LOOKING AHEAD Designing Decision Simulation Models With Trade Offs In Mind

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Those interested in exploring how the results of development decision simulation models can be applied for supporting uncertain decisions in complex agricultural systems are reminded to keep trade-offs and synergies in mind in the design of their research. These types of holistic modeling approaches move agricultural science from the lab bench and field trials to real world application and decision support for farmers and agricultural decision makers.

Description & takeaways

Deciding on agricultural interventions is often risky as there is usually some uncertainty about how interventions will influence the intended outcomes. Understanding and forecasting the trade-offs and synergies related to, and resulting from, agricultural interventions is difficult. Farming systems are dynamic and the impact of any intervention - policy or management decision - is likely to be influenced by many factors ranging from soil and crop dynamics to social dynamics such as farmer and community perceptions.

The design and formulation of research to support decision making about risky interventions can include and address all the factors that are considered important, including all relevant risk factors and interactions between them. Designing and applying such research approaches can provide scientific support for decision making and offer insights about trade-offs and synergies.

Transdisciplinary approaches can provide such decision support. These approaches seek to include stakeholders and decision makers in research, people seen as the main experts and primary knowledge holders who can provide insights into the formulation and roll-out of interventions. Transdisciplinary approaches applied for decision analysis can provide model structures and allow for realistic simulations of interventions. They can give decision-makers insights into the potential long-term sustainability outcomes before implementing interventions. Such holistic modeling approaches move agricultural science from the lab bench and field trials to real world application and decision support for farmers and agricultural decision makers such as those in government ministries and aid organizations. Several examples can be found in CGIAR and University of Bonn's collaborative assessments of agricultural interventions such as agroforestry in Vietnam and on home gardens in Uganda (see references below).

In the process of modeling to provide decision support, a model is built with and peer reviewed by experts. The resulting model structure then provides the framework for a simulation. The results of these simulations can be assessed for their usefulness and practicality for guiding decisions. Typically, the results of these models are distributions of the probability of different events and the likelihood that one decision is preferable to another (i.e. that one decision has a greater positive and lower negative outcome potential). Distributions of possible outcomes can be simulated for any kind of important variables, for example a model on homegardens in Uganda showed the simulated Vitamin A nutrition gaps for households given the transition to industrial farming. These differences between these outcome distributions for different

decisions can help provide decision support, for example, suggesting that maintaining diverse gardens is preferable to industrial monocrops in terms of meeting the populations' Vitamin A needs.

The model structure itself and the collaborative process of creating and refining it can also be very informative and helpful in decision making. When defining the important interactions along the impact pathway, decision makers and stakeholders have a chance to tease out all the nuances and determine a theory of change. They can gain major insights through the process of making a logical map of the various pathways through which a given intervention is expected to influence an outcome of interest.

A simulation, generated based on the impact pathway, can then provide a collection of many possible outcomes. As mentioned above, these can then be compared and a decision can be made based on the difference in these distributions. Back to our Uganda example, if the distribution of Vitamin A deficiency is much lower given one decision option in comparison to others, we can make a recommendation that this is a preferable option.

There are also additional model assessment methods that allow for determining further research priorities. There is always some degree of uncertainty surrounding a decision, because there is always a chance that the decision turns out to be wrong. Value of information assessment can help us to measure the expected value of that uncertainty. It helps us determine if more research will be helpful in understanding the expected change in the value of a decision outcome through reducing uncertainty on a given variable. We can determine the hypothetical value of access to perfect information that eliminates the possibility of making the wrong decision.

Key references

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For more technical information about probability distributions, value of information and other model parts: http://htmlpreview.github.io/?https://github.com/CWWhitney/Decision_Analysis_Course/blob/main/Index.html