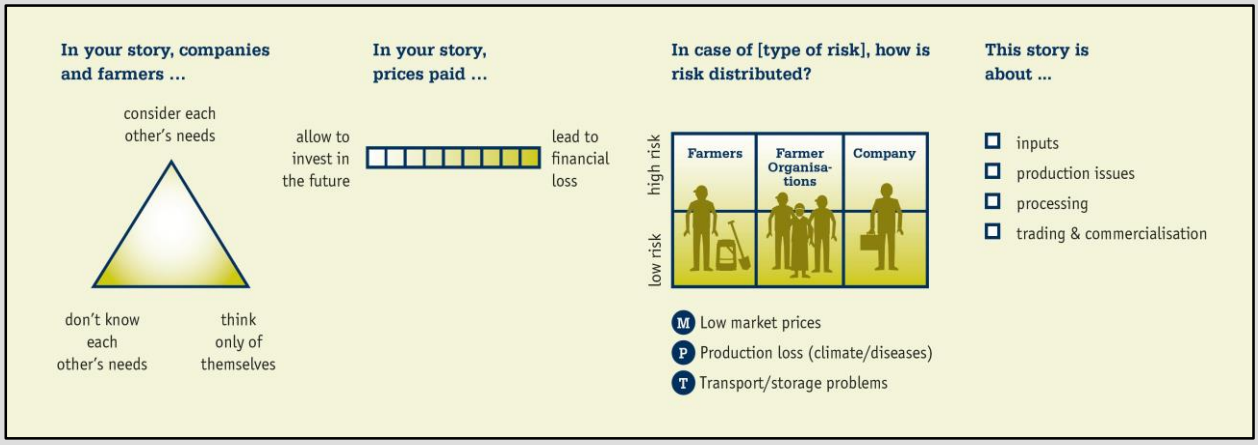
TESTING TOOLS FOR ASSESSING SYSTEMIC CHANGE: SENSEMAKER

BEAM EXCHANGE

LEO Leveraging Economic Opportunities

LEO REPORT #44



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CONTENTS

ACRONYMS

LEO	Leveraging Economic Opportunities
RCT	Randomized controlled trial
SCF	Small commercial farmers
SHF	Smallholder farmers
SMP	Seed Multiplication Project
USAID	United States Agency for International Development

EXECUTIVE SUMMARY

SenseMaker® is a research approach that gathers narratives (i.e. qualitative data) as well as the self-signified meaning of these narratives (i.e. quantitative data) to understand existing perspectives, beliefs, decisions and norms – or to understand the way these are changing in response to interventions and other environmental factors.

In 2016, a SenseMaker® consultant with the Leveraging Economic Opportunities (LEO)[1] activity, in collaboration with the BEAM Exchange, led a trial in Northern Mozambique which focused on assessing changes in behaviors and practices of smallholder farmers following an intervention by the Seed Multiplication Project (SMP). The intervention focused on building the capacity of a network of small commercial farmers (SCFs) to provide goods and services to smallholder farmers (SHFs). By increasing knowledge of innovative practices and access to better services and products, the intervention was expected to facilitate SHFs' transition from older and less efficient to innovative and more profitable farming practices.

Another objective of this research was to assess suitability and effectiveness of SenseMaker® to understand change in system[2] properties and behaviors, as well as the practical aspects of using the approach.

The research found that:

- The program intervention is strongly associated with change in behaviors of affected SHFs – they are more likely to adapt new farming practices than their counterparts not exposed to intervention;
- There is some, though marginal, diffusion of innovative farming practices among non-client smallholder farmers in the communities where SCFs are present;
- Continuous and high frequency of interaction between SCFs and SHFs is strongly associated with high rates of change in farming practices;
- SCFs have strong influence on the way SHFs work and help reduce costs and increase revenue. Machinery services provided by SCFs make the biggest contribution on farming practices; followed by information-based services;
- Information provided by SCFs is viewed as of good quality but not that accessible;
- SHFs do not have a lot of trust in being told how to do their work and report a lack of knowledge and skills.

There is growing recognition among market systems development practitioners of the need to capture the deeper changes that are occurring in the systems in which they work. LEO has been investigating practical ways to measure indications of systemic change; this started with a literature review and synthesis of efforts to evaluate systemic change for inclusive market development. The synthesis paper identified the growing interest among practitioners to measure indications of systemic change, but also the lack of well-recognized tools and frameworks for doing so.

To support this, LEO explored the utility of four tools – **Standard Measurement Tools, Outcome Harvesting, SenseMaker, and Social Network Analysis**, conducting trials of each on field-based projects. Full reports from those tool trials are available at www.microlins.org/leo, along with a synthesis report.

[1] For more information on LEO, visit www.microlinks.org/leo. For more information on the BEAM Exchange, visit www.beamexchange.org.

[2] There are many definitions of systemic change – this paper uses the term to indicate a shift in underlying norms that influence the behaviors of actors in a market system.

The analysis also identified small clusters of treatment group respondents that are distinct from all other observations. The presence of change is represented by how close or far away respondents are to a data point. When it is the latter (farther away) then these clusters, often referred to as outliers or positive deviants, may serve as early or weak signals of change when they appear following multiple applications of the tool.[3] Some of the outliers identified in this study relate to:

- The relationships between SCFs and SHF contributes to diminished workload and both increasing revenues or reduction in cost;
- The absence of innovative methods of farming and marketing in a specific subset of treatment group respondents;
- The type, provision, availability and increased access to information that is perceived as 'important', or to the information that is easy to obtain and of good quality, but not perceived as important;
- The instances where the lack of knowledge and skills is reported as the strongest contributor to making farming work difficult.

This activity also looked at the utility of SenseMaker® itself as a tool for market systems practitioners and evaluators[4]. The above findings suggest that SenseMaker® has a potential to provide insights into the 'how' and 'why' properties and behaviors in a system change, as well as to identify modulators that affect change (e.g. frequency of interactions). However, there are a number of caveats that need to be taken into account.

First, SenseMaker® typically requires supplementation with additional tools in order to inform project interventions. The findings can suggest areas for further investigation, but cannot in themselves indicate how a project should respond. Attempting to do so without additional evidence can be misleading and can easily lead to non-systemic or counterproductive interventions. Further, SenseMaker® is generally less suited to capturing a project's contribution to change than other tools, particularly if only applied once. Another finding of the trial was that triads – one of the most distinctive elements of the SenseMaker® analysis suite – are often difficult to interpret. As to the practicalities of using this approach in the field, this trial showed that similarly to any other research tool, SenseMaker® requires time and relies on external support, as well as continuous engagement from the project team in order to generate fruitful evidence. Finally, SenseMaker® is like other tools in that it will not automatically surface systemic changes. Users must have a concept of the types of systemic changes they are interested in understanding during the design phase, so that this can be reflected in the structure of the signification framework.

Future applications of SenseMaker® would also greatly benefit from a better sampling strategy (larger sample, better balance across treatment/spillover/control groups); project team record keeping of clients, sales, and participants; and a quantitative survey that captures system properties that would help inform SenseMaker® instrument design and analytical framework. Crucially, qualitative data in the form of narratives were not made readily available by the project team and hence was not utilized in this analysis. This is a very important limitation as qualitative evidence (narratives) are one of the two evidence pillars in SenseMaker® approach. Therefore, no evidence-based claim can be made about the value of contextualization in this trial.

