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Multi-Agent Modelling for Estimating the Possible Impacts of Irrigation-Related Innovations on Rural Poverty and Sustainable Land Use in Ghana

Nedumaran Swamikannu, Thomas Berger

University of Hohenheim, Institute for Agricultural Economics and Social Sciences in the Tropics and Subtropics, Germany

Abstract

The erratic rainfall pattern and degraded natural resource base coupled with unfavourable market and policy conditions cause poverty and hunger in the semi-arid tropics of Sub-Saharan African countries. This is particularly true for the semi-arid areas in northern Ghana, where poverty levels beyond 70 percent have persisted over the last decades and the majority of the poor are food crop subsistence farmers. The key determinants of rural poverty and malnutrition in rainfed semi-arid areas are small percentage of irrigated agricultural land and lack of access to water for productive purposes in agriculture. Irrigation increases the stability and the level of crop yields and gives rise to wider and more diversified cropping systems as well as opportunities for producing high-value crops. To increase the area under irrigation and thereby alleviate poverty, the government of Ghana plans to introduce new small-scale irrigation techniques that could enhance productivity and farm incomes. This paper applied a multi agent-based integrated bio-economic modelling approach, which incorporates a hydrology model component and a socio-economic model component with an extended three stage budgeting systems (including a savings model, a Working-Leser model, and an Almost Ideal Demand System), to assess and evaluate the possible impacts of irrigation-related innovations. The model was validated with stakeholders from the ministry of agriculture and food, Volta basin board and farmers, using empirical data from the Upper East Region of Ghana. Scenarios of small-scale irrigation technology are simulated to demonstrate the usefulness of the model for analysing the *ex ante* impacts on rural poverty and overall surface water demand.

Keywords: Multi-agent modelling, rural poverty, surface water demand

Contact Address: Nedumaran Swamikannu, University of Hohenheim, Institute for Agricultural Economics and Social Sciences in the Tropics and Subtropics, Fruwirthstr 12, 70599 Stuttgart, Germany, e-mail: s.nedumaran@uni-hohenheim.de