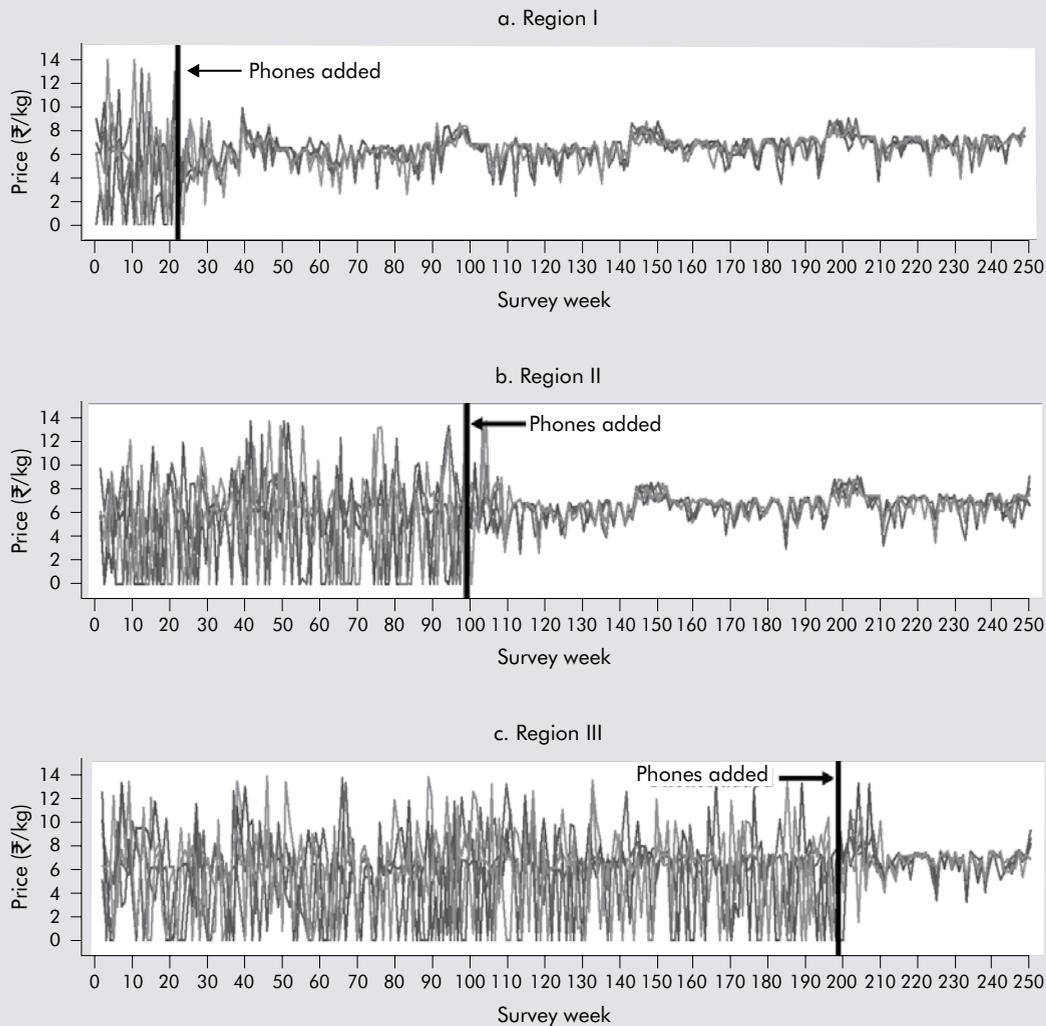
this disparity, suboptimal agricultural practices and poor management are also to blame. New production technologies such as improved seed varieties, nutrient management, and pest control methods are not necessarily reaching farmers. Public extension agents can overcome information barriers related to new agricultural practices and technologies, but such extension programs have been burdened by limited scale, sustainability, and impact.

Digital technologies help overcome these constraints. They are reviving agricultural extension and advisory services around the world. In cooperation with agricultural research and extension services, organizations such as Digital Green, the Grameen Foundation, and TechnoServe deliver timely, relevant, and actionable information and advice to farmers in South Asia, Latin America, and Sub-Saharan Africa, respectively, at a dramatically lower cost than traditional services can. Rather than always visiting a farmer, extension agents use a combination of phone calls, text, videos, and internet to reduce transaction costs and increase the frequency of interaction with farmers. Governments, in partnership with mobile operators, use phones to coordinate distribution of seeds and subsidized fertilizers in remote areas through e-vouchers, as in Nigeria's large-scale e-wallet initiative (spotlight 2, "Digital finance"). Technology firms such as Climate Corp, based in Silicon Valley, are pioneering the provision of agrometeorological services for early warning of weather and climate risks. A number of innovations aim for real-time and accurate weather monitoring using remote sensing and technologies enabled with geographic information systems (GIS) for climate-resilient agriculture.