[3] When outliers are observed in the first application of SenseMaker, such as in this trial, it is unclear whether they represent a sign of change since their responses may been similar even prior to the beginning of the project.

[4] In all, LEO evaluated the utility of four tools, also conducting field trials for each. A synthesis report is available at www.microlinks.org/library/testing-tools-assessing-systemic-change-synthesis-and-tool-trial-reports

I. INTRODUCTION

A. SEED MULTIPLICATION PROJECT

The Seed Multiplication Project (SMP) was initiated in 2013 in Northern Mozambique by TechnoServe and is funded by the Dutch Government with support from the Bill and Melinda Gates Foundation. It initially focused on building the capacity of a network of SCFs to provide goods and services to neighboring SHFs. Participating and carefully selected SCFs received training and capital support in three cohorts. Successful SCFs were then 'scaled up' with an $80,000 investment package (tractor, thresher, irrigation, maize mill) and had a business plan of farming on approximately 15 hectares of land. They were expected to produce and sell goods (seeds and other inputs), and sell services (mechanical land preparation, threshing, maize milling) to approximately 300 neighboring smallholders each.

A seed multiplier cooperative, COPAZA, and a seed processing and sales company, SBS, in a joint venture with SCFs and a group of investors, were then set up in the Lioma administrative post of Gurue district in upper Zambezia province of Mozambique. COPAZA members sell genetically improved seeds, inoculant for soy seeds, tractor services for land preparation and some mechanized threshing services at harvest. As part of this project, COPAZA members themselves contribute 50% to the purchase of the tractor and other equipment, along with training and maintenance. The common agricultural production cycle for farmers in the area includes land preparation, planting, weeding, harvest, threshing, and land clean-up.

A total of 60 SCFs embarked on a journey to transform their own working practices, as well as the farming techniques of approximately 18,000 SHFs from a 'slash-and-burn' to an 'input intensive' system. These inputs include access and ownership of tractors and threshers, maintenance of equipment, access and usage of loans, access and perceived benefits of training, social networking opportunities, and access to investment partnerships.

The SMP is anticipated to leverage these changes by providing technology and services that change the way smallholders prepare land, plant, and harvest. At the SHFs' level, the following outcomes were anticipated:

- Change in products;
- Change in production processes;
- Change in services purchased or provided by SCFs;
- Types/quantities of seeds purchased or sold by SCFs;
- Changes in family investment strategies;
- Changes in farming investment strategies;
- Changes in debt management;
- Changes in health management;
- Changes in land care practices.

B. LEO/BEAM TOOL TRIALS

The USAID-funded Leveraging Economic Opportunities (LEO) project is designed to support the capacity of donor staff and market systems development projects to design and implement evidence-based programs that facilitate inclusive market systems development.

The DFID-funded BEAM Exchange is a one-stop shop for sharing knowledge and learning about market systems approaches for reducing poverty. Its goal is to improve the impact and effectiveness of programs that

use these approaches: creating jobs, raising incomes and improving access to basic services – sustainably and at scale. Following extensive consultation with implementers and other actors involved in market systems programs, BEAM identified 'Improved tools for evaluating systemic change' and 'identifying systemic change' as the two themes where the difference between the interest and the availability of information was largest.

In sum, the core research questions of interest to both LEO and BEAM include:

- How does one define and recognize significant, enduring, pro-poor change in market systems resulting from the activities of donors? What are the defining features of these kinds of intermediate outcomes?
- How can we identify early changes that reflect progress in a market systems facilitation project, before systemic changes and final project goals have had enough time to occur?
- What practical methods and tools can we use to monitor systemic change and early change?
- How can these results provide feedback to improve the management of facilitation activities?

The LEO/BEAM-sponsored tool trials are intended to address the above questions through a series of tests with projects that are experimenting with tools for measuring systemic change, and profiles with projects that have already experimented with those tools

C. LEO/BEAM AND SMP COLLABORATION TO TRIAL SENSEMAKER

An independent consultant, Anna Hanchar, led the design, analysis and write-up of findings, funded through support from the BEAM Exchange. SMP team members were involved in the results analysis. The SMP team also directly carried out survey testing and data collection. Ben Fowler and Tim Sparkman of MarketShare Associates, a partner on the LEO project, oversaw the trial and provided discrete inputs.

D. REPORT STRUCTURE

This report is organized as follows:

- This section, Section 1, describes SMP, the LEO/BEAM tool trials, and the purpose of the Sensemaker® trial.
- Section 2 of this report describe the study and its objectives, and the conceptual underpinning.
- Section 3 describes methodology, the research instrument, the practical aspect of conducting this trial, and limitations.
- Section 4 discusses the analytical framework, observations, and results.
- Sections 5 and 6 provide conclusions and make recommendations at the program level, beneficiary level, as well as other programs interested in using SenseMaker® for assessing change and its modulators.

II. CONTEXT

The SMP interventions are expected to contribute to the emergence of new practices and adaption of new behaviors in farming. Even seemingly insignificant changes in behaviors, attitudes and practices at multiple levels might indicate the shift towards change in farming practices from 'slash-and-burn' to 'input intensive':

- SCFs are sources of inputs to SHFs. As direct beneficiaries of the SMP initiatives, SCFs were contributing towards the emergence of new practices and adoption of new behaviors by generating and sharing new knowledge, distributing better products and selling new services.

- SHFs are indirect beneficiaries of SMP. SHFs were expected to yield better produce and produce higher volumes, using previously unavailable mechanized land preparation services; and to benefit from access to information about farming practices;
- Other indirect beneficiaries, such as community members and SCFs' and SHFs' family members could benefit from the diffusion of these activities and outputs – for example, changes in land preparation practices or better access to produce.

At the same time, even if these shifts in practices and behaviors are observable, suggesting that change in the system is taking place, they may not yet have reached a 'critical mass' change that would suggest that sustainability is achieved.

III. METHODOLOGY

A. NARRATIVE RESEARCH

A significant degree of social system complexity, where new properties and behaviors that emerge cannot easily be predicted from a knowledge of initial conditions, and are not necessarily contained in the essence of the constituent elements, makes linear predicting and modelling insufficient for understanding complex systems[5,6]. Instead, exploratory approaches, such as narrative research, may serve better as means for describing complex system dynamics.

Narrative research allows capturing behaviors and elements of the systems at multiple levels and allows the identification of even seemingly insignificant patterns that can potentially contribute to bigger changes. The approach combines qualitative material (narratives) with a quantitative framework and differs from conventional survey techniques, which assume representative sampling, building probability models and hypothesis testing[7,8]. Its focus is on common patterns, as well as weak signals of threats and successes. A shift in these patterns and signals indicates a shift in the patterns of individual behaviors, as well as in the structure of the system governing these behaviors and, hence, a transformation in the system.

The Sensemaker® approach combines methodology and software and is based on the collection and analysis of short narratives which respond to prompting questions or images and which are self-coded by the respondents at the point of sharing. SenseMaker® helps to understand behavioral patterns and attitudes by visualizing responses. This allows the identification of emerging patterns of perceptions and attitudes and provides insights that can be used to adjust an intervention in order to amplify or dampen any emerging patterns.

