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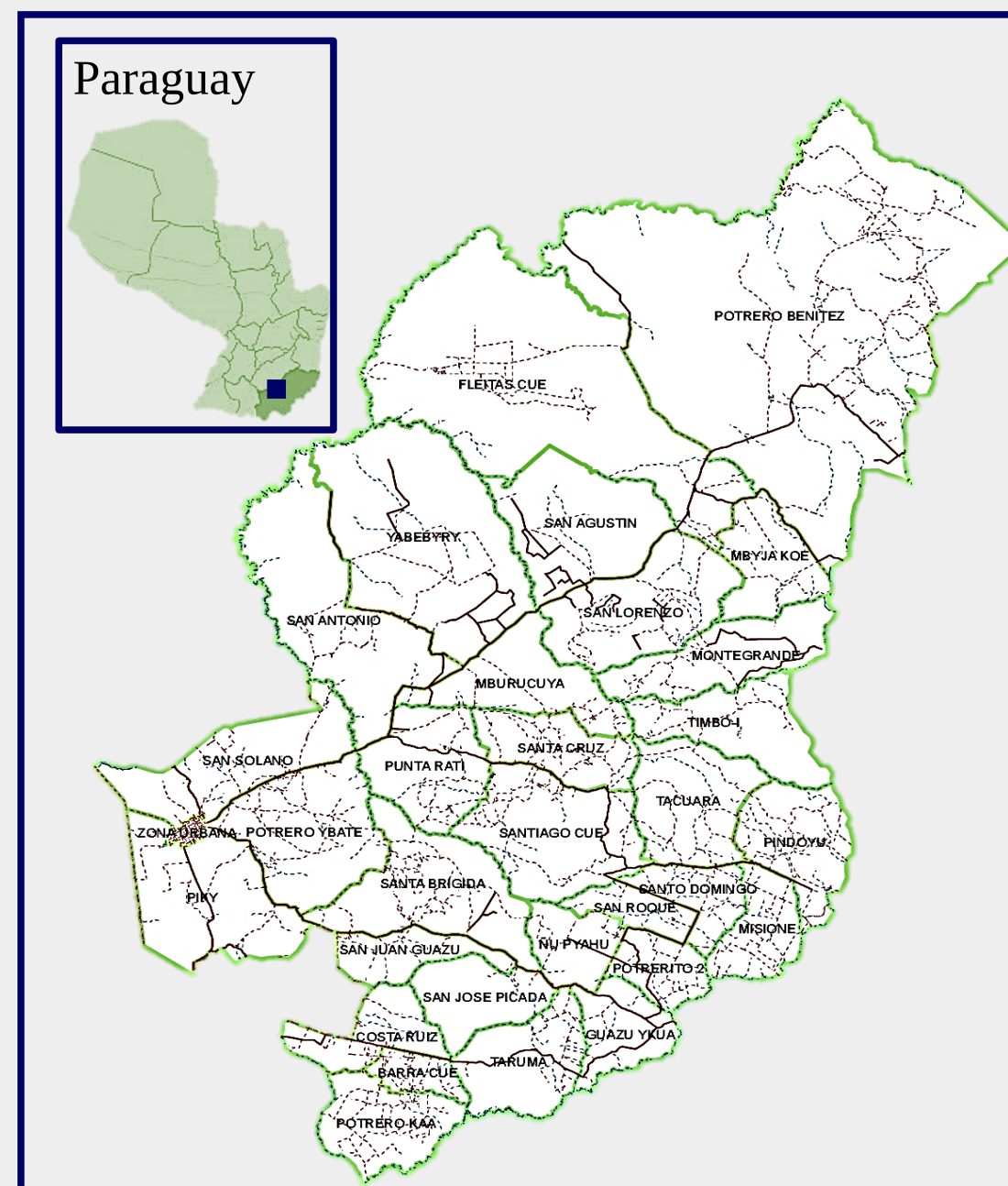
# Participatory Farm Mathematical Programming (PFMP) A management tool for smallholders in transition

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## INTRODUCTION AND AIMS

**Mathematical Programming (MP)** has been used for more than five decades by agricultural researchers to analyse the multifaceted aspects of the farm systems. However, the stage of technology in the past limited its participatory applicability in the field. Nowadays, portable devices allow direct farmers involvement, which could improve MP's usefulness, suitability, and accuracy.

In this regard, a management tool named **Participatory Farm Mathematical Programming (PFMP)** was developed and implemented in San Pedro del Paraná (SPdP), Paraguay (**Fig. 1**), to analyse alternative land-use strategies in cooperation with farmers, and to evaluate to what extent they are willing to adopt the tool for future planning activities.



