Summary sheet of the *ex post* case "**Organic Fertilizer Pits" – innovative management of organic fertilizer in the agro-pastoral systems of western Burkina Faso**

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I-The innovation story

Research setting and rationale: In the early 2000s, western Burkina Faso witnessed numerous changes. Traditional practices (fallow, livestock penning) could no longer ensure the maintenance of soil fertility. On the market, the price of mineral fertilizer was increasing faster than that of cotton. On farms, organic fertilizer (OF) production was stagnating at a low level (9% of farm OF demand covered, and with low quality OF). The percentage of farms equipped with OF pits was low (33% with field pits and 7% with house pits). Only 12% of agricultural residues and feces were being used to produce OF. Farmers dug cemented house manure pits near where animals were penned at night. This system had a major drawback: field residues had to be carried from the fields to the pit, and the fertilizer had to be carried in turn from the pit to the fields (located further and further away from the houses). Significant shares of agricultural residues consequently were abandoned and not used for OF production.

The innovation studied: OF production was not something new in the area. Numerous research studies had been undertaken on OF production techniques and their role on farms. What was new, however, was the following:

- moving part of the OF production onto the fields;
- using cotton stalks mixed with animal feces;
- reducing OF production stage operations to a minimum;
- adapting fertilizer doses according to the quality of the OF;
- involving farmers in innovation design.

A farm's OF production should be based on two elements:

- OF field pits: filled all at once, during the dry season (February-March) with a mix composed of 80% crop residues (cotton stalks and straw) and 20% livestock waste; then emptied after letting nature do its work for 12 months (no watering, no turning over).
- OF house pits: these should be built near the livestock pens, filled progressively over the course of the year with waste, litter and refused herbage collected on the pen sites, and emptied every year at the end of the dry season.

Temporal and geographic framework: The research took place in western Burkina Faso in the province of Tuy (5,620 km², 233,000 inhabitants in 2006) and more specifically in 7 villages of the province with a total population of about 35,000 inhabitants. The period considered for the case study, 2005 to 2015, was chosen because during this period a relatively stable core of research institutions conducted work on the co-design of innovation in polyculture livestock systems and notably on OF in this geographic area.

The story of the innovation revolves around 4 periods (see timeline)

Before 2005, period of research on OF techniques and management practices. Research focused on analyzing soil fertility, the management of OF on farms and territories, and the development of OF management techniques. On the development side, models focused only on OF house pits, improved pens, and the intensive production of compost. The proposals and models produced by research were not met with much enthusiasm, and the question arose as to whether a possible cause was insufficient partnership between researchers and stakeholders in the field.

From 2005 to 2008, period in which work began on the co-design of innovative OF management modes with farmers. A group of researchers (CIRDES, INERA, IER, UPB/IDR, CIRAD) became interested in innovations in local OF management in Mali, and in parallel began work on the design of innovative agricultural systems in Burkina Faso based on the research-action in partnership concept. An alternative OF management model inspired by observations in Mali began to emerge. The first schemes involving the co-design of innovative agricultural systems were initiated with some success (about fifteen OF pits were tested during this period).

From 2008-2012, a period of co-design of large-scale management models. Based on the initial results, the co-design work expanded and benefited from more extensive resources, which permitted work on a larger scale and with more ambitious objectives under the framework of the Fertipartenaires project. Several Villager Consultative Committees (VCC = club of experimenter producers) began to operate, and training sessions and a study tour of the VCCs enabled an alternative OF production model to be developed (incorporating field pits, the systematic use of cotton stalks and livestock waste, without increasing labor or inputs). Numerous farmers joined the program and set up house and field pits (about 1,600).

From 2012 to present, period of disengagement from OF co-design work. Since the end of the Fertipartenaires project (in 2012), co-design work has focused on topics other than OF. In 2015, questions were raised concerning the evolution of the innovation since the disengagement of research (continued? slowed down? reoriented?).