B. METHOD AND DATA

OVERVIEW

SenseMaker® represents an approach to narrative research and incorporates elements of a scientific and conceptual background that is rooted in complexity, cognitive science, the natural sciences and social sciences. This approach is augmented by the use of customized software tools and enables capturing

[5] Mason, M, (2016) *Complexity Theory and / systemic Chang in Education Governance* in Governing Education in a Complex World, Burns, T. and F. Köster (eds.), OECD Publishing, Paris.
[6] French, S (2013) *Cynefin, statistics and decision analysis*. Journal of the Operational Research Society, 64.
[7] Roberts, F.S. (1979). Measurement Theory. Academic Press: New York.
[8] French, S (1986) Decision Theory: An Introduction to the Mathematics of Rationality. Ellis Horwood: Chichester.

quantitative and qualitative data through an innovative method of data collection and indexing, and heavily relies on data visualization-driven analytics.

Narrative research holds that the best way to understand the perspectives, beliefs and dispositions influencing decision-making is to understand the actual decisions being made, not merely the trends surrounding them. It allows early detection of outliers and, after multiple applications, 'weak signals' of change, opportunities and threats that can potentially provide useful insights. SenseMaker® captures large volumes of these decisions in the form of micro-narratives and allows for self-indexing on patented geometric indexes (triads and dyads). The indexing provides quantitative metadata, as well as measurement systems for data and analytics (e.g. through identifying baseline and impact indicators).

DATA

SenseMaker® provides a quantitative approach in what is traditionally a qualitative field. Micro-narratives and self-signified data enable quantitative analysis of qualitative data. Figure 2 shows the link between quantitative meta data (pattern visualization) and qualitative micro-narratives (narrative text).

INSTRUMENT

A SenseMaker® instrument is a result of careful design efforts which incorporate methodological knowledge, experience, and an in-depth study of the context within which the instrument is deployed.

Each instrument, often referred to as 'signification framework', contains a prompt question, a set of signification questions, and a demographic section.

COLLECTION PROCESS

A typical data capture process includes the following steps:

- **Step 1**. Respondents' memory is triggered to situate respondents in an experience they or someone they know have had, seen, or heard about and that relates to the field of interest;
- **Step 2.** Respondents share a narrative associated with that experience and thus bringing it into working memory;
- **Step 3**. Respondents signify (interpret, self-index) that experience using a set of geometric indexes and multiple-choice questions, as well as share their demographic data.

The 'self-signification' allows a respondent not only to interpret her/his own experiences, but also to give additional meaning to each situation that was not explicitly expressed in the narrative. This provides a rich set of quantitative meta-data for analysis. In addition, self-signification ensures that the researcher's frames of reference are not imposed on the conversations.

Self-signification is process where respondents make a mark to show where they believe their story sits. Respondents then answer some multiple-choice questions – firstly about their micro-narrative and then about themselves.

DATA ANALYSIS PROCESS

Each instrument question generates a multitude of data points for each story related to the concepts and aspects used to design the signifiers. Typically, the process of data analysis goes through two main stages:

- Stage 1: Analysis of the data firstly concentrates on the metadata, whereby a consultant explores visualizations and patterns generated through the process of self-signification. This allows to

generate preliminary hypothesis and insights, and to test assumptions and hypothesis generated during the instrument design stage.

- Stage 2: This stage builds on the initial analysis and requires team engagement to make sense of preliminary insights and patterns identified by the consultant during Stage 1. Facilitated discussion allows to deep-dive into data and generate deeper insights about the meaning of patterns and what they may mean in the context of the project.

- Stage 3: Based on the outcomes of and insights generated during Stage 2, the consultant goes into a more focused analysis of specific groups or issues. This may require complex patterns exploration techniques (e.g. landscapes and contour maps), statistical analysis, and benchmarking across populations and groups.

- Stage 4: Finally, the consultant looks into explanatory narratives to add persuasive evidence and meaning to numbers and patterns. Narratives help to understand specific contexts and nuances in providing evidence of what works well and what needs a different approach. They form a powerful body of evidence and help to explore the ways to create more stories 'like this' and less stories 'like that'.

C. CONDUCTING THE STUDY

INSTRUMENT DESIGN AND TESTING

The SenseMaker® research instrument used to collect data for this project was first drafted at a five-day facilitated workshop held on Nampula and Gurue, Mozambique, in May 2016. The instrument was designed with the input from the country project team and SCF family members. While focusing on the objectives of this specific research, the instrument also incorporated general concepts derived from literature review and theory, experience of previous SenseMaker® work on sustainable change in development, and evaluation, as well as specific expectations and perception of stakeholders. The design also ensured there is a potential complementarity of the SenseMaker® instrument with other approaches that may be utilized in the future thus allowing for additional insight and triangulation.

The English version of the instrument underwent a few rounds of internal and field testing before being translated into Portuguese for another round of testing. Insights generated during all testing rounds were integrated into the final version of the instrument, which was then configured as an online collection site and phone/tablet collection app in both English and Portuguese.

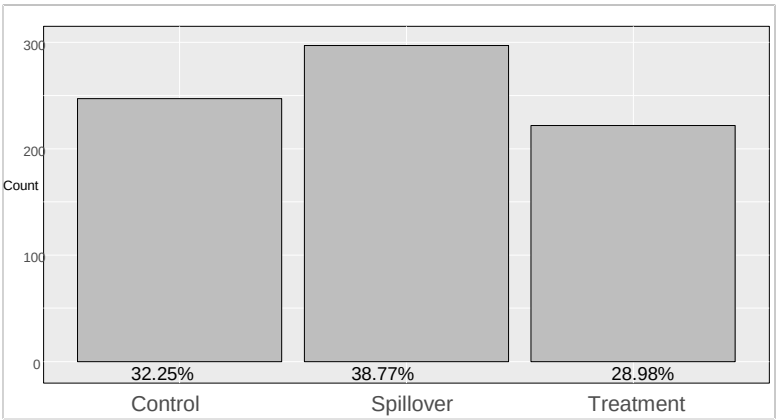
SAMPLE COMPOSITION

Sampling was designed to capture data at the level of COPAZA member clients – SHFs. This became a 'treatment' group and allowed to explore behaviors of SHFs and their perception of SCFs they interact with, as well as quality and accessibility of outputs – products and services – provided to SHFs by SCFs. Lists of SHFs were obtained from their corresponding SCFs. A total of 29% of responses were collected from this group (Figure 3-1).

Behavior of the treatment group was expected to influence others in the same system by sharing information or giving examples. 39% (297) of responses were collected from 'spillover' group respondents – the group that potentially feels a spillover effect from the interventions (farmers residing in areas adjacent to where interventions were taking place). In the context of this study, data collected from this group were not used to control the effect of intervention, but instead gave an indication of diffusion of new practices which indicates change in the behavior of a wider community.

