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Original Research Article

Awareness and adoption of land, soil and water conservation practices in the Chinyanja Triangle, Southern Africa

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ABSTRACT

The promotion of land, soil and water conservation measures has been a widespread development in sub-Saharan Africa in a bid to tackle degradation and improve productivity. As a result, several governments have launched various campaigns on soil, land and water conservation measures. The aim of this study is to determine some of the factors that influence farmers' awareness (knowledge) and adoption of land, soil and water conservation practices. Data for this study was collected from 312 households using a questionnaire survey in the Chinyanja Triangle of Southern Africa. The study sites were sampled from Tete province of Mozambique, central and southern regions of Malawi and eastern Province of Zambia. We used *t*-tests to classify adopters and non-adopters of soil, land and water conservation measures and binomial logit models to identify the factors that influence farmers' knowledge of conservation measures and adoption of land productivity practices. The results show that the household head's age, education, agricultural advice reception and farmer group membership are critical in raising awareness. While the household head's age, education, agricultural advice reception, farmer group membership, pieces of land owned or used in production and land-to-man ratio influenced adoption decisions. The study, therefore, concludes that in order to improve land productivity in the Chinyanja Triangle, there is a need to consider farmers' heterogeneity in terms of household head's age, level of education, extension services outreach, and socio-economic characteristics. This suggests that governments' policies in the region should be aimed at improving farmers' level of education, extension delivery that will target the elderly and the youth, land ownership, credit access, and social capital such as group formation.

1. Introduction and background

The economies of most countries in sub-Saharan Africa, including Malawi, Mozambique and Zambia, are agro-based of which smallholder farmers are major food producers (Kassie, Jaleta, Shiferaw, Mmbando, & Mekuria, 2012). The agricultural sector's fortune directly affects economic development, food security, poverty alleviation and social welfare. However in sub-Saharan Africa, fluctuations in production and volatility of markets have affected development of the sector (Kassie et al., 2012). Despite the fact that the sector employs about two-thirds of the labour force, it contributes only about a quarter of the total gross domestic product (GDP) (Pretty, Toulmin, & Williams, 2011). The importance of the agricultural sector is more conspicuous, especially in rural areas, where families depend heavily on agriculture alone to make a living (AGRA, 2013).

Despite low performance of agricultural sector, there are variations within and among regions across sub-Saharan Africa. In Malawi, for example, the Economic Growth Strategy of 2004 considers agriculture as the pivotal sector for economic development accounting for 39% of GDP, 85% of the labour force and 83% of foreign exchange earnings (Chirwa, 2004). In Zambia, rural households who own small land holdings comprise about 88% of the farming population and often strive to meet their livelihood needs despite contributing 60% to the value of national agricultural output (Saasa, 2003). The land resource has been employed in various proportions to meet both subsistence and commercial needs. In Mozambique, agriculture is also considered the basis for development (Mucavele, 2013). About 90% of rural households are engaged in agriculture, and this equates to 80% of the total population who depend on agriculture. The role of

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agriculture in Mozambique includes supplying food to 80% of Mozambicans, providing employment to about 80% of the population, of which 50% are women, supplying foreign earnings through agricultural produce exports, as well as supplying raw materials to agro-industries and other sectors of the economy, and capital accumulation (Cunguara, Langyintuo, & Darnhofer, 2011).

Although the economies of Mozambique, Zambia and Malawi centre on agriculture, the sector faces many challenges. The casual factors for slow economic growth could be attributed to a number of biophysical and socioeconomic factors limiting agricultural growth (Ajayi, 2007; Misiko & Ramisch, 2007; Pender, Place, & Ehui, 2006). Among biophysical factors, soil fertility depletion is considered the main limiting factor for increasing food production of most smallholder farmers in the region. Issues related to the degradation of land, water and soil resources have mainly been blamed for the continual decline in soil fertility. Sustainable extensive agriculture production options that were coupled with fallowing period of certain parcels of land are increasingly becoming difficult. With increasing population densities per land area and scarcity of new land to exploit, allowing land to lie fallow has become more difficult in the region. Constrained on small farms, most households find themselves in a vicious cycle of poor agricultural productivity, low returns to enable investment, continued resource overuse and increasing demand for land to sustain livelihoods (Misiko & Ramisch, 2007; Pender et al., 2006).