The map and role of stakeholders: The key innovation stakeholders were the partners of the Fertipartenaires project:

- CIRDES and CIRAD contributed methodological and logistical support for the design in partnership of innovative agricultural systems;
- INADES contributed to the training programs and capacity building of stakeholders;
- UPPCT and other producer organizations were responsible for animating the VCCs;
- the VCCs were responsible for organizing and monitoring activities at the local level.

Other players who influenced the innovation were INERA and IER (contribution of knowledge and know-how), the agricultural, livestock and environment technical services of Tuy (critical assessment of activities), SOFITEX, and NGOs addressing the OF theme from other angles (biodigesters, latrines, biological activators), community officials.

The stakeholders impacted by the innovation were:

- 1,170 Experimenters who participated directly in the OF pit program;
- VCC producers who participated in the preparation and monitoring of activities;
- Neighbors who followed the activities of the VCCs without adhering to the OF pit program and who experimented at home;
- producer organizations (UPPCT) and elected officials of certain local governments who took the results of the project into account in their strategic plans.

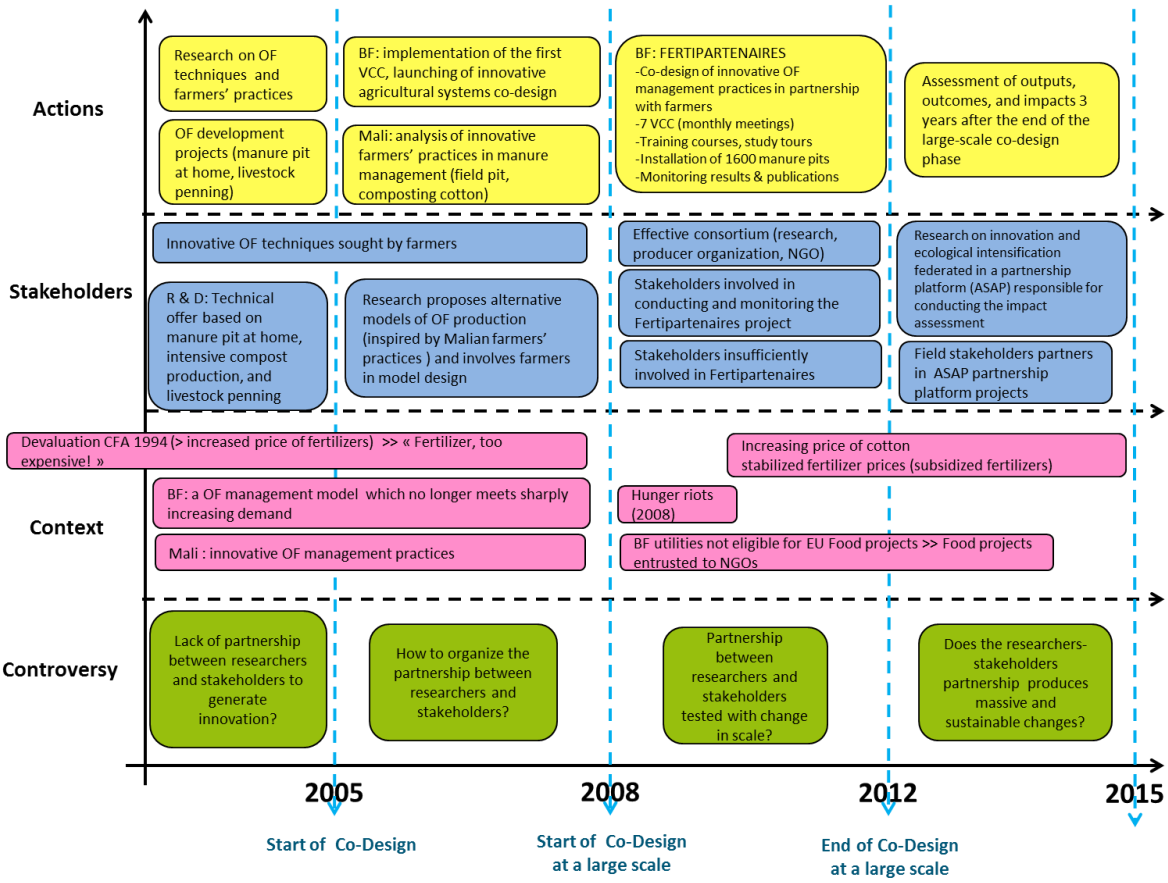

Figure 1 - Timeline

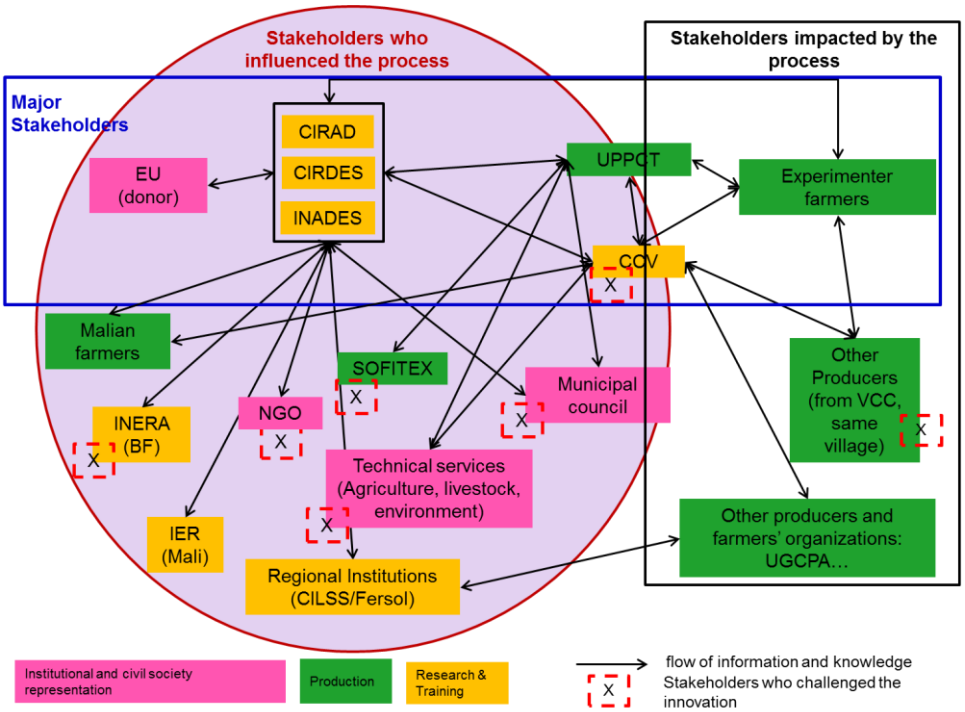

Figure 2- Landscape of stakeholders

II- Findings from the analysis of the impact pathway

At the inception workshop, the participants agreed that the impact was what remained once the research was completed; the impact was thus the footprint (*a nôon* in Diula) left by research. Working from this definition, the participants divided into groups and first identified 72 descriptors of effects (Outputs, Outcomes, Impacts = OOI) related to our case study, then regrouped these into 21 OOI effects (1 output, 3 outcomes, 16 level 1 impacts, 1 level 2 impact). The impact pathway reconstruction exercises carried out for some fifteen impacts enabled the identification of a typical pathway with 3 stages (Figure 3): knowledge acquired (= outputs), produced changes in practices (strategies, organization) on farms, and by repeating themselves over time and in space, produced diverse effects (impacts).

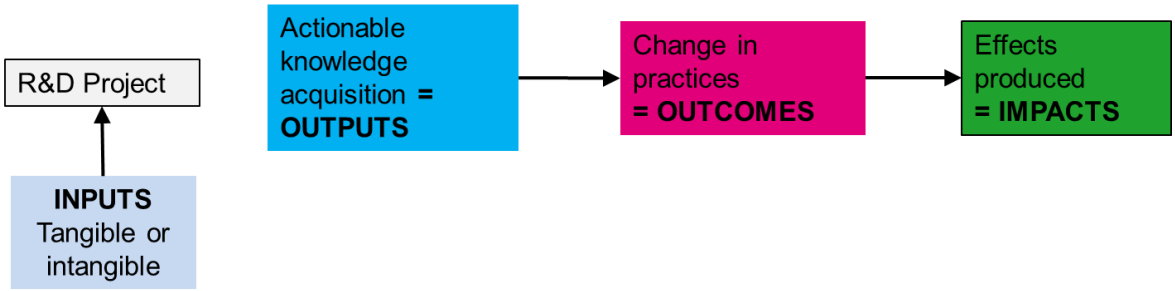

Figure 3. Standard impact pathway

This work allowed an impact pathway to be built from the perspective of stakeholders (Figure 4: $CI_{acteurs}$ next page).