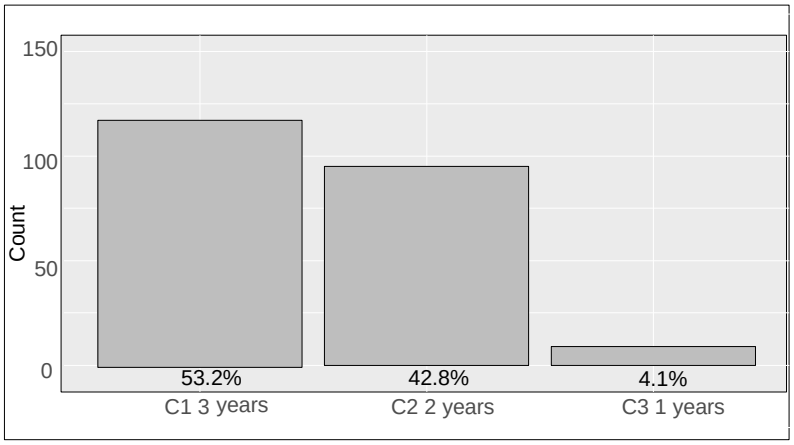
A total of 29% (222) of responses were collected from 'control' group farmers who reside and work in areas not exposed to interventions. This group shared similar characteristics to the control group and was used to control for the effect of interventions.

Figure 3-1: Sampling groups



The treatment group sample was divided into three cohorts corresponding with the length of associated SCFs participation in the SMP. This allowed comparing the degree in change of practices and properties based on the length of exposure to new information and better products and services, thus providing additional evidence. The breakdown of responses per treatment group cohorts are presented in Figure 3-2.

Figure 3-2: Cohorts C1, C2, C3 and duration of participation in SMP



This study did not aim for a representative sample of population. 'Duration of participation in the SMP' and 'location' were the only predefined sample parameters in this study. All other socio-demographic characteristics of the overall sample were captured in the 'demographic' section of the instrument and aimed at allowing to differentiate between subgroups in the population.

COLLECTION

Collection was undertaken by 12 trained SCFs between 6 July and 22 July 2016. It was coordinated and overseen by the TechnoServe survey team consisting of a data and logistics manager, a field supervisor, a driver fluent in the local languages, and two additional on-site technicians who worked to keep the mobile tablet technology functional. MPesa, the mobile money transfer service, was used to pay interviewers for approved surveys through their mobile phone accounts.

The initial project team intention of using SCFs younger family members (age group 15-35) to leverage their existing technological training and established networking capabilities did not work. The assumption of the project team that youth would be involved in, or have knowledge and interest in their parents' business, leading to some interest in collecting data, appeared to be incorrect. Very few identified youth collectors remained with the project following the original collector training exercise.

DATA CLEANING AND PREPARATION

A total of 920 interviews were collected, but 153 were rejected as tests or based on the interval of time automatically recorded. Rejected response entries were those that took less than 14 minutes for the treatment group, or less than 9 minutes for the control or spillover groups. The difference in expected time of completion between treatment and other groups is determined by the framework design, where some of the questions only apply if a respondent had been exposed to an intervention (treatment group). Some interviews originally rejected were redone, as respondents were ultimately located by interviewers who were familiar with the area.

The data preparation stage also included manual correction of collector codes and redefining of the sampling group field to distinguish spillover from out-of-area controls, based on unique combination of area and collector code.

ANALYSIS

Analysis was conducted in several stages:

- Stage 1: Upon the completion of data collection, the visual patterns and basic descriptive statistics were reviewed by the consultant to be used as a starting point for insight.
- Stage 2: A three-day 'sense-making' participatory workshop was then held in Nampula, Mozambique, where project team members, representatives of collectors, and the consultant reviewed and discussed the collected data, potential insights and hypothesis, and implications of results.
- Stage 3: Based on the insights generated during the workshop, a consultant 'deep-dived' into data looking for deeper insights and relationships. A number of analytical methods was used to allow for triangulation of findings, including statistical analysis (to the degree permissible by the nature of this study and data collected), descriptive statistics, and data visualization.

The observation and result section of this report presents these insights generated by analyzing data visualization and patterns built on participatory and collaborate analysis process between the consultant and the project team. Triad data is graphically represented as a collection of points (individual responses), as well as a heatmap, where the individual values are represented as colors, and darker colors indicate higher concentration of data. This presentation of data helps to deal with the problem caused by overlapping points, where the higher frequency of responses is difficult to see.

Unfortunately, qualitative data in the form of narratives has not been made readily available by the project team and hence was not utilized in this analysis. Software packages used for the analysis, visualization, and the generation of graphics included RStudio, Excel, SenseMaker® patterns, and SenseMaker® Explorer.

LIMITATIONS TO THE ANALYSIS

Multiple errors and difficulties associated with sampling and collection occurred at different stages of the study. These included:

Training: Choice and training of collectors who dropped out due to discrepancies in their expectations and reality. This may call for a review of motivational arguments (e.g. what is the reward structure, what can be offered in return for collectors' time, is paying for collection the right approach, etc.).

Instrument design: A question on which sampling group a respondent belong to was initially excluded from the instrument in error. This was promptly resolved following testing and first days of collection.

Translation: As it became clear during the 'sense-making' workshop, translation into Portuguese of the three questions (D1, Q10 and Q11) was not done correctly leading to confusion on the part of the respondents and lack of clarity on the meaning of the data. These questions were omitted from the analysis.

Sampling: Several sampling-related issues occurred:

- When responding to question T5[9] some of the control group respondents indicated that they had some relationship with, connection to, or knowledge of a COPAZA member. Control group respondents should not have had any exposure to COPAZA member by design, therefore these responses may suggest that there was some contamination of the control group sample. This may also indicate that control group respondents treated question T5 as 'what if' scenario, e.g. 'what would you expect if you had access to a tractor'.
- Smaller and less balanced sample size: the number of interviews was reduced from 1,395 (465 per each of the three sampling groups) to 920 due to access issues and time constrains.
- Equal distribution of responses in the treatment group per cohort was not achieved. Instead of 155 in each cohort, only nine data points were collected from Cohort 3 respondents who participated in the program for one year only, and only 118 and 95 responses were collected from Cohort 1 and Cohort 2 respondents.
- Realization that there is little record keeping and management of sales receipts and client lists by SCFs. Collection strategy heavily relied on this information and lack of it made sampling and access issues problematic. There are a few hypotheses of why this is the case, which the local team is currently addressing.

Collection: Miscoding by collectors of 'spillover' groups as 'treatment' groups. The error was rectified once the collection finished.

Project design: Sampling, collection and analysis were designed to fit a very tight schedule hence the respondent numbers were lower and collection coverage was not as wide as initially anticipated.

At the same time, basic data validity checks performed give good confidence in research and data validity:

- Narratives are distributed across triads without any repeating pattern and data are not being restricted to one area. This suggests that respondents thought about their responses to questions and carefully considered their answers;
- The number of 'non applicable' responses is very low, suggesting that all questions were found to be relevant and had applicability to the subject; and that all questions were phrased correctly;
- The collection was continuously monitored and any issues associated with a collector, or a region were immediately investigated;

[9] Question T5: "In the past three years, what activities delivered by commercial farmers did you participate in/complete (select as many as apply)?"

- The narratives were audio recorded and sample recordings show that answers were indeed given by farmers and not 'produced' or 'cleaned' by data collectors.

