Using personalised digital extension services to improve agriculture performance – an example from India

Many farmers already benefit from digital extension services in several areas. Personalising such structures gives them an additional edge and can result in advantages such as better input allocation and higher productivity, as a recent study in India found.

By Pallavi Rajkhowa

More than 1,100 households participated in the survey in eastern India. The digital extension services had positive impacts on production diversity, intensity of input use, crop productivity and crop income.

Photos: Pallavi Raikhowa

Smallholder farmers are often trapped in a vicious cycle of low productivity and subsistence-oriented farming due to inadequate access to information, technologies, and financial services. Thus, an important policy question that arises is how information and market access constraints that smallholder farmers face can be overcome.

Traditionally, the main method for the diffusion of knowledge and innovation in many developing economies is public sector-supported agriculture extension services. In this system, extension agents train smallholder farmers directly regarding best practices or work closely with selected 'model farmers' who try out suggestions on new agricultural inputs and cultivation practices and then communicate these to other farmers. However, the effectiveness of this approach has been limited because of insufficient funding and information that is not personalised to farmers' requirements.

In the past two decades, with the rapid spread of mobile phones in developing countries, information and communication technologies (ICTs) such as text messages, training videos, and interactive voice response services have been used to improve the delivery of market and weather information to farmers. Further, in recent years, the rapid rise of high-speed internet connections and smartphones has led to the evolution of the use of new digital extension approaches. Cloud services, low-cost open-source software and big data analytics have made it possible for emerging economies to invest in pioneering 'agriculture technology platforms' that can tailor the extension information based on farmers' individual needs and conditions. This is possible because predictive analytics and machine learning algorithms can combine data on weather forecasts, soil conditions, market prices and individual farmer characteristics to develop and deliver site-specific agricultural recommendations.

How can personalised digital extension benefit smallholder farmers?

Digital extension services can benefit smallholder farmers through several pathways. First, they can reduce information barriers by providing personalised advice on which types of crops to grow in which season, the appropriate types and quantities of inputs to use and the best timing for the different operations and input applications. Second, digital extension services can link farmers to new input markets by giving transparent information on market prices and reputed brands and suppliers. Third, they can increase farmers' bargaining power by giving more options for purchasing inputs from several vendors. Fourth, access to new information and quality inputs can result in a shift from subsistence crop cultivation towards more market-oriented farming by altering the pattern of production and structure of input use. This may provide direct benefits in farm productivity and crop income.

In a collaborative research project between the Center for Development Research (ZEF) and the University of Göttingen, both in Germany, we analyse whether such positive effects can be observed using the example of a concrete digital extension platform started in India by e-Kutir, a social business enterprise. This agriculture technology platform offers real-time agricultural extension services and a marketplace for seeds, fertilisers and pesticides. The application enables its users to plan season-wise cropping activities and provides information on best practices for growing specific crops. It also makes recommendations on the types and quantities of inputs to use and provides information on relevant pests and diseases and how to control them.

Bridging digital illiteracy and trust gaps

In India, the average landholding of farmers is about 1.08 hectares, and 86 per cent of holdings are less than two hectares in size. Because of the small-sized landholding, farmers are often unable to reap the benefits of economies of scale. To improve farmers' bargaining power and access to information, technology and markets, the developers of the digital platform work in collaboration with farmer collectives or farmer producer organisations (FPO). The adoption of digital technologies in rural areas is often limited due to low levels of education and lack of farmers' trust in accepting new technologies; thus the model takes a 'human-centric' approach to bridge digital illiteracy and trust gaps by creating a 'local for local' development model.

> Entrepreneurial models that provide digitally enabled solutions to small and marginalised farmers in developing countries are yet to fully mature.

The developers of the digital platform train trusted members of the community (also called micro-entrepreneurs) who serve as advisors to farmers based on the information that the platform provides. In the example we study, the farmers do not directly receive the extension services on their mobile phones. Instead, farmers keen on digital extension services contact the head of the FPO, who then operates the internet-based application on the farmer's behalf. Thus, the head of the FPO takes on the role of an extension agent equipped with digital technology which enables him to provide tailor-made agricultural advice and services to the other members. When a member of the FPO wants to use the digital extension services, the FPO head creates an individual account of the farmer by entering personalised data, including farm-specific details such as location, land size, types of crops currently grown and soil conditions. These details in conjunction with the application's algorithms on weather forecasts, market conditions and optimal production decisions help provide personalised advice on crop selection, the schedule of agricultural activities and input regimes. After every season, the micro-entrepreneur enters additional data on the actual inputs used by each farmer, the yields obtained and the prices to further improve the algorithms' predictions and advice for future seasons. When the survey was conducted, the digital platform was voluntary for farmers and free of charge. However, over time, there may be a subscription fee for a package of services. Further, in the current format of the model, e-Kutir incentivises the micro-entrepreneur to get new customers on board by paying a commission fee of 15 rupees (equivalent to 0.12 US dollars) per farmer.

The gains to smallholder farmers

The research conducted in eastern India (Odisha) in early 2019 surveyed around 1,105 households, out of which 603 were members of the FPO and 502 were not. The digital extension services are accessible only to FPO members. However, as adoption for FPO members is voluntary, not all FPO members adopted the digital extension services. Of the 603 FPO members in our sample, 465 (around 77 %) adopted digital extension services, while the others did not although they would have been eligible. The study finds that the main types of information that were requested through the digital platform were the types of crops to grow, the method of cultivating selected crops, and the type and quantity of inputs to be used. We also see this information translating into better agriculture performance in several ways. The study finds that the digital extension services increased the production diversity of adopters as well as the intensity of input use by 15 to 20 per cent. Further, crop productivity increased by around 18 per cent, whereas the degree of crop commercialisation was up by five to seven percentage points. Finally, we find that using digital extension services increased crop income by 25 to 29 per cent. These results suggest that digital technologies that use data from farms to provide personalised information are effective in terms of helping farmers to make better cropping, technology, and input decisions and allocate their resources more efficiently.

The way forward

Technological advancements in areas such as open-source software, artificial intelligence and machine learning are likely to increase investments in innovative agriculture technology platforms in developing countries. The Indian example suggests that personalised digital extension services can be used to augment the public sector's efforts to provide agriculture-related information in rural areas. However, for such digital extension services to be an effective tool, some basic infrastructure such as roads, electricity, a telephone network and internet coverage needs to be accessible, which may require support from the government. Besides, a minimum level of computer and digital literacy is required either among farmers or at least among local intermediaries. Further, from a business point of view, entrepreneurial models that provide digitally enabled solutions to small and marginalised farmers in developing countries are yet to fully mature. Providing these services for free requires significant market-building investments that may not be readily accessible to agri-tech start-ups. Thus, the long-term viability and scalability of these solutions depend on the ability to charge for these services, but farmers may be reluctant to adopt a new technology if the expected benefits are perceived as low. However, given the magnitude of the benefits we find in our study, farmers may be willing to pay a certain amount for such digital services. From a policy perspective, investments in rural road and ICT infrastructure, in promoting digital literacy among rural households and in creating an enabling business environment for related entrepreneurial activities are important steps towards fostering agricultural innovation and equitable growth in the small-farm sector.

Using digital extension services increased crop income by up to 29 per cent.

Photo: Jörg Bötling

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