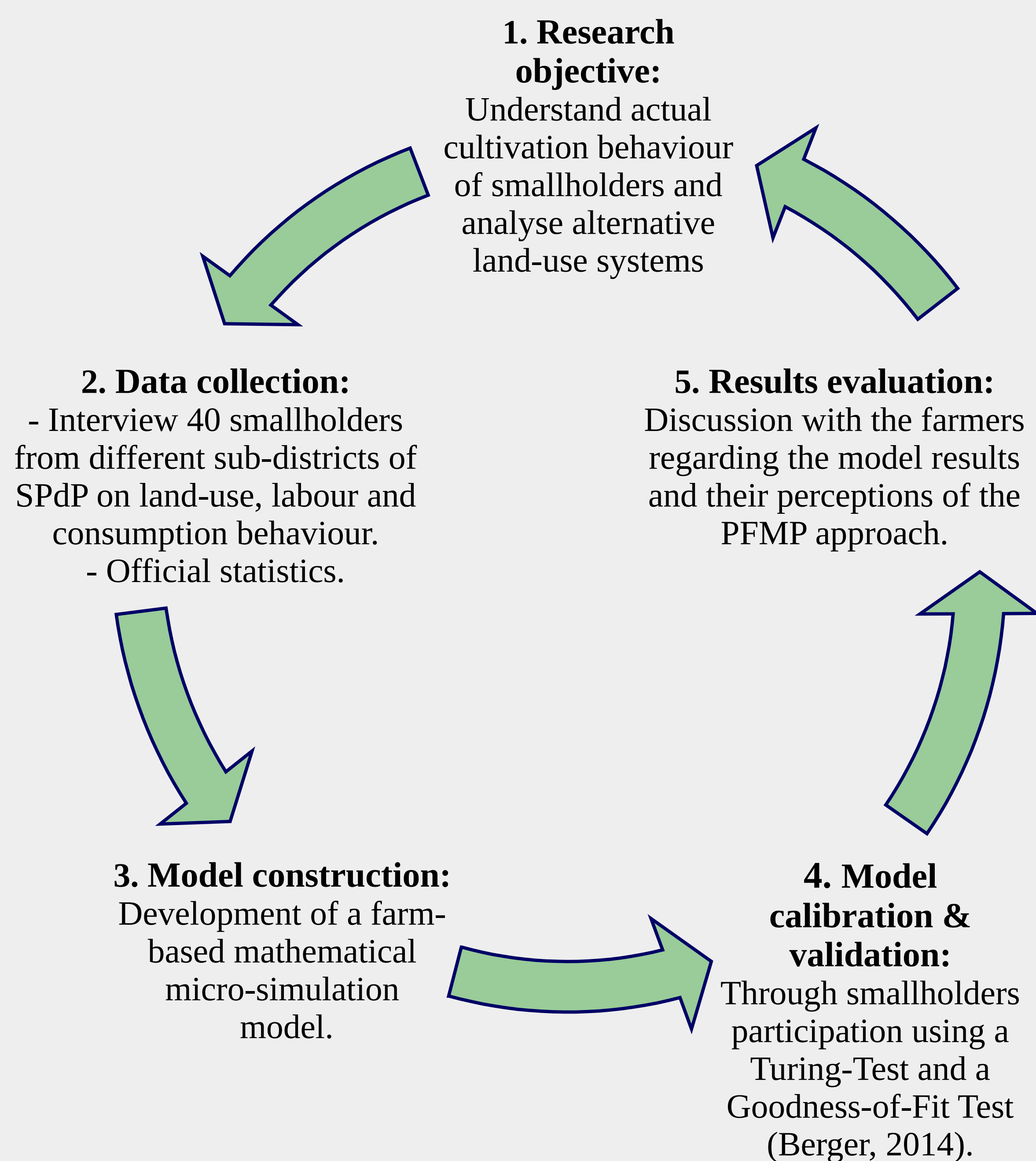
**Fig 1:** San Pedro del Paraná within the region of Itapúa, Paraguay.



**Teaching smallholders how PFMP works (SPdP, 03/2016).**

## METHODOLOGY

- I. Literature review** to analyse current participatory approaches within MP.
- II. Development of the PFMP model** based on an Iterative Participatory Farm Modelling Process (**Fig. 2**).