IV. FINDINGS

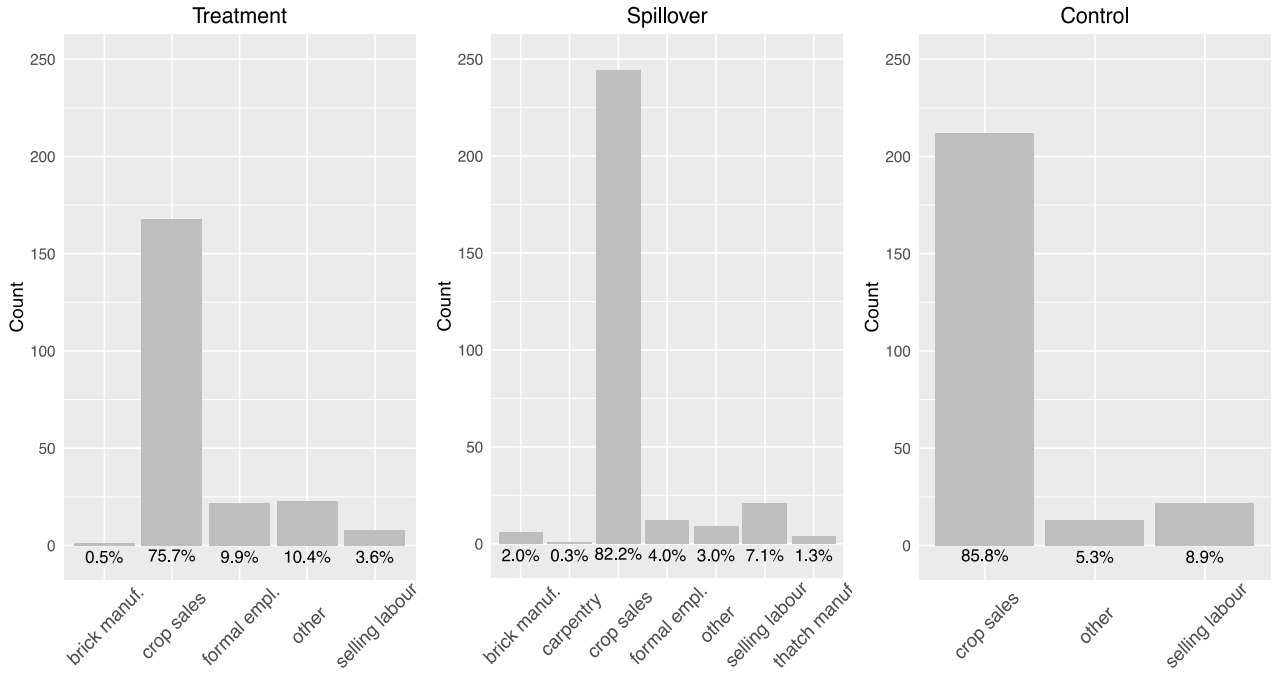
A. THE RESPONDENTS

SOCIO-DEMOGRAPHICS CHARACTERISTICS

As mentioned in the Sampling section of this report (p.7), 'duration of participation in the SMP' and 'location' were the only predefined sample parameters. Hence, the responses to socio-demographic questions help to understand whose perspectives we have gathered and which groups we can differentiate between.

The data mostly represents those whose main source of income is 'crop sales', and this is reported by a higher proportion of control group respondents compared to the other two groups (86%). Fewer treatment group respondents earn income by 'selling labor' than the other two sampling groups. 'Formal employment' and 'other' were each reported as a main source of income by 10% of the treatment group respondents. For spillover and control groups 'selling labor' became the second most reported source – 7% and 9% respectively.

Figure 3-3: Main source of income

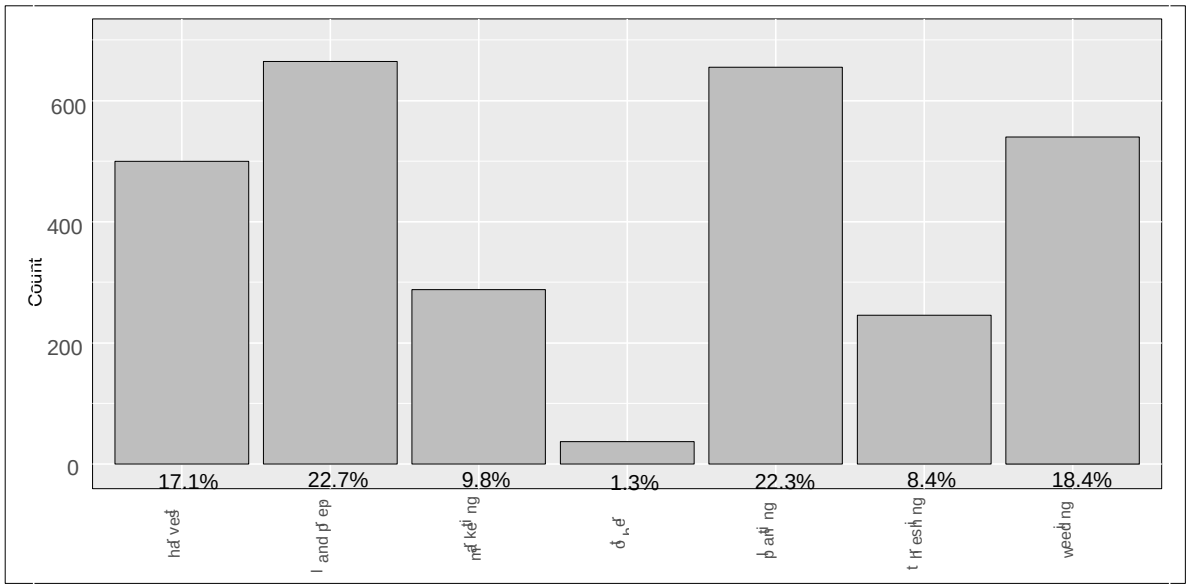


The data also represents mostly Catholics, those aged between 25 and 44, those who completed primary education.

