Rapid Response Brief

What factors positively affect the adoption of agricultural technologies by smallholder farmers?

Improved agricultural technologies are essential to improving the productivity, sustainability and resilience of smallholder farmers. These technologies include a wide range of advances, such as improved seeds, newer irrigation systems, and better pest management approaches. However, adoption of new agricultural technologies is rare in many African countries, and the challenges relating to agricultural development are numerous. This brief presents evidence on the determinants of adoption of improved agricultural technologies by smallholder farmers, responding to a question from the West African Development Bank (BOAD). The brief is based on three categories of papers measuring adoption rates, assessing the impact of interventions to promote new technologies, and identifying factors positively associated with adoption.

Key Findings

- Overall adoption rates of new technologies are very low across the board.
- In specific contexts, Farmer Field Schools (FFS) and agricultural extension programs have increased agricultural production through the adoption of new technologies.
- There is little or no evidence of any program leading to widespread adoption or diffusion.

Factors associated with higher rates of adoption of agricultural technologies include:

- Policy tools: access to extension, information, credit and farmer groups
- Farmers' wealth, including land size, number of livestock and off-farm income
- Secure land tenure

Key Recommendations

- Promote FFS and agricultural extension services.
- Consider expanding access to credit.
- Promote secure land tenure.
- Improve the affordability of new technologies.
- Design policies and programs to address multiple barriers.
- To maximize adoption, target farmers with more wealth, livestock, off-farm income and land.

3ie International Initiative for Impact Evaluation

WACIE
West Africa Capacity-building and Impact Evaluation Program
Programme de renforcement des capacités et d'évaluation d'impact en Afrique de l'Ouest

ACED

Context

Although African agricultural production has increased steadily in recent decades, there has been very little improvement in productivity. The continent has the lowest agricultural labor and land productivity in the world. This underperformance is also worsened by adverse effects of climate change and desertification, contributing to alarming food insecurity, endemic food crises and extreme poverty. Numerous agricultural technologies have been developed, deployed and promoted in different areas in attempts to address these challenges. Technologically, a number of types of interventions have been shown to increase yields, raise farmer profits and increase the sustainability of agricultural production. However, encouraging widespread adoption of these improved approaches remains a primary challenge.

Details of studies

The findings in this brief are drawn from different evidence syntheses measuring adoption rate, assessing the impact of adoption interventions and analyzing the determinants of agricultural technologies adoption.

A global analysis on adoption comes from a study assessing the adoption and diffusion of natural resource management practices, including agricultural technologies. The study is based on research projects that measured the adoption rate of five NRM practices through surveys in nine countries (2 Asian countries, 1 Latin American country and 7 African countries).

A second set of analyses comes from a systematic review of FFS programs and an impact evaluation of improved maize seed adoption conducted in Benin. The systematic review brought together the results of 92 impact evaluations of FFS in 25 countries. Thirty-one were conducted in Sub-Saharan Africa, 50 in Asia and 11 in Latin America. Interventions considered as FFS were those that provided intensive group training with the use of control plots as well as information on holistic techniques and inputs. The study conducted in Benin was a randomized control trial, which combined the provision of improved maize seed and agricultural extension support as treatment.

A third analysis comes from a meta-analysis of 168 studies conducted in 23 African countries that investigated the determinants of agricultural technologies adoption. The studies included in the meta-analysis used microeconometric methods to identify factors that are positively associated with the adoption of agricultural technologies. Because of the research designs used in these studies, findings cannot be used to make claims about what effect any policy change or program might have on farmers' behavior.

Findings

Overall adoption rates are low

"Adoption of the [new technologies is] remarkably and consistently low, ranging from less than 1% to less than 10% in those areas where a variety of actors had been promoting these practices," write Stevenson & Vlek (2018). Adoption rates were low across different types of technologies and countries. These surveys were conducted in areas where the new agricultural technologies had previously been promoted – making them among the most likely places to find higher adoption rates. The low rates in these areas suggest that adoption rates are likely even lower elsewhere.

Interventions can improve adoption among participants in the short term

Several types of interventions, including FFS and other agriculture extension services, have been shown to increase adoption. FFS also increased farmers' yields and profits. (For more information, see our full brief on FFS.)

An ongoing 3ie evidence synthesis will draw together results from recent impact evaluations on agricultural innovations, including several which aimed to increase adoption. Any key findings, and a link to that report, will be added here when it is complete.

Interventions tend to show no evidence of diffusion or long-term impact

FFS do not show evidence of leading to diffusion of new farming practices among nonparticipants.

Even among participants, effects may be short-lived. A 2020 impact evaluation from Benin on agricultural extension services linked to improved maize seeds showed positive effects in the year it was implemented. However, after the intensive extension services stopped, even the targeted farmers mostly did not continue to implement the improved practices.