The participation of stakeholders allowed the confirmation of 11 OOI effects present in the impact hypothesis (impact pathway developed *a priori* by researchers during the 2015 ImpresS Workshop, see report). It also enabled 9 additional OOI effects to be identified. Lastly, some OOI effects in the initial hypothesis were not validated by the stakeholders.

The analysis of causal links gave rise to the idea of a possible transmission and erosion of OOI effects over the pathway (impacts transmitting their effect from upstream to downstream (possible feedback); the extent of a downstream impact possibly conditioned by the extent of upstream impacts).

Work to harmonize the impact pathways undertaken with Agathe led to a different presentation of the impact pathway (see next page Figure 5: The impact pathway from the perspective of the ImpresS methodological group; $CI_{Impress}$). A comparison of the two pathways ($CI_{Impress}$, vs $CI_{acteurs}$) shows the different representations of the same phenomenon taken from different points of view. One sees that the stakeholders noted a large number of impacts in their environment, but basically overlooked the inputs contributed by research and the outputs produced by research. Conversely, the researchers accorded great importance to inputs (difficult to obtain) and to outputs (on which they are mainly evaluated) because these elements have considerable importance in their work… and because they might be slightly deluding themselves (level 2 impacts…).

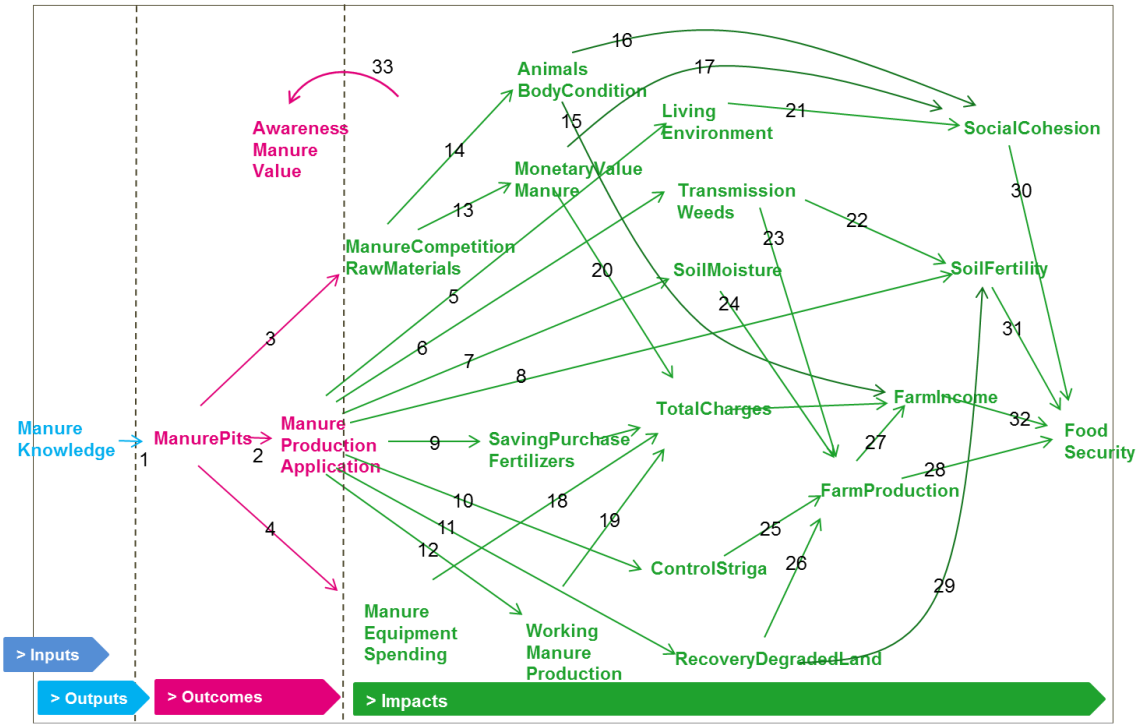

Figure 4 – The impact pathway from the point of view of stakeholders

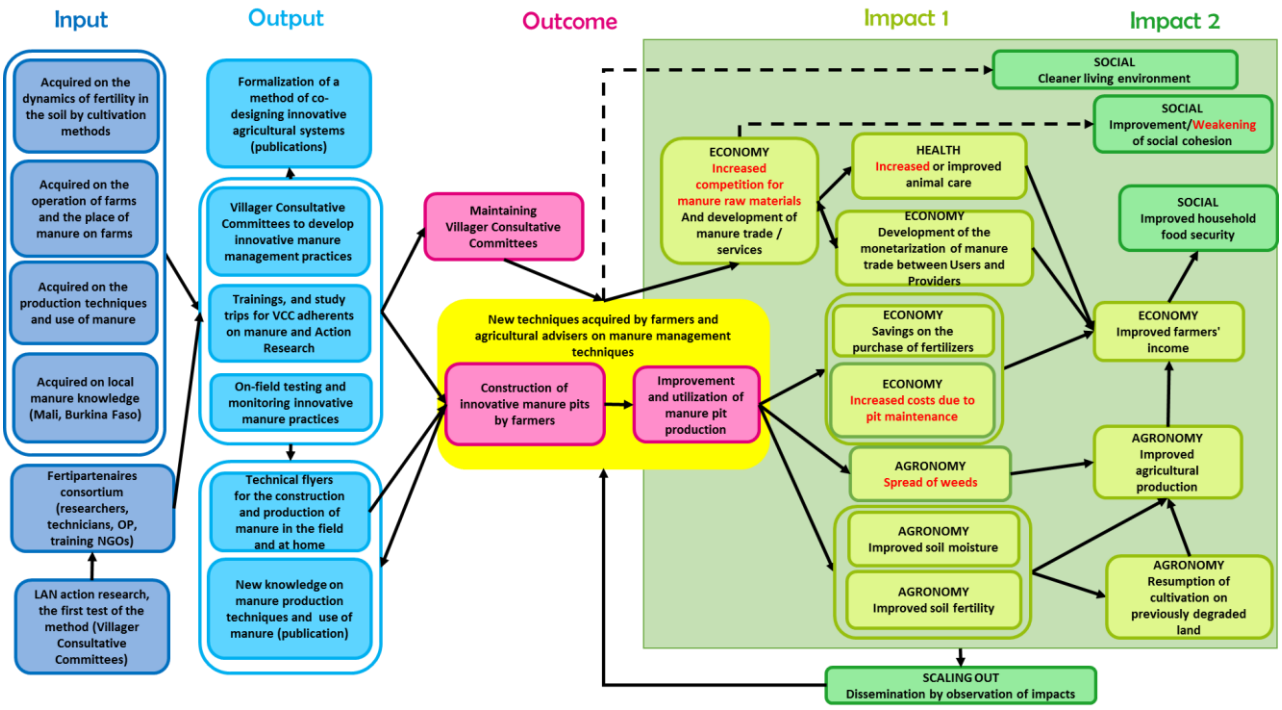

Figure 5 – The impact pathway from the point of view of the ImpresS methodological group

III- Measuring impacts

III-1 Measurements of impacts (and indicators)

Summary of the measurement method How may the research footprint (RF) be assessed along the impact pathway? We assumed that in the impact pathway, everything happens as if, starting from an initial impetus provided by knowledge (composed of inputs and outputs), the OOI effects spread from person to person (outputs to outcomes, then outcomes to impacts, then from one impact to another), but with a transmission of less than 100%, thus giving rise to the possible erosion of OOI effects from person to person, or, in other words, a diminished RF over the pathway (Figure 6).

