Environment for Development

POLICY BRIEF

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The role of production risk in farm technology adoption

Production risks, gender, security of land tenure and regional factors are critical in adoption of farm technologies

BY OGADA MAURICE JUMA–MAY, 2009

The Kenya Vision 2030, World Bank (2008) and Strategy for Revitalization of Agriculture (2004) appreciate the fact that productivity of farmers can be improved through use of modern technologies. It is, however, surprising that despite the heavy investment by the government of Kenya in agricultural extension services, farmers, and particularly the small holders, have not sufficiently adopted the modern production technologies that guarantee sustainable land use. Without appropriate technology, agricultural productivity is jeopardized and agriculture becomes a threat to the environment.

Key Points

- Adoption of farm technologies is yield increasing.
- Security of land tenure motivates farmers to undertake long term investments in land. This promotes sustainable land management.
- Production risks discourage farmers from adopting modern farm technologies.
- It is important to provide safety nets to farmers guard them against production risks and encourage them to adopt farm technologies.
- Women are better environmental stewards and should be targeted in farm management policies.
- Policies should address region-specific factors.

It is the foregoing discussion that motivated our study to find out factors beyond farm and farmer characteristics that could influence technology adoption among farmers, especially the small holders. The study used data from 321 farm households from Machakos and Taita Taveta Districts of Kenya collected by IFPRI in the year 2003. The analysis focused on maize, a staple crop that is widely grown in the country under widely varying climatic conditions. Maize is very important to most Kenyan households and its shortage implies famine. Because maize is widely grown in the country, the results of this study can be applied for other crops.

The rest of the brief presents the findings of the study before discussing the policy options.

The findings

The study revealed that production risks are important in technology adoption decisions. The effects of the various production risk factors are outlined below:

Variability of maize yield: This refers to fluctuation of maize output from the average yield. Such fluctuations reduce the probability of adopting fertilizer and manure use. This implies that farmers are risk averse but also keen on maximizing their profits by adopting technologies that promise high returns with low risks.

Predicted mean maize yield: This implies the average maize output that the farmers expect from a given plot. When expected yield is high, the farmers are motivated to use fertilizer and adopt terracing. The underlying rationale, here, is that farmers are profit motivated- only ready to invest in high cost inputs when they expect higher returns, capable of repaying the costs and earning profits.

Risk of crop failure (downside risk): Higher likelihood of crop failure encourages farmers to apply manure while low probability of crop failure increases the possibility of fertilizer use. This indicates that use of fertilizer is meant to enhance output while manure input is meant to maintain the level of yield or to restore severely degraded soils that no longer promise good yields. Thus, farmers view manure application as mechanisms for reducing downside risk.

Other factors that are important in technology adoption include:

Farm location: Farmers in Machakos district are better adopters of technology compared to their counterparts in Taita Taveta. This indicates that each region has certain unique characteristics that make it a better or a poor adopter of a given technology. These characteristics could be historical, household-based or farm-based.

Distance of plot from household: How far a plot lies from the household impacts on manure use. Farmers with plots closer to the household are better users of manure. This is because manure is bulky and heavy and could be more expensive to transport to distant plots. Normally manure is accumulated in the backyard and would be more convenient to apply on farms closer to the household.

Tenure security as perceived by farmers: Farmers who are convinced that they have secure land tenure are encouraged to undertake terracing. This is possibly informed by the fact that terracing is a long term investment whose returns are not immediate. Like any other investor, the farmer only undertakes an investment if he/she is more certain of reaping the gains. Thus, farmers whose security of land tenure is not guaranteed would be more inclined towards short term investments in land, and sustainability concerns are not likely to be their top priority.

Social capital: Refers to willingness to form associations/groups and to cultivate trust to enhance co-operative efforts, communal action and overcoming socio-economic barriers. The study reveals that it is important in influencing terrace adoption.

