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Selective attention and information loss in the lab-to-farm knowledge chain: The case of Malawian agricultural extension programs

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ABSTRACT

A multitude of approaches and modalities are available for delivering useful information to rural communities. However, evidence regarding the information efficiency of these modalities is limited, as are studies identifying the mechanisms of potential information loss in the agricultural extension system. In this paper, we assess information efficiency along the knowledge transmission chain from researchers to agricultural extension agents (EAs) to lead farmers (LFs) to other farmers. By asking the same set of questions about a fairly well known technology, pit planting, we construct a measure of knowledge at each node of the knowledge transmission chain. Evidence shows that the majority of information loss happens at the researcher-to-EA link and the EA-to-LF link, and that the loss is potentially caused by teaching failures or by selective attention and learning among both the EAs and the LFs concerning all important details of the technology. Results highlight the need for greater emphasis during training and learning on key dimensions of technology packages that are commonly ignored.

1. Introduction

Agricultural extension can play a crucial role in promoting agricultural productivity, increasing food security, and improving rural livelihoods. As one of their major functions, extension services are critical for moving research and technologies from the lab to the field, thereby translating new knowledge into innovative practices. Over time, the term agricultural *extension*, while still commonly used, is being gradually replaced by the term agricultural *advisory services,* defined as the entire set of organizations and institutions that support and facilitate people engaged in agricultural production to solve problems and to obtain information, skills, and technologies to improve their livelihoods and well-being (Birner et al., 2009, p. 342). Some have extended the term to be even broader: (i) *rural advisory services,* to include other sources of livelihood other than agriculture and greater focus on the facilitation and brokerage role beyond technology transfer (Davis and Heemskerk, 2012; Faure et al., 2012; Sulaiman and Davis, 2012; Swanson and Rajalahti, 2010); and (ii) *nutrition and agricultural advisory services,* to include nutrition information provision and behavior change communication for better health and nutrition outcomes (Fanzo et al., 2015).

These changes reflect shifts in thinking and practice over recent decades in the provision of information to and support for rural communities. One shift has been from a system of solely public extension to a pluralistic system with greater roles for private and nongovernmental organizations (Klerkx et al., 2016; Faure et al., 2012; Feder et al., 2011). Another shift has been in moving the focus from agricultural production alone to a broader set of services targeting income, market linkage, food and nutrition security, and improved wellbeing (Kilelu et al., 2014; Sulaiman and Davis, 2012). A third shift has stemmed from increased criticism of the transfer-of-technologies approach, shifting it toward a promotion of methods based on facilitation, learning processes, and increased capacity to innovate (Davis and Heemskerk, 2012; Klerkx et al., 2009). However, in many countries, the linear approaches still dominate, as does the focus on agricultural production, and thus, much of the research on this theme is heavily linked to technology adoption and farm productivity (Faure et al., 2012; Swanson and Rajalahti, 2010; Birner et al., 2009).

Given these shifts and the broadening of definitions, rigorous evaluation of the quality, effectiveness, and development impacts of agricultural extension service approaches and models is scanty, owing to various measurement challenges, attribution issues, and data limitations (Ragasa and Mazunda, 2018; Faure et al., 2012; Birner et al., 2009). First, measuring the quality of services or information has proven to be challenging. Various studies have used innovate ways to ask farmers about their satisfaction with, and their feedback on, the

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extension services or advice they have received, and in almost all settings the ratings have been overwhelmingly high (Berhane et al., 2018; Ragasa and Niu, 2017a; Ragasa et al., 2013; Buadi et al., 2013; World Bank and IFPRI, 2010). On the one hand, this response is credible and so is the possibility that the extension information is useful and is acted upon by the farmers. On the other hand, other studies have highlighted caution in interpreting responses to questions that ask farmers about satisfaction, as there may be problems of overreporting and a serious social desirability bias in the responses in some settings and country contexts.[1] Moreover, satisfaction with extension services is also highly correlated with the promotion and provision of inputs, as has already been highlighted by Elias et al. (2015) and Ragasa and Mazunda (2018). Therefore, one may need to exercise caution in interpreting responses on satisfaction, but at the same time one may be able to learn from the insights such surveys provide into *why* there is satisfaction or dissatisfaction.

Second, measuring the effectiveness or impact of extension services on technology adoption, productivity, or income is extremely challenging, given that information access is only one of the factors that contribute to these outcomes and attribution is difficult. Existing research has focused on measuring the marginal product or direct effect of access to extension services on farm productivity by using production models in which production output is expressed as a function of land, capital, inputs, and other factors (see review by Birkhaeuser et al., 1991, and more recent studies by Owens et al., 2003 and Ragasa et al., 2013); or by using frontier models, in which extension services are used as a factor to explain differences in technical efficiency levels rather than as an input in the production function (for example, Kalirajan and Shand, 1985; Seyoum et al., 1998; Young and Deng, 1999); or by using a combination of these models (Dinar et al., 2007).