**Fig. 2:** Iterative Participatory Farm Modelling Process.

## RESULTS

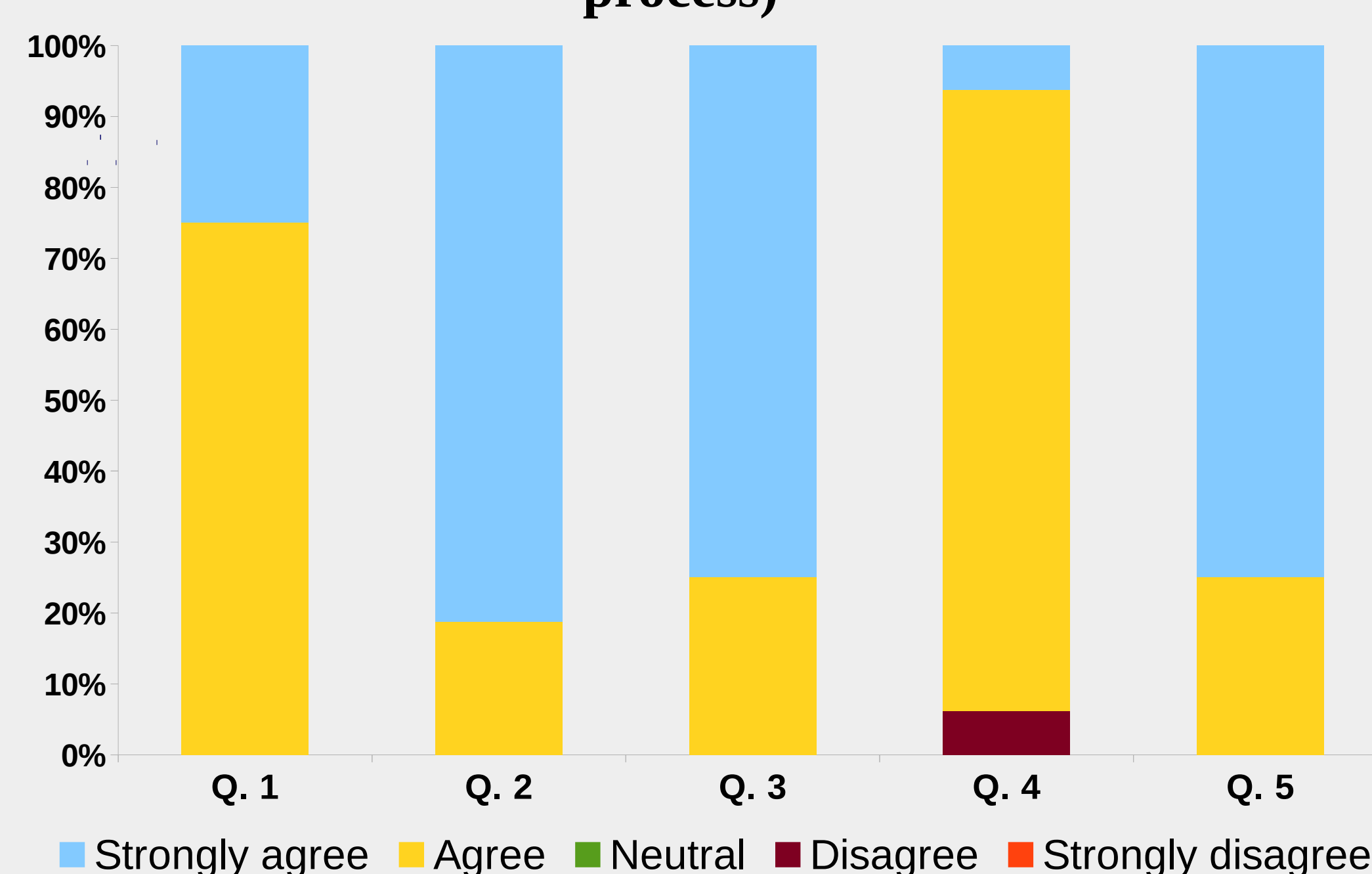
### I. Literature review

- Technology, social media, and web applications have increased smallholders participation in modelling (Voinov et al, 2016).
- This had lead to refine model's complexity to ensure broader comprehensibility and long term development and use by the smallholders (Dorward et al, 2007).
- MP should follow this trend to enhance model's outcomes.

### II. Development of the PFMP model

- Turing-Test and Goodness-of-Fit Test results reflected the accuracy of the model outcome.
- In the discussion, farmers highlighted comprehensibility, accuracy, and usefulness as the main strengths of the tool.
- Smallholders asserted the willingness to adopt PFMP for farming management and confirmed land-use changes derived from the discussion of the model's outcome (**Fig. 3**).
- Although farmers understood PFMP's objectives and methodology, more training time was suggested to help farmers familiarize with the tool.

