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Adaptation Strategies of Smallholder Paddy Farmers in the Office du Niger Zone to the Effects of Climate Change: Perceptions and Determinants

Africa's agricultural sector needs to be transformed or better structured to address the challenges of climate change, food insecurity, malnutrition, poverty and environmental degradation (Nyasimi & al., 2014). Climate smart agriculture integrates the three dimensions (economic, social and environmental) of sustainable development. Its approach is based on three main pillars: sustainable increase of agricultural productivity and income; adaptation and strengthening of resilience to climate change; reduction of greenhouse gas emissions and/or absorption where possible. The application of AIC best practices is determined by intensifying cropping systems, improving the efficiency of livestock production systems, preserving land and water resources to ensure adaptive management of natural resources at farm and landscape level (Williams, & al., 2015).

Almost 80% of the Malian population depends on agriculture. However, the poorest segments of the population suffer the negative impacts of climate change. In contrast, climate change is characterised by very high temperatures, (insufficient and unpredictable) rainfall, frequent floods, strong winds or droughts. In Mali, recurrent droughts have contributed to the impoverishment of farmers and reduced their resilience. All other things being equal, this results in a degradation of the environment and natural resources (Makougoum, 2018). The Malian economy is highly dependent on agriculture. The sensitivity of the agricultural sector to the effects of climate change is accentuated by the drought and desertification that have persisted for several decades. The degradation of soils and natural resources caused by the impacts of climate change is a threat to food security and livelihoods.

The soils of the Office du Niger, the most important rice production basin in Mali, are undergoing continuous degradation due to climate change. Under an intensive rice-growing system (SRI), the yield of paddy rice can vary from 2.2 to 10.7 tonnes per hectare. This can be achieved with the optimal use of organic and mineral fertiliser to ensure better efficiency and sustainability of the production systems. However, the variability of paddy rice yields depends on cultivation practices and soil and water fertility management (Bagayoko & al., 2017).

Short-term strategies used by farmers to cope with the effects of climate change are often damaging to the environment and to the economic sustainability of farms. To adapt to climate change that leads to a decrease in soil productivity, farmers resort to the use of early seed varieties. They are also modifying their farming practices through a rational use of production

means. The development of new activities (processing of agricultural products, livestock farming and development of market gardening) is used as an alternative by farmers to cope with the effects of climate change. To mitigate the effects of climate change, which further impoverish farmers, the latter migrate or have part of the household's agricultural assets migrate temporarily (Dugué, 2012). The Malian government, in its policy of combating the effects of climate change, which negatively impact the productivity of producers, is supporting research centres to develop resistant rice seed varieties that can adapt to the decline in soil fertility. Farmers are increasingly using early seed varieties to cope with rainfall variability and short winter seasons. To increase productivity, farmers are increasingly using a combination of organic and mineral fertilisers to further fertilise less fertile land. These measures allow farmers to be resilient and adapt to the negative impacts of climate change (Clot, 2008).

The options considered by farmers to cope with climate change and declining productivity vary according to their perception and endogenous knowledge, often complemented by modern farming methods experimented by research centres. These factors are crucial as adaptation and resilience measures for Sahelian farmers, most of whom practice traditional agriculture. In light of these factors and the climatic context that impacts agricultural productivity and resilience of farmers in Mali, this paper aims to understand the factors that determine the adaptation strategies and choices of farmers in the Office du Niger to cope with the effects of climate change. The results that will be obtained through the primary data will allow us to make recommendations regarding appropriate policy choices aimed at making small-scale farmers more resilient in a context marked by a climate risk to increased agricultural production.

The study will involve 100 smallholder paddy farmers who will be randomly selected in two communes (Niono and Siribala) of the Niono cercle. The choice of the sample is based on the homogeneity of the population with mostly the same socio-demographic and economic characteristics. The Stata software will be used for descriptive statistics and modelling of the data collected. The binominal logit model will be used to analyse and interpret the factors that influence the decision of rice farmers to adapt or not to climate change. The second estimation will involve the multinomial model to analyse and interpret the factors that determine the choice of strategies (agriculture combined with livestock, use of improved rice varieties, use of organic-chemical fertilisers and pesticides, and income-generating activities) for adapting to climate change by rice farmers.

Key words : Adaptation strategies, Climate-smart agriculture, Producers, Office du Niger, Paddy rice and Sahelof Huánuco and Lima.