Mucavele (2013) found that the majority of smallholder farmers in Malawi, Mozambique, Zambia and other sub-Saharan African economies still practice unimproved traditional methods of cultivation. Most of the smallholder farmers are said to apply no or minimum improved inputs to their farming activities, and modern soil and water conservation technologies are not practiced. In addition, the lack of diversification in farming systems, with 80–90% of the crop being maize, also aggravates problems of degradation, leading ultimately to soil fertility problems.

The major concern is that the degradation of land, water and soil resources adversely affects agriculture. For example, land degradation leads to the deterioration of soil quality. A reduction in land and soil productivity endangers the sustainability of agriculture, environmental stability and quality, and also has an adverse impact on economic and social development. Without taking appropriate soil, water and land management measures, the cost of arresting degradation will get higher and yields will persistently decline thereby increasing recurrence of food insecurity for greater populations of sub-Saharan Africa. It will also affect export earnings from agricultural products.

As a result of the problems arising in agricultural communities, the adoption and diffusion of certain sustainable agricultural practices have become an important issue in the development policy agenda for sub-Saharan Africa, especially as a way of finding solutions to the problems (Ajayi, 2007; Scoones & Toulmin, 1999). The adoption of land, soil and water conservation practices that include mulching, rainwater harvesting, the construction of box ridges and contour ridges, and many other conservation practices has been part of the development policy agenda for agriculture.

Notwithstanding their benefits, the adoption rate of some of these sustainable agricultural practices is still low in the rural areas of developing countries (Kassie, Zikhali, Manjur, & Edwards, 2009; Wollni, Lee, & Thies, 2010), despite a number of national and international initiatives to encourage farmers to invest in them. This is also true for Mozambique, Zambia and Malawi, where, despite accelerated erosion and considerable efforts to promote various soil and water conservation technologies, the adoption of many recommended measures is minimal and soil degradation continues to be a major limitation to productivity (Barungi & Maonga, 2011). Moreover, relatively little empirical work has been done to examine the factors that influence the adoption and diffusion of some of these sustainable agricultural practices, especially land, soil and water conservation practices. In this article, important land, soil and water conservation practices include constructing box ridges and contour ridges, mulching, rainwater harvesting practices, using Vetiver grass, using planting basins and ripping.

The objective of this article is to identify some of the socio-economic factors that influence awareness (knowledge) and those that influence farmers to adopt land, soil and water conservation practices. This is important in enhancing the adoption process, as targeting those factors can improve both the awareness and adoption of conservation practices. Awareness (knowledge) is considered important, as the innovation decision process begins with the knowledge stage (Rogers, 2003). Rogers (2003) argues that one cannot begin the adoption process without knowing about the innovation. In this stage, a person first becomes aware of the technology through different options. In this article, awareness, together with adoption, was considered, based on the innovation decision theory.

This article fills the gap in understanding adoption of land productivity enhancing technologies, especially in the Chinyanja Triangle of Southern Africa. The adoption of innovation or technology can generally not be said to be a random process, as farmers usually self-select treatment (Faltermeier & Abdulai, 2009). Analysing important factors that raise awareness and those that motivate farmers to adopt certain soil, land and water conservation practices is an important contribution to literature, as results can be used to curb further problems of resource degradation that are a threat to poverty reduction efforts in the region.

2. Description of study sites

The study was conducted in the Chinyanja Triangle, including the Furancungo in Tete Province of Mozambique, Budula-siliya in Zambia's eastern Province and Linthipe and Nsipe in the central and southern regions of Malawi (Fig. 1). The common denominator in the region is the inhabitants' mother language, Chichewa. Culturally, the majority of the people in the region share the same beliefs and it is hypothesised that they could share similar approaches to resource management, especially land, on which they all depend for their livelihoods (Amede, Desta, Harris, Kizito, & Cai, 2014; Makate, Makate, & Mango, 2017). Some 38% of the studied area is under shrub cover and is classified as crossed-open deciduous. Tree cover occupies 31% of the research sites. Cultivated and managed areas make up 24% of the area and water bodies occupy 4%. Herbaceous species cover 2% of the sites and bare, artificial and associated areas take up less than 1%. The study sites are dominated by maize as the staple food crop, mixed with legumes and groundnuts.

3. Analytical approach

3.1. Model choice

A set of factors (demographic, biophysical, institutional, and socioeconomic) may sway farmers to adopt, or reject innovative technologies at the farm level. It is for this reason, that both empirical and theoretical modelling of farmers actions to new innovative technologies has become very important. Both quantitative and or qualitative methods can be used to evaluate the determinants of innovative practices (technologies & methods) adoption. In cases where adoption is measured as a dummy variable that take a value of 1 for adoption and 0 otherwise, estimation

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