This sector focus was contributed by Aparajita Goyal.

Figure F1.1 Introducing mobile phone service reduces price dispersion in local markets

Sardine prices in three coastal markets in Kerala, India



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Note: kg = kilogram; ₹ = Indian rupee.

Facilitating market transparency

Agricultural product markets in many developing countries are poorly integrated. High search costs have tended to lower competition and create an inefficient allocation of goods across markets. When the internet took off in the mid-1990s, it was often claimed that it would improve price transparency, cut out middlemen, and make markets more efficient. Indeed, rapid adoption of digital technologies has dramatically reduced the search costs incurred

by farmers and traders, and hence overcome an important constraint in the context of limited infrastructure. As Robert Jensen's classic 2007 study of sardine fishermen and wholesalers in Kerala, India, found, the introduction of mobile phone service dramatically reduced price dispersion and waste in the sardine catch, increasing welfare for producers and consumers (figure F1.1). Similar effects have been shown for communication platforms such as Esoko in Ghana, e-Choupal in India, and telecenters in Peru, as well as studies on grain traders in Niger and farmers in the Philippines.¹

Enabling efficient logistics and improving quality control

Digital technologies also improve the management of agricultural supply chains. With globalized food systems, ensuring food safety has become more complex. These trends have catalyzed innovations to trace the food supply from producer to consumer—which is important for developing countries that want to reach new export markets. Smallholder farms can turn to cooperatives and aggregators, who use digital tools to improve collection, transportation, and quality control. By opening up new specialized market opportunities, the internet has improved consumer protection and farmers' livelihoods.

Lessons for adapting digital technologies for agriculture

Why do many of these innovations fail to scale up and achieve wider acceptance? One reason is market fragmentation—even though market consolidation will, over time, enhance growth prospects. Another reason is the lack of financially sustainable business models that will attract private sector investments in innovative solutions for small-scale agriculture. There is great potential for the internet and related technologies to improve rural economies, but several lessons need to be kept in mind.

First, agriculture is becoming increasingly knowledge-intensive and high-tech. Some of the world's newest industries have started to put money and tech talent into farming—the world's oldest industry. Digital soil maps, remote sensing, and global positioning system (GPS) guidance are critical tools for modern farmers. "Big data" for precision agriculture increases yields and efficiency. These high-tech tools mostly benefit big farms that can make large investments in technology. But there are also many innovative ways in which illiterate and otherwise disadvantaged people use digital technologies, such as basic mobile phones. Greater efforts to *close the digital divide* in rural areas can have great payoffs.

Second, basic price and market information systems can improve efficiency and welfare. The evidence, although strong, is still limited to certain countries and certain contexts. A number of recent studies

have cast doubt on the overall novelty of information provided to the farmer and the degree of competition in many markets. One explanation of weak effects is low take-up of fee-based price information services. But even when farmers are seemingly better informed, they may not necessarily be able to act on that information because of the inaccessibility of alternative markets and the complex interlinked relationships between buyers and sellers in low-income developing economies. Rather than assuming that an information and communication technology (ICT) approach will always be cost-effective and yield a better outcome, a more nuanced *understanding of the underlying institutional environment and constraints* is warranted.

Third, technology-enabled interventions are no panacea in themselves, and need to be backed by *complementary investments in physical infrastructure*, including electricity and literacy. The versatility and near-constant innovation that characterize digital technologies can sometimes be a distraction that can cause interventions to focus more on the technology than on the demands and priorities of the intended beneficiaries and the trade-offs imposed by resource-constrained environments.

Finally, information technology (IT) policy and the *broader regulatory environment* in a country should be discussed jointly. Whereas the expansion of mobile phone access has been rapid and commercially self-sustaining even among many of the poor, the same is not true of the internet. In the long run, the internet can have an even greater impact on rural growth; much depends on finding sustainable business models to encourage its spread in the poorest parts of the world.

Note

1. Nakasone, Torero, and Minten 2014.

References

- Jensen, Robert. 2007. "The Digital Divide: Information (Technology), Market Performance, and Welfare in the South Indian Fisheries Sector." *Quarterly Journal of Economics* 122 (3): 879–924.
- Nakasone, E., M. Torero, and B. Minten. 2014. "The Power of Information: The ICT Revolution in Agricultural Development." *Annual Review of Resource Economics*. doi: 10.1146/annurev-resource-100913-012714.