For productivity, fertilizer has the greatest impact followed by labour, manure and terracing, respectively. Large plots reduce productivity, implying that smaller plots are better managed, more intensively utilized and more productive. Male headed households are also more productive perhaps because men control more resources that translate into better agricultural inputs and supervision or because they are fairly better at risk taking in relation to technology adoption. The findings on productivity confirm that technology adoption is indeed output-increasing and could be used as exit route from poverty, especially the rural poverty given that about 70 percent of the poor in Sub-Saharan Africa live in rural areas and largely depend on agriculture for income and livelihood.

Policy Options

The above findings have various policy implications:

a. *Hedging against production risks:* When making agricultural/land management policies, it is important to consider the role of risks. For instance, while considering promoting use of fertilizer by farmers, policies must be put in place to ensure minimal fluctuations in agricultural returns and maintain high returns. This is possible with introduction of safety nets to cover against negative fluctuation. Generally, all technologies have a degree of risks associated with them and because farmers are risk averse, economic instruments to hedge against exposure to risks are necessary to motivate farmers to easily and quickly adopt the desired technologies. Formal crop insurance is one of the options that the government could consider. Alternatively, the government could set up an incentive scheme (e.g. subsidies) for the adopters to cushion them against risks.

   Advantages: The policy would make agriculture more attractive to even farmers that are less endowed with resources. Farmers will be motivated to embrace new technologies faster and to desirable levels. This will in turn increase agricultural production, improve food security in the country and reduce poverty levels in line with the vision 2030.

   Disadvantages: Agricultural insurance is a new concept among the small holders. This implies that initially it will be the responsibility of the government to insure them against production risks or heavily subsidize the policies. While this may be overcome in the long run, in the short run the government will have to bear the heavy financial burden associated with it. Implementation of this policy, therefore, has to be accompanied with rigorous education of the farmers so that they are able to appreciate the need for crop insurance such that they are able to meet their own cost of insurance with time.

b. *Targeting women farmers:* Women farmers appear more risk averse as explained by their lower productivity. Apparently they are more hesitant to adopt technologies that would guarantee higher output per unit of land. As a result, government policies targeting improved agricultural production should, foremost, target women farmers and cushion them against risks associated with technology adoption.

Advantages: Women are more heavily impacted by crop failure because of their direct responsibility of feeding the family. Any policy that targets them is for the wider good of the family. Such policies would also play a role of empowering women economically and reducing income inequality between men and women.

Disadvantages: Currently men own much of the land the country. Unless men are made to understand the integral role of women in agriculture, women-inclined agricultural policies are likely to face opposition from men who head majority of households.

c. *Region-specific policies:* Technologies are adopted at different rates in different regions. Policies, therefore, should be customized to different conditions in different areas. Toolbox approach to policy should be discouraged. Regional, farm-level and household-level factor should all be fused in the policies if such policies are to succeed.
d. *Enhancing security of land tenure:* Security of tenure is essential for adoption of terracing as a sustainable soil and water management technology. This makes it necessary for the government to, not only, issue land titles but also make citizens have faith in the sanctity of such titles. This will stimulate long term investment in land and help farmers break the poverty trap besides ensuring that land is sustainably used.
e. *Setting optimal landholding size:* Optimal landholding size should be determined and implemented because beyond an economically viable maximum, productivity falls. This could be incorporated in the proposed land policy. Does this call for land redistribution? While this is an option, it is beyond this study to determine. Other options like renting out any land owned beyond the desirable limit could also be explored. The advantage of this is that land for farming will be available for more people instead of a few people holding too much land that cannot be put to productive use. This will enhance wealth redistribution and create a more equal society as envisaged in vision 2030.

Agriculture is more beneficial if it is carried out sustainably. This is possible if farmers can embrace appropriate technologies. Thus, all factors that impede adoption of technologies among farmers should be addressed decisively and urgently.

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ABOUT THIS BRIEF

This brief is based on results from: Ogada M.J., W. Nyangena and Yesuf, M., 2009 “The role of production risk in farm technology adoption among rain-fed maize producers in semi-arid lands of Kenya”.

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