TYPE OF WORK RECENTLY COMPLETED

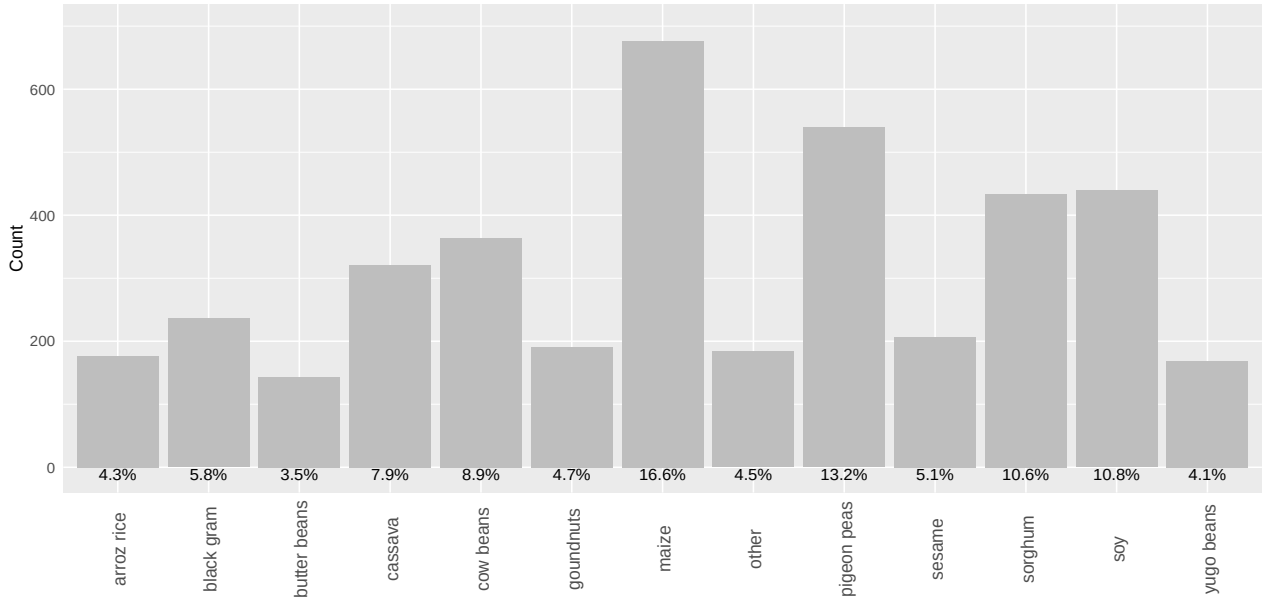
Most of the work the respondents had finished prior to this study was related to harvest (17%), land preparation (23%), planting (22%) and weeding (18%). Marketing and threshing appear to be the least reported activities (10% and 8% respectively).

Figure 3-4: Work recently completed by SHFs



The work also involved a range of crops - the most cultivated were maize (17%) and pigeon peas (13%), followed by sorghum (11%), soy (11%), cow beans (9%) and cassava (8%).

Figure 3-5: Products that featured in work recently completed by SHFs



B. CHANGE IN FARMING PRACTICES (ALL GROUPS)

The theory of change discussed earlier assumes the emergence of new farming practices in response to the SMP intervention. The intervention itself has been structured across several cohorts (length of program participation). To assess the effect of an intervention in a standard RCT setting, a comparison between the

treatment/ spillover and control groups would need to be made with indicators of farming practice change potentially structuring the effect over intervention cohorts.

However, in addition to being an exploratory narrative research with a complexity focus, the current study also faces several limitations that make implementing a standard RCT approach irrelevant. For example, it was not possible to implement a fully randomized treatment assignment due to local access and record-keeping issues - cohort data and customer records were not readily available, or were incomplete. Therefore, this analysis would be more appropriately viewed as a study with observational data (with some characteristics of treatment presence/absence across groups), and any observations need to be carefully interpreted in terms of causal relationships.

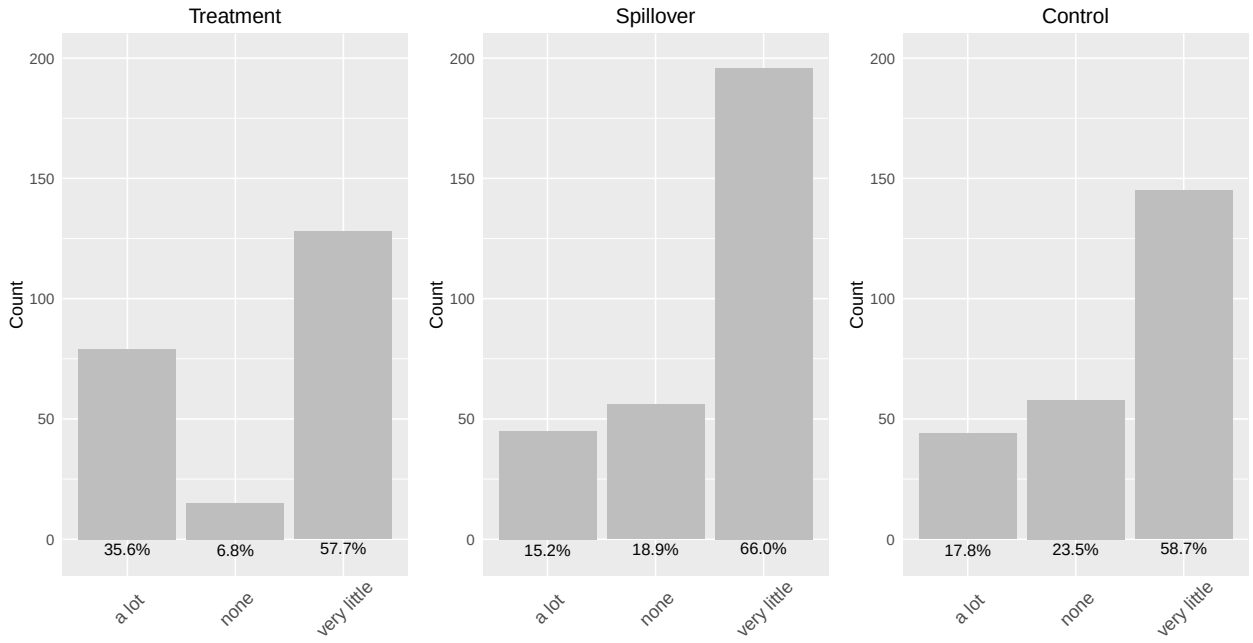
With the above caveats, and as described in more detail in Analytical framework section (p. 10), it is still possible to assess the relationship between a self-reported measure of change in farming practices (Q.9, Change In Practice) and treatment, control and spillover sampling groups. This provides an insight in the emergence of change in the system and its potential association with the SMP. Descriptive statistics, Mosaic plot, and logistics regression were used to assess the effect.

The observations presented below indicate that there is a difference in the level of self-perceived adaptation of new farming practices among those who have been directly exposed to the SMP and other groups. The data also shows a marginally higher level of adaptation by spillover respondents compared to control group.

'Change' observation 1: more self-perceived change in farming practices is reported by treatment group (Figure 3-6).

Descriptive statistics presented in Figure 3-6 suggests that twice as many treatment group respondents, compared to spillover and control groups (36% vs 15% and 18%) reported 'a lot' of change in their farming practices (Figure 3-6). Comparing spillover and control groups, there are marginally more people reporting 'very little' change (7% more) and less people reporting 'no' change (5% less) in the former.

Figure 3-6: Sampling group vs. Self-reported change in farming practices



'Change' observation 2: Significantly more changes in farming practices, compared with control and spillover sampling groups were reported by the treatment group (blue area in the lower right corner, Figure 3-7).

