Interactive Validation of an Agent-Based Model in the time of Covid-19

Habtamu Demilew Yismaw, Christian Troost, Thomas Berger

University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Germany

Abstract

This study developed an agent-based model (ABM) to examine the effect of smallholder farmers' investment in agroforestry to adapt to extreme climate and price variability in Ethiopia. The agent-based simulation package Mathematical Programming-based Multi-Agent Systems (MPMAS) was used to build the model. Validation is an essential step during the modeling process. In a first step, simulated agent production decisions were compared with cross-sectional survey data collected in the study area in 2018. Nevertheless, comparing simulation results with cross-sectional survey data obtained at a single point of time is prone to overfitting and, more importantly, cannot provide insights into the appropriate dynamic behavior of the model. To complement the results obtained using survey-based validation, a participatory model validation method was designed. The participatory validation was intended to be conducted in the field with farmers who had participated in the survey. However, it was not possible to administer farmer-to-model interactive validation due to the COVID-19 pandemic without inflicting exposure to contagion. As a result, an alternative online participatory platform was designed to validate the model with agricultural experts instead of farmers. Experts were selected based on relevance of their expertise to the objective of the model and their experience working in the area. To undertake the participatory validation, an interactive web application was developed using R Shiny. The app was designed as a web page. Participants were sent the link and could open it using any device they wished to use. The interactive session was guided by the researcher through a video call. All necessary simulations were run in advance and results uploaded to the server. The app operates with minimal bandwidth requirements suitable for the poor internet connectivity in Ethiopia. The interactive session has been successful and provided valuable insights to improve the modeling process. In this way, the interactive model validation was undertaken while keeping all participants safe from COVID-19.

Keywords: Farm-level model, MPMAS, participatory modelling, R Shiny, web-based interface