Policy factors commonly correlated with adoption

Uptake rates of new agricultural technologies were higher among farmers in Africa in places where certain policy tools were in place that ensured that farmers:

- Had access to **credit**, allowing farmers to make investments in newer technologies.
- Had access to **extension services** and **information**, allowing farmers to understand new technologies and make informed decisions.
- Had secure **land tenure**, meaning that farmers could continue to benefit from new technologies with upfront costs.
- Participated in **organized farmer groups**, allowing peer learning about new farming approaches.

However, the research design of these studies does not permit claims that these policies directly caused increased adoption of new technologies.

Farmer characteristics commonly correlated with adoption

Uptake of new agricultural technologies was more common among farmers in Africa who had above-average:

- Wealth
- Livestock
- Land
- Off-farm income
- Access to labor

These characteristics are generally associated with farmers who are more financially secure and thus might be more willing to take risks and experiment with new agricultural technologies.

Recommendations

In general, when designing any new agriculture program, a primary consideration should be to understand potential barriers to adoption. Investing upfront to identify concerns of targeted groups may help pinpoint the best approaches to encourage adoption.

- **Design policies and programs to address multiple barriers**. Issues related to the adoption of agricultural technologies are often complex. Understanding contextual factors and identifying barriers is an important step in the process of developing a good policy of technologies adoption. Thus, harnessing synergies between different determinants and contextual factors is a good strategy.
- **Expand FFS and extension services as much as possible**. These interventions have been shown to be successful on the micro level. Also, farmer groups are associated with higher adoption rates more broadly.
- **Consider expanding access to credit**. Costs and access to financing are key factors for smallholder farmers, and access to credit is positively associated with the adoption of new technologies.
- **Promote secure land tenure**. Secure land tenure can allow farmers to capture long-term benefits from new technologies with upfront costs. A land tenure component can be added to intervention packages in cases where farmers face land insecurity.
- **Aim to make new technologies affordable**. Improving the affordability of technologies is a crucial aspect for the success of agricultural technologies adoption policies, given the low investment capacity of farmers.

Evidence quality, strengths and limitations

This brief draws together evidence of several different types, each with its own strengths and limitations.

Much of the evidence in this brief is not designed to allow causal claims, meaning it cannot identify what the effect of a particular policy change or program will be. This caveat applies to the evidence about overall adoption rates and about the factors associated with higher adoption rates. It is possible that these factors may not cause higher adoption rates; they may simply be correlated with adoption for other reasons. The available evidence also does not permit disaggregation by gender or for other subgroups.

The evidence about FFS and extension services does identify the causal effects of the programs, but it only does so among the small subset of the population targeted with the interventions.

What is the WACIE helpdesk?

The WACIE helpdesk, an initiative led by 3ie's WACIE program in collaboration with IDinsight, provides rapid synthesis and evidence translation to help policymakers in West Africa understand what evidence exists for specific policy questions. The helpdesk can also connect interested policymakers with further resources to meet additional needs. It is staffed by the WACIE Secretariat in Cotonou and the IDinsight regional office in Dakar, with engagement from the wider 3ie and IDinsight technical staff and other experts as needed. For this brief, ACED contributed subject matter expertise.

To submit a policy question, or for additional information, contact wacie@3ieimpact.org.

What is WACIE?

The West Africa Capacity Building and Impact Evaluation (WACIE) program, a partnership between 3ie and the Government of Benin, was launched to help build evaluation capacity in the eight countries that comprise the West African Economic and Monetary Union (WAEMU): Benin, Burkina Faso, Cote d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal and Togo. Program goals include increasing evaluation capacity in targeted countries, ensuring that policymakers have access to relevant evidence and promoting takeup of high-quality evidence by relevant stakeholders.

This rapid response brief is based on the following

Arslan, A, Floress, K, Lamanna, C, Lipper, L, Asfaw, S and Rosenstock, T., 2020. The adoption of improved agricultural technologies: A meta-analysis for Africa.

Houndolo, D-G, Hodonou, A, Sossou, DS and Hamidou Yacoubou, R, 2020. "A pathway to adoption of yield-enhancing agricultural technologies among the rural poor: evidence from a randomized control trial in Benin." *Partnership for Economic Policy Working Paper* 2020-15.

Stevenson, JR and Vlek, P, 2018. Assessing the adoption and diffusion of natural resource management practices: synthesis of a new set of empirical studies. Rome: Independent Science and Partnership Council (ISPC).

Waddington, H, Snilsveit, B, Hombrados, J, Vojtkova, M, Philips, D, Davies, P and White, H, 2014. "Farmer Field Schools for improving farming practices and farmer outcomes: a systematic review." *Campbell Systematic Reviews* 10.1: i-335.

The International Initiative for Impact Evaluation (3ie) promotes evidence-informed, equitable, inclusive and sustainable development. We support the generation and effective use of high-quality evidence to inform decision-making and improve the lives of people living in poverty in low- and middle-income countries. We provide guidance and support to produce, synthesise and quality assure evidence of what works, for whom, how, why and at what cost.

ACED is an independent non-profit organization based in Benin that works on the most important challenges of food and nutrition security. We combine research, policy and local action to reduce poverty and hunger in the most vulnerable communities. We act as a think-and-do tank.

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