Open-up the (co)design process of farming systems: a reflexive analysis.

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1 Introduction

Participatory research methods are increasingly used in the agricultural research for several years all over the world. In this perspective, participative methodologies are developed to design and assess innovative farming systems (Cerf *et al.*, 2012). However, as there is a lack of scientific debate about the design methodologies and a lack of consideration of end-users in the agronomic research (Prost *et al.*, 2012); the objectives of these participatory methodologies are not always extremely clear, such as their conditions of implementation (Neuberg, 2000). What is the interest of using participatory methods for designing farming systems? What is expected by the agronomists? What challenges are they facing during the implementation of this participatory design process? What could be the place of a social scientist in this process, how does he take part in the action? How do interactions between agronomists and social scientists feed the evolution of a participatory research program?

To address these questions we developed a reflexive analysis of a research program using participatory methods, involving both social scientists and agronomists, as it has already been done (Eshuis & Stuiver, 2005; Lyon *et al.*, 2010). This communication will show why and how agronomists working on a system experiment on station chose to formally involve technicians, farmers, specialized scientists and extension agents in their design process, how the interactions between social scientists and agronomists fed the evolution of the participative research program and finally to explain why involving all these people doesn't necessary mean that this is a "co-design" process.

2 Materials and Methods

The 4SYSLEG project aims at producing scientific and operational knowledge on pesticide-free practices in protected vegetable crops. To reach this objective and make sure that this knowledge would be shared and used (by producers, scientists), we developed a pluri-disciplinary and reflexive approach, involving social scientists and agronomists to guide the participative design method developed in the 4SYSLEG project. Agronomists developed a step by step participative design methodology (Meynard *et al.*, 2012) to produce and assess innovative prototypes of cropping systems. The participative program can be declined in three main points: (i) Producers or experts (scientists, extension agents) are punctually contacted at different stages of the project. These exchanges contribute to clarify the set of goals and constraints built for each cropping system experimented (first step of an iterative design process; Debaeke *et al.*, 2009), and to collect knowledge to understand biological processes or manage the crops experimented. (ii) Design workshops are implemented one day every semester gathering researchers, technicians, farmers and extension agents to explore in collective hitherto unseen way to design innovative practices, cropping systems and management strategies (e.g. intercropping systems). (iii) Tracking of on-farm innovations developed by producers consists in looking out for innovations designed by farmers and analyzing them to acquire empirical references useful to guide the design process.

The prototypes are then experimented on station during the design process and combine practices to reduce pesticides use while maintaining socio-economical performances expected in different sets of productive contexts.

In the same time, social scientists realized interviews with technicians and researchers (15) of the experimental station where takes place the 4SYSLEG project. The interviews aimed at analyzing the context of development of the participative approach and focused on the transformation of the experimental activities, the research themes and the nature of partnerships within the experimental station. A scientist also made observations of the participative design process and frequently asked agronomists to explicit their choices to maintain the reflexive dynamic. On the basis of these interviews, observations and regular interactions, social scientists are both observers and actors of the participative process. They contribute to formalize the participative method and its evolution through "live feedback" or retrospective analysis which help to integrate social dimensions in the management of the design process.

3 Results - Discussion

This reflexive approach explains the questions who led agronomists to use a participative design approach and the challenges they faced. The two main questions leading them to get involved in a participative approach are: How to design and assess innovative systems responding the challenge of pesticide use reduction at the cropping system scale while considering productive constraints? How to design innovative systems facing the lack of scientific kowledge on market gardening systems? This is to adress these questions that agronomists developed a step by step design methodology, based on the capitalization of learnings to make evolve the prototypes experimented. As this method maintain open the realm of the possible in terms of design choices, it allows identifying and integrating, in the project, step by step, new research questions and knowledge (coming from the experiment or from partners).

This is also to guide this process that they organized recurrent workshops to gather a fixed collective of stakeholders having experiences and knowledge complementary to the project's carriers. Working with this collective allowed the

agronomists to go over "concepts", to face it to "farmer's realities" (normative recommendations, logistic or economic constraints on farm, technical uncertainty). It invited agronomists to consider in the design multiple dimensions of farming systems and allowed producing prototypes of systems more innovative and operational. During these workshops, prototypes and results of the experiment are discussed within the group, which allows bringing scientific results closer to the "practice" and identifying new gaps in scientific knowledge. To fill these gaps (also identified through the experiment) on specific practices or combination of practices (decisional or biological process), agronomists collaborate with specialized scientists, extension agents but also with farmers, knowing to develop innovations on their farms (Goulet *et al.*, 2008).