**Evaluation of PFMP approach**  
(n= 16 smallholders participating in the whole iterative process)



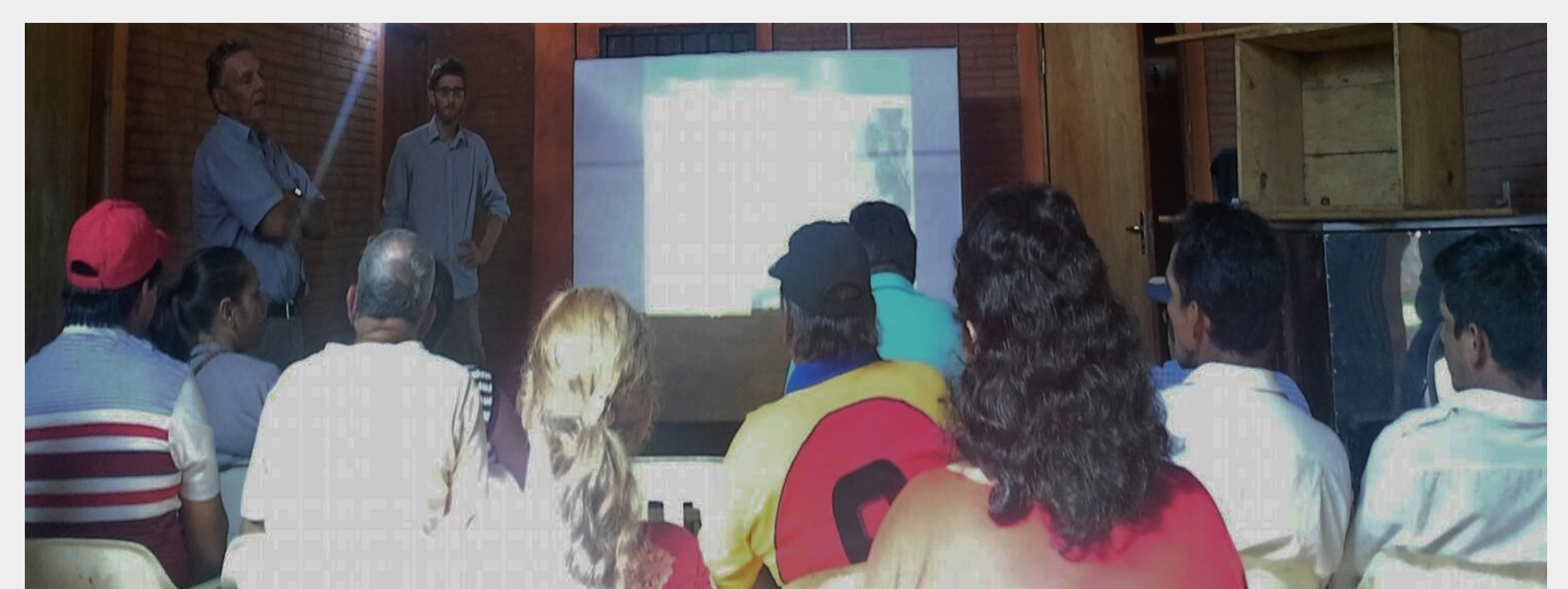
**Fig. 3:** Perceptions of the farmers regarding the PFMP approach.

### Interview

- Q.1:** The farmer could follow the instructions for the model.  
**Q.2:** The model could reflect land-use practices on the farm.  
**Q.3:** The model helps to manage the farm work.  
**Q.4:** Time for working with the model was enough.  
**Q.5:** The farmer would like to keep working with the model.

## CONCLUDING REMARKS

- This study follows a new approach that makes MP available directly on the farms.
- PFMP allows scientific expertise to interact with local knowledge providing a management tool that farmers demand, understand and are willing to use.
- PFMP helps smallholders, who seek for more convenient production strategies, to reassess their traditional farming systems.
- A more user-friendly platform, as well as more training time, would ensure PFMP farmers comprehension.
- To improve model results, more smallholders are required to test the tool.



**Workshop to evaluate farmers PFMP perceptions (SPdP, 04/2016).**

### Selected references:

- Berger, T., Troost, C. (2014). Agent-based modelling of climate adaptation and mitigation options in agriculture. *Journal of Agricultural Economics* 65, 323–348.
- Dorward, P., Shepherd, D., & Galpin, M. (2007). Participatory farm management methods for analysis, decision making and communication.
- Schreinemachers, P., Berger, T. (2011). An agent-based simulation model of human environment interactions in agricultural systems. *Environmental Modelling & Software* 26, 845-859.
- Voinov A, Bousquet F. (2010). *Environmental Modelling and Software*, vol. 25, issue 11. pp. 1268-1281.
- Voinov, A., et al. (2016). Modelling with stakeholders - Next generation. *Environmental Modelling and Software*. Elsevier Ltd. p.196-220.