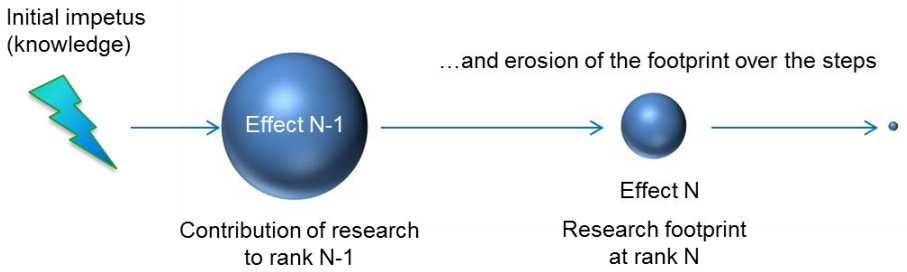

Figure 6. Spread from person to person of OOI effects

To give the RF a value, for each of the 21 OOI effects we assessed:

- the value of effect N on a scale of 0 to 100%;
- the contribution of effects N-1 on a scale of 0 to 100%;
- the contribution of research to effect N on a scale of 0 to 100%.

Integrating these values in the following recurrence formula gives a value to RF on a scale of 0 to 100%:

RF (effect N)% = Contribution effects N-1 x Contribution research effect N x Value effect N

Data collection

Focus groups enabled 61 indicators to be identified linked to 21 OOI effects (or 2 to 5 indicators per OOI effect), specifying the range of variation and a weighting coefficient (weak to strong).

To fill in the values of the 61 indicators and their sensitivity coefficient on the 3 dates identified in the case study (2008: before intervention), 2012 (at the end of the intervention), 2015 (3 years after the intervention) we relied on a database and a survey for the missing data. This work was carried out on 48 farms (24 Experimenters and 24 Neighbors, equally distributed in the farm structure classes).
Note: the tables of indicators, impacts, and their measurements are too large to be included in this summary (see the report of the case study).

III-2 – Ranking of impacts

Figures 7 and 8 present the RF on the Experimenters and the Neighbors on the 3 dates identified in the case study.

One sees that:

- in the two populations, the footprint increased between 2008 and the two other dates (2012 and 2015);

- that the footprint diminishes (or erodes) along the pathway;
- that the footprint is stronger on Experimenters than on Neighbors;
- that the footprint increases between 2012 and 2015 on the Neighbors;
- while it decreases slightly on the Experimenters during the same period.
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Conclusion: three years after the intervention, the research footprint was not only maintained (on the Experimenters), but also increased on the Neighbors. The innovation prompted by research continues to spread (by relying on the Experimenter club networks (CCVs) set up during the active research stage). Research conducted in partnership produces lasting impacts.

