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Modelling households and value chains as complementary methods for learning and evaluation in innovations platforms

Rigolot C, Watson I, Herrero M, Delma BJ, Vall E, Andrieu N, Yacouba B, Ouédraogo S, Ziebe R, Dowe V, Kolyang T, Prestwidge D, McDonald C, Stirzaker R, Bruce C, Carberry P

1- Introduction

Innovation platforms (IPs) are one of the basic levels of implementation of Integrated Agricultural Research for Development (IAR4D) (Hall et al., 2007). IPs aim at fostering iterative interactions between farmers, researchers and extension officers, and the integration of both technology and institutional dimensions of innovations. Critical issues for the success of IAR4D are the assessment of IPs, and their ability to enhance learning between actors. To these aims, quantitative modelling of farm and value chains are currently used in a diversity of IPs, as part of broader methodological frameworks. This paper proposes a crosscutting synthesis with practical examples of how household and value chain modelling can facilitate learning and evaluation within IPs.

2- Methods

The analysis is based on the recent modelling experiences within the integrated program AFSI (African Food Security Initiative). AFSI is a program covering 61 IPs and 6 research projects in West Africa (Carberry et al. 2011). As part of this program, the CSIRO household model (IAT) has been introduced in two research projects covering several IPs with a range of technical entry points and farming systems. IAT is a dynamic farm model with interacting crop, livestock and economic components (Lisson et al., 2010). Quantitative value chain modelling was less mature in the project, but it has been practically explored and generated stimulating perspectives. Together with the explicit learning plan of the AFSI program (Ison et al., 2012), the diversity of case studies gives a rich material for an inductive characterization of the different roles of household modelling and the potential of value chain modelling in the specific context of IPs.

3- Results

3-1- Screening innovations and identifying priority (*ex-ante* assessment)

A first role of modelling emerging from this analysis is to assess *ex-ante* the potential of different options to guide the actions in an IP (at the beginning of a project or a new season of field trials). A clear example of this was developed during an IAT workshop with a Niger IP case study. First, a representative farm was characterised (8 people, 1.5 ha (millet, cowpea and sorghum), 8-15 goats, 5-10 head of cattle). A discussion was held with workshop participants resulting in contrasting scenarios. Simulation results suggested an important potential for introducing the improved variety of cowpea (Gross margin (GM) +23%, low cost, easy to implement). Cattle supplementation appeared to be very profitable (GM +37%) but would involve a greater cost and risk, whereas corralling cattle on crop land appeared to add little extra value.

3-2- Household modelling can lead to improved farming systems designs

In the Koumbia IP (Burkina Faso), after the introduction of IAT, the model has been used with an innovative participatory approach with three individual farmers in an iterative manner (Delma et al., 2014). The simulations showed that the scenarios planned by each farmer would not improve the gross margin of their farms, whereas more ambitious scenarios co-designed with researchers could significantly improve farm income for all simulated years (Rivat, 2013). During the process, the IAT model has provided a practical support to expose farmers to expert knowledge for animal feeding, and for researchers to better understand farmers' constraints and rationality (Rivat, 2013).

3-3- Household modelling as a basis for upscaling the results to the region

A third structuring role for household modelling in AFSI has been to provide a basis for aggregated assessment discussions (upscaling). This requires linking farm-scale simulations with farm typologies and estimates of innovation adoption rates (Herrero, 2009), or directly with farm surveys. In the region around Mindif IP (Cameroun), an economic analysis of cattle fattening was carried out with the same economic principles as the IAT on 35 farms (Yacouba et al., 2015). The calculations show that cattle fattening activity is profitable at an aggregated scale in the area. Variability between farms is high, firstly driven by the size of fattening units (average GM between 138312 FCFA to 573916 FCFA for units with less than 2 and more than 6 animals, respectively).

3-4- Beyond the household: The potential of quantitative value chain modelling

The necessity to integrate value chain modelling early emerged in the AFSI program. In the case of the Niger IP representative farm, an increase of meat price of 500 FCFA/kg resulting from value chain improvements would increase average farm gross margin by 18%. In Banfora IP (Burkina Faso), milk price almost doubled in one year of the project as a result of innovations in the milk value chain. Quantitative value chain modelling enables assessment, *ex-ante*, of the impacts of different value chain interventions on the performance of the system, teasing out impacts for different value chain nodes and typologies of chain actors (e.g. small vs. large farms) (Rich et al., 2011). Promising linkages between household and value chain modelling have been initiated in the program with two contrasting methods: System dynamics and agent-based model. Both methods are equally valid, but some differences are the unit of analysis (average agent vs heterogeneous set of agents, respectively), and the ability of agent-based models to address spatial issues (Fotsing et al., 2013). The choice of the method depends on the research question and development interventions, which are diverse across AFSI research projects.

4- Discussion

By facilitating interactions between actors, innovation platforms provide opportunities for a diversity of use of quantitative modelling. For the Niger IP, it has been used in a single workshop with several participants to stimulate options screening and selection for action priorities. In Koumbia IP, the IAT model has been used in a sequential approach, face to face with individual farmers. In several cases, simulations have provided a basis for aggregated assessment of the total impacts of innovations promoted in the platform. Depending on the objectives, the modelling can be performed at the beginning (*ex-ante*), the end (*ex post*) or continuously in course of development projects, with either “representative”, “real” or “typical” farms. Other more “classical” roles of modelling have been observed within AFSI, such as identifying trade-offs and priorities for the design of new field experiments. Finally, we identify an important potential to tackle combined effects of on-farm and value chain innovations, by linking household and value chain modelling.

5- Conclusion

From our experiences in the AFSI program, we conclude quantitative modelling can be a useful tool to learn and evaluate in innovation platforms. Yet, we have also observed difficulties of implementation, and it is important to also emphasize the need of simple appropriate tools and a progressive capacity building for modelling skills. Another remaining question is how the modelling can be articulated synergistically with more qualitative approaches, such as the Most Significant Change stories developed in the AFSI program (Davies et al. 2015).

Key words: Household modelling; Value Chain; Innovation platform