However, while implementing this participative design process, agronomists faced two new challenges. The first was to develop design methods hinging on participative research and system experiment and to qualify the kind of knowledge produced by these design methods. Social science can contribute saying that the extension agents and farmers provide "experiential knowledge" about the coordination of different "socio-technical growth factors" within specific localities especially useful for systemic approach (Stuiver *et al*., 2004). This "experiential knowledge" is mixed with scientific knowledge. After that, agronomists deal with on-station experimental advantages (e.g. taking risks is more possible than in on-farm experiments) and constraints (e.g. dealing with the overall activities to coordinate in the station). The designed systems are then experimented on station and discussed within the group of participants. Even if the agronomists finally stay the only decision-makers and monitors of the experimentation, we can consider this experience as a step towards "experiential science" (Baars, 2011).

The second challenge was to build and maintain a participative program where scientific and nonscientific interests meet. In this case, as social scientists and agronomists regularly exchanged, the participative design process is the result of a combination between agronomists' needs (e.g. knowledge on intercropping systems) and sociological hypothesis and analysis (e.g. about the interactions between the various actors and about the science-nature relationship). These exchanges help the scientists to be more comfortable with the fact that the design process is a dynamic learning process requiring modifications as work progresses and different participants learn or change their expectations – as it is often the case during participatory programs (Cardoso *et al*., 2001). In our case, the design process has been constructed and evolved following the nonlinear "design-experiment-assessment process" where the system experiment appeared to be an interesting "intermediary object" to build and maintain interactions with partners, as it provides results and offers a concrete way to valorize the knowledge exchanged.

4 Conclusions

This reflexive analysis of a co-design process, explains how working with partners allowed the agronomists to bring their work closer to farmer's realities while capitalizing scientific and operational knowledge to design and manage the innovative cropping system experimented. It also shows how interactions between agronomists and social scientists generated a dynamic learning process which contributed to the evolution of the program. This interdisciplinary analysis finally outlines the characteristics of a non-linear and dynamic participative design method opening the door to an "experiential science", which could be the future of the knowledge production on research experimental station.

Acknowledgements. We gratefully acknowledge financial support from the SMACH INRA program.

References

Baars T. (2011). Experiential Science; Towards an Integration of Implicit and Reflected Practitioner-Expert Knowledge in the Scientific Development of Organic Farming. *Journal of Agricultural and Environmental Ethics*, **24-6**, 601-628.

Cardoso I.M., Guijt I., Franco F.S., Carvalho A.F., Ferreira Neto P.S. (2001). Continual learning for agroforestry system design: university, NGO and farmer partnership in Minas Gerais, Brazil. *Agricultural Systems*, **69-3**, 235-257.

Cerf M., Jeuffroy M.-H., Prost L., Meynard J.-M. (2012). Participatory design of agricultural decision support tools: taking account of the use Situations. *Agronomy for Sustainable Development*, **32-4**, 899-910.

Debaeke, P., Munier-Jolain, N., Bertrand, M., Guichard, L., Nolot, J-M., Faloya, V. and Saulas, P. (2009). Iterative design and evaluation of rule based cropping systems: methodology and case studies. A review. *Agronomy for Sustainable Development*, **29** (1), 73 86.

Eshuis J., Stuiver M. (2005). Learning in context through conflict and alignment: Farmers and scientists in search of sustainable agriculture. *Agriculture and Human Values*, **22-2**, 137-148.

Goulet F. Pervanchon F., Conneau C., Cerf M. (2008). Les agriculteurs innovent par eux-mêmes dans leurs systèmes de culture in Reau R. et Doré T., *Systèmes de culture innovants et durables : quelles méthodes pour les mettre au point et les évaluer ?* Educagri, Dijon, 53-69

Lyon A., Bell M., Croll N.S., Jackson R., Gratton C. (2010). Maculate conceptions: power, process, and creativity in participatory research. *Rural Sociology*, **75-4**, 538-559.

Meynard J.-M., Dedieu B., Bos A.P.(2012) Re-design and co-design of farming systems. An overview of methods and practices, in I. Darnhofer, D. Gibbon, B. Dedieu. *Farming Systems Research into the 21st Century: The New Dynamic*, 405-429.

Neubert D. (2000). A new magic term is not enough. Participatory approaches in agricultural research. *Quarterly Journal of International Agriculture*, **39-1**, 25-50.

Prost L., Cerf M., Jeuffroy M.-H. (2012) Lack of consideration for end-users during the design of agronomic models. A review. *Agronomy for Sustainable Development*, **32-2**, 581-594.

Stuiver M., Leeuwis C., van der Ploeg J.D. (2004). The power of experience: farmers' knowledge and sustainable innovations in agriculture in Wiskerke, JSC; Ploeg, JD *Seeds of transition: essays on novelty production, niches and regimes in agriculture*, 93-118.

Vinck D. (2009). De l'objet intermédiaire à l'objet-frontière. Vers la prise en compte du travail d'équipement. *Revue d'anthropologie des connaissances*, 3, **1-1**, 51-72.