Some have measured the impact of access to extension services on welfare outcomes using time-series data (Dercon et al., 2009; Krishnan and Patnam, 2014). Others have attempted to evaluate the impact of a particular approach or modality, such as farmer field school, using variants of matching, double-differencing, or instrumental variable techniques, depending on the nature of the datasets available (Benin et al., 2011; Davis et al., 2012; Feder et al., 2004). Nonetheless, these evaluative models are challenging given the inherent interlinkages among extension services, technology, and input use and their confounding effects on production and welfare outcomes. Even rates of return to extension services are difficult to measure, since they are often interlinked with investments, breeding, research, and other factors affecting technology adoption.

Another approach is to trace the flow of information from its source to the intended recipients, while also outlining feedback mechanisms. This paper takes this last approach by examining a particular technology package and analyzing the flow of information along the knowledge chain and measuring the loss of this information in each node along the chain. The research attempts to evaluate the efficiency of information transmission along the knowledge chain from lab to farm and assess the types of information failure, whether teaching or learning failures. By tracking knowledge scores of geographically linked extension agents (EAs), lead farmers (LFs), and other farmers (OFs), we provide an objective measure of information loss for the current extension modality in Malawi, while at the same time focusing on the quality of information provision, avoiding challenges in attribution. This paper answers the following questions:

- How efficient is the information transmission from scientist to extension agent (EA) to lead farmer (LF) to other farmer (OF)?
- If there is information loss along the chain, where does it happen?
- Which extension delivery approaches are linked to greater or less information loss?
- How does this information inefficiency affect technology adoption?

Section 2 of this paper sketches the background concerning Malawi's extension service approaches and existing studies of efficacy. Section 3 introduces the theoretical background. Section 4 describes the dataset and analytical methods. Section 5 lays out the results, introducing the researcher-to-farmer knowledge chain (Section 5.1); results from testing the selective attention model in explaining the observed information loss (Section 5.2); results of the cluster, or localization, analysis of knowledge (Section 5.3); an investigation of how extension delivery methods and intensity are related to knowledge scores (Section 5.4); and a summary of the association of knowledge scores and adoption results (Section 5.5). Section 6 describes the limitations of the study, and offers overall conclusions and a discussion of policy implications.

2. Background

We focus our analysis on Malawi, which is among the poorest and most food-insecure countries in Africa (Malawi, MoAIWD, 2016), because in recent years the Malawian government has pioneered several modalities in disseminating knowledge from research to farmers. These include the pluralistic and demand-driven extension systems, promoted in 2000; and the LF (or farmer-to-farmer) approach, begun in 2003 and formally institutionalized in the Malawi Department of Agricultural Extension Services programs in 2007 (Kundhlande et al., 2014), which has been commonly used by donors, farmer associations, and nongovernmental organizations (NGOs). These policies make Malawi an ideal country in which to assess the information efficiency of different information transmission modalities. The results of our analysis in Malawi also have the potential to exert a major influence on many other developing countries.

Lack of information has long been recognized as one explanation for low adoption of agricultural technology that promotes productivity (Conley and Udry, 2010; Foster and Rosenzweig, 1995; Levitt et al., 2013; Micheels and Nolan, 2016), along with other explanations such as credit constraints, differences in preferences, differences in agroecological conditions, and spatially heterogeneous costs and benefits (Duflo et al., 2011; Suri, 2011). The research on information failure has usually focused on diffusion through a social network, and the policy recommendation that has emerged from such research is to target the most socially connected people in the networks to reduce cost and increase information efficiency (Conley and Udry, 2010; Foster and Rosenzweig, 1995).

The modality of lead farmers (or contact farmers) aligns with this line of research (Beaman et al., 2015; Kondylis et al., 2017). In Malawi, as in many other countries, both governmental and nongovernmental agencies have adopted the LF concept. A LF is supposed to learn from the EA and then diffuse the information to other farmers in his or her community. However, recent studies on this modality provide mixed evidence regarding its efficacy. Fisher et al. (2017) link 180 LFs and 455 followers in four districts in Malawi and find that LFs' motivation, awareness, and adoption of conservation agriculture techniques are positively associated with OFs' awareness and adoption. However, their study does not address the information efficiency problem among LFs and OFs. Nationally representative surveys in Malawi show that 1 to 3% of households report getting some agricultural advice from an LF (Ragasa and Mazunda, 2018; Ragasa and Niu, 2017a). Some analyses find that training LFs might not increase the information efficiency or technology adoption by farmers in the community in the context of Mozambique (Beaman et al., 2015; Kondylis et al., 2017) and raise questions about the effectiveness of this modality of information transmission. Using field experiments, Kondylis et al. (2017) find that while LFs increase their adoption rates after training, their knowledge about the technologies does not increase significantly. Additionally, they find that the training of EAs and LFs does not affect adoption by

[1] See Ragasa and Niu (2017a) for more details.