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Modelling Agricultural Realities to Support Development Decisions

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Abstract

Most agricultural models do not adequately represent real-life development decisions, not least because they fail to consider the impact of the full range of biophysical, socio-economic, political and cultural factors that affect decision outcomes. Many modelling exercises restrict their scope to system aspects that can be characterised with precision, but this can lead to biased recommendations. For instance, only considering annual crop yields while neglecting ecosystem services provided by trees systematically undervalues agroforestry systems. Similarly, crop models that only consider abiotic factors but leave out pests, weeds and diseases may favour crop varieties that fit poorly in smallholder farming systems. To produce more holistic assessments that respond to the needs of development decision-makers, agricultural modelling needs new strategies that enhance its ability to deal with real-world complexities and allow capturing system aspects that defy precise quantification.

Decision analysis, a decision-support approach from the private sector, aims to make recommendations for specific decisions based on currently available knowledge. To gain a holistic perspective, it starts with an assessment — often involving decision-makers, stakeholders and experts — of all decision-relevant aspects and their interconnections. Results from this assessment are translated into causal decision models, in which all factors are considered in quantitative terms, represented using probability distributions. For each input variable, all available sources of information, including hard data and expert opinion, are used to construct the distributions. Simulations produce probability distributions expressing the range of plausible decision outcomes. These outputs are often sufficient for identifying preferable decision options. If not, tools such as Value of Information analysis are used to highlight critical knowledge gaps where further information is needed to reduce uncertainty and clarify the best decision alternative.

Decision analysis approaches are new to agricultural research for development, but several successful applications across Africa, e.g. forecasting the impacts of agricultural interventions in Kenya or prioritising among strategies for reservoir protection in Burkina Faso, have underscored their potential. Experiences so far indicate that decision analysis could emerge as a new paradigm for holistic, decision-focused agricultural modelling.

Keywords: Bayesian modelling, decision analysis, holistic modelling

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