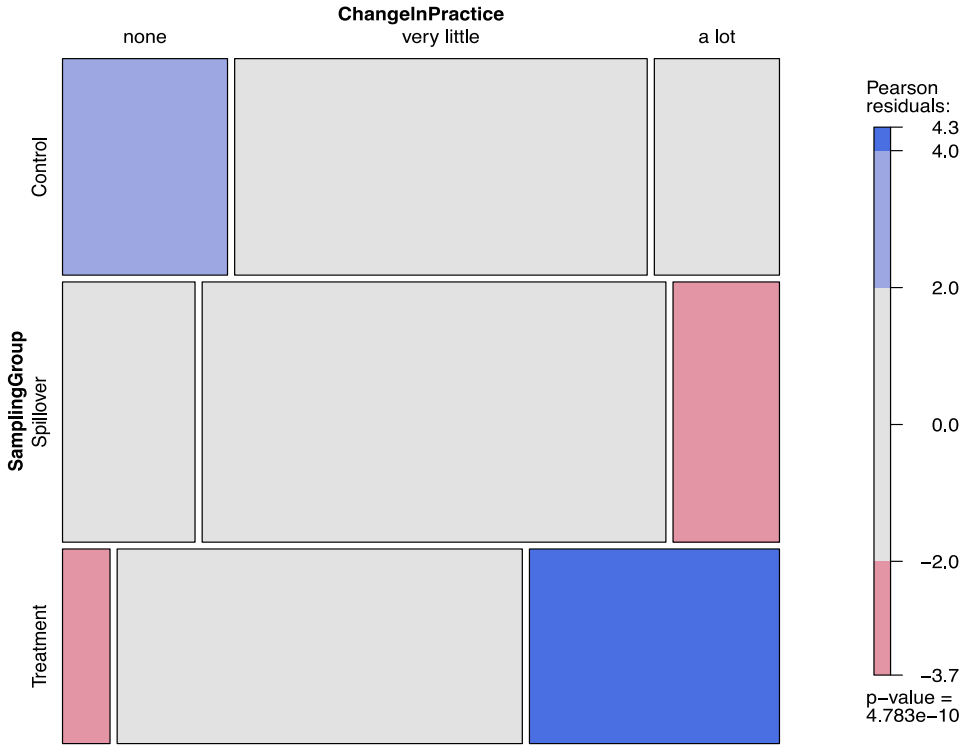
'Change' observation 3: Significantly more 'none' responses indicating no change to their farming practices were reported by the control group, compared with other sampling groups (blue area in the upper left corner, Figure 3-7).

'Change' observation 4: Significantly fewer spillover respondents, compared to the other sampling groups, reported 'a lot' of changes in their farming practices (Figure 3-7).

Given the nature of this study and the fact that this is not a traditional fully randomized RCT, another limitation needs to be considered - the omitted variable bias. The results of this analysis will be biased if there is a factor (Z) that is currently not in the model (not part of the control variables), but that satisfies both of the following conditions: Z is correlated with variable one (the treatment group indicator) and Z is correlated with variable 2 (Q.9, ChangeInPractice). However, after carefully considering local area and program characteristics, there does not seem to be a readily available factor that is not present in our model constituting omitted variable bias. Thus, the results presented below are treated as valid estimates of the relationship between program participation and changes in farming practices.

A mosaic plot[10] of the relationship between a self-reported measure of change and sampling groups (Figure 3-7) is a visual representation of the contingency table. It is an area-proportional visualization of frequencies in the cross-tabulation over levels of the two key variables.

Figure 3-7: Mosaic plot



[10] Meyer,D., Zeileis,A. and K.Hornik (2007) *The Strucplot framework: Visualizing multi-way contingency tables with vcd*. Journal of Statistical Software, 17(3)

The area of each tile is proportional to the corresponding cell entry. The colors represent the level of the residual for that cell/combination of levels. As per legend, blue means there are more observations in that cell than would be expected under the null model (independence); red means there are fewer observations than would have been expected. This shows which cells are contributing to the significance of the chi-squared test result - this test of independence in contingency tables assesses whether two categorical variables are related. The null hypothesis of the test is that in the population, the two categorical variables are independent.

'Change' observation 5: Participation in treatment group increases the likelihood of changes in farming practices (Table 4-1).

The relationship between two variables described earlier can also be tested using a logistic regression where outcome variable (Q.9, ChangeInPractice) is converted into a binary variable (change vs. no change) and a baseline for the categorical variable for treatment and spillover groups being a control sampling group.

Table 4-1: Logistic regression results

	Model 1
(Intercept)	1.18 ***
	(0.15)
SamplingGroupSpillover	0.28
	(0.21)
SamplingGroupTreatment	1.44 ***
	(0.31)
AIC	672.61
BIC	686.54
Log Likelihood	-333.31
Deviance	666.61
Num. obs.	766

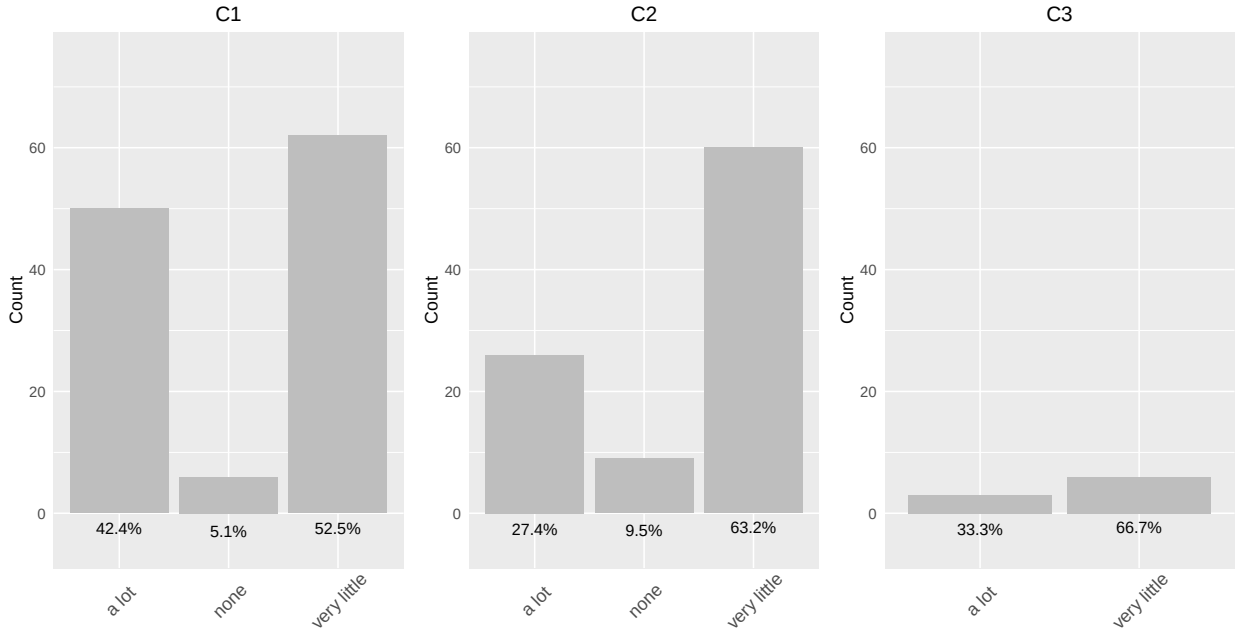
*** p < 0.001, ** p < 0.01, * p < 0.05

C. CHANGE IN FARMING PRACTICES (TREATMENT GROUP)

'Change' observation 6: the scale of adopting new farming practices is related to the length of program participation and exposure to interventions (Figure 4-1).

The difference in the level and scope of adopting of new farming practices depends on the length of exposure to new products and services provided by SCFs. 42% of respondents from C1 (longest exposure to the program) reported 'a lot' of change in their practices, compared to 27% of C2 and 33% of C3 (there were very few observations related to cohort C3–1 year of program participation).