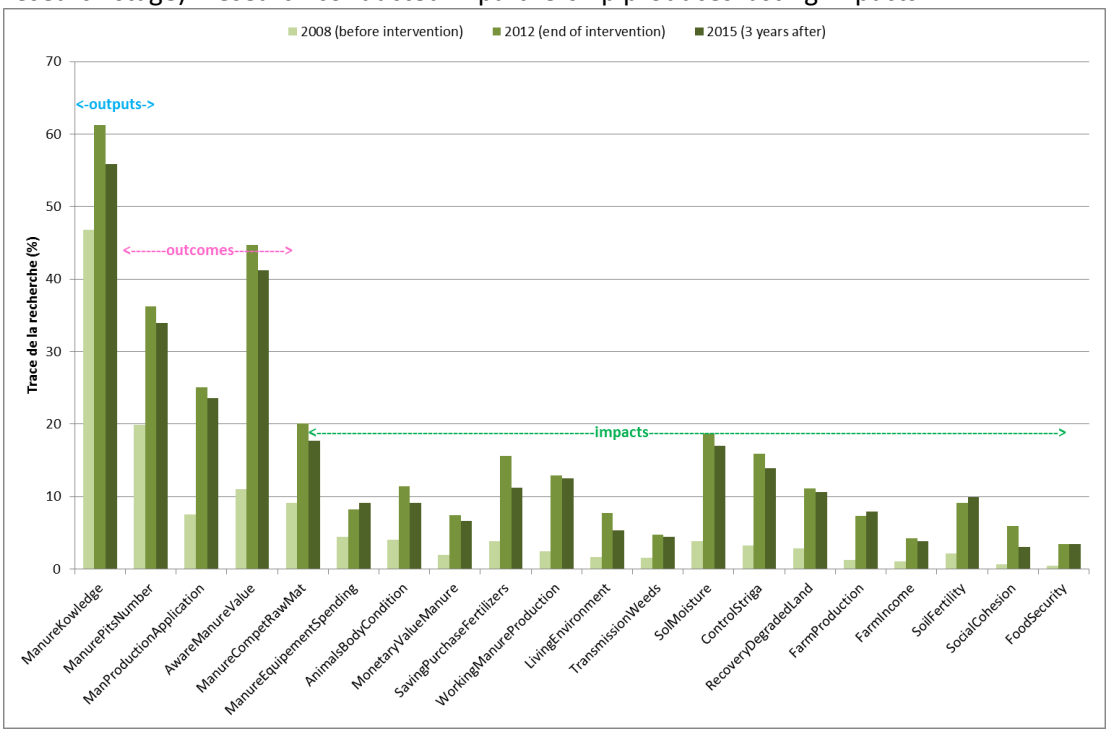

Figure 7. Research footprint on <u>Experimenters</u> on the 3 dates identified

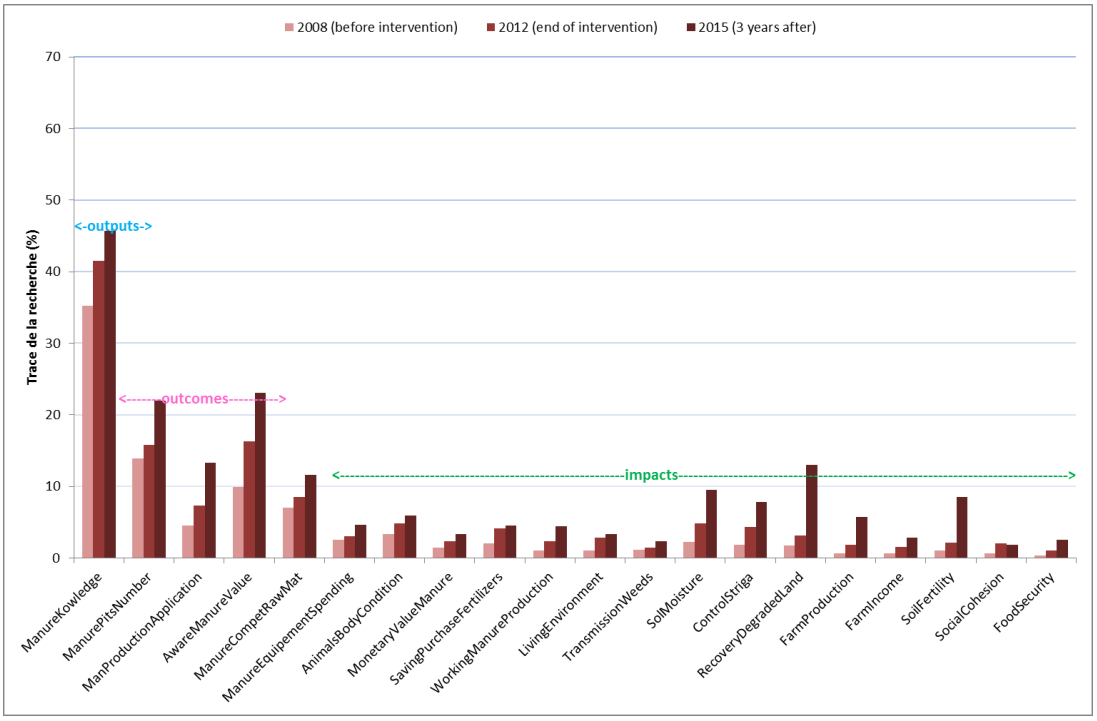

Figure 8. Research footprint on the <u>Neighbors</u> on the 3 dates identified