Figure 4-1: Cohorts vs. Self-reported change in farming practice



E. INTERACTION BETWEEN SCFS AND SHFS (TREATMENT GROUP ONLY)

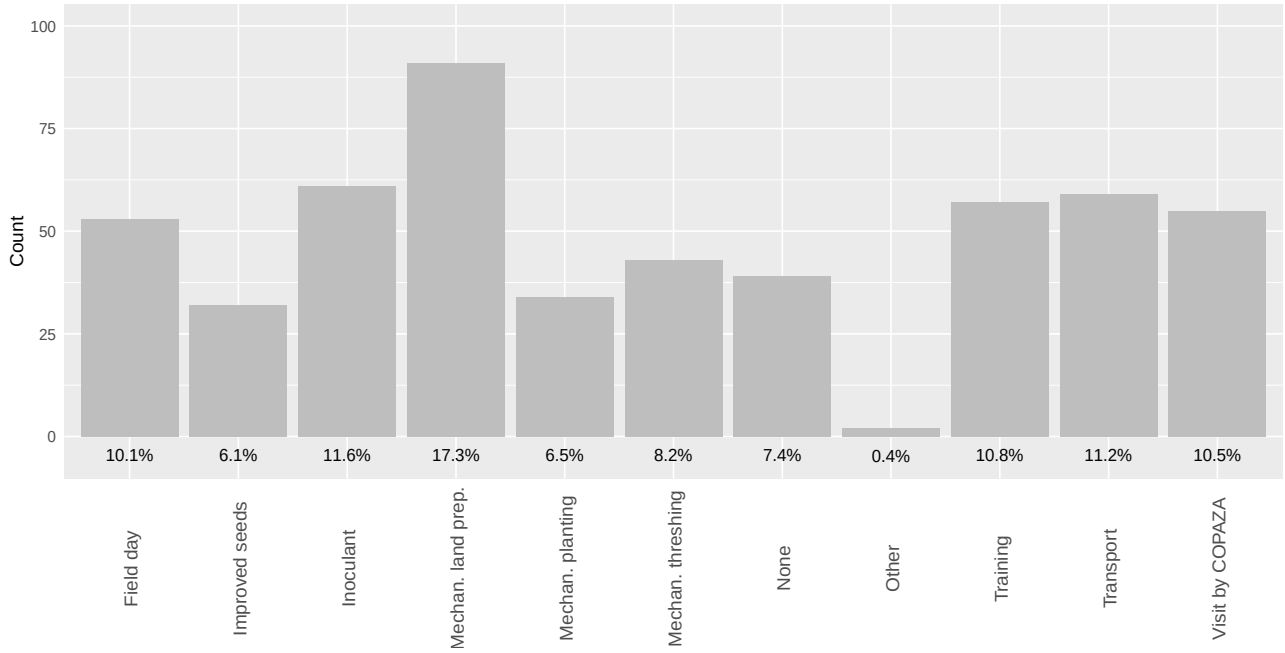
Looking into the level and quality of interaction between SCFs and SHFs was one of the main objectives of this study. This interaction assumes the presence of a relationship between the two groups, hence data covering this aspect of the study was collected from treatment group only[11].

'Interaction' observation 1: All of the services provided by SCFs are used by SHFs, although to a varying degree (Figure 4-2).

In the recent work described by the treatment sampling group respondents, using and accessing 'improved seeds' offered by SCFs was reported as the least frequent activity (6%), while 'mechanized land preparation' appears to be the most used by SHFs service (17%). Surprisingly, 7% of treatment group respondents reported no interaction with SCFs. Visits, training, transport services, inoculant and field days were forms of interaction for 10-11% of treatment group respondents.

[11] No spillover or control group respondents were expected to have direct interaction with COPAZA.

Figure 4-2: SCF activities used by SHFs (treatment group only)



'Interaction' observation 2: Out of machinery services, 'mechanized land preparation' on its own appears to be the main biggest contributor to changes in farming practices (Figure 4-2).

'Interaction' observation 3: A combination of information-based services is the second largest contributor to changes in farming practices (Figure 4-2).

For those respondents who reported that their practices had 'changed a lot', 'mechanized land preparation' was the most reported service used (22%), followed by the combination of 'mechanized land preparation' and 'transport' (5.1%), the combination of 'visits' and 'training' and 'inoculant' (5.1%), and the combination of visits, field day and training' (Figure 4-2).

Out of those respondents who reported that their practices changed 'only a little', almost a quarter (24%) said that they had used no services provided by the SCFs, 6% reported using transport only, and 5% - mechanized land preparation. Similarly, among those who reported that practices 'had not changed' almost one third reported not using services offered by SCFs, and 13% said they had 'fields days' and 'trainings'.

Of those SHFs who had an interaction with SCFs, around 80% of respondents had a one-time interaction only. Most of the interactions between SCFs and SHFs took place in 2015 and 2016.

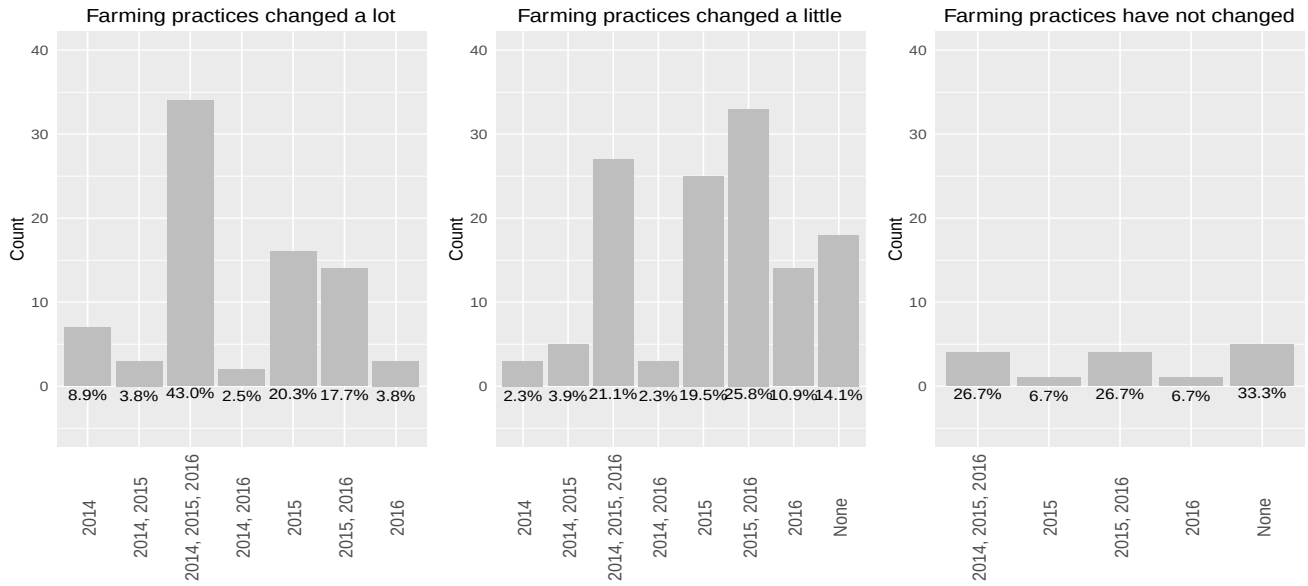
'Interaction' observation 4: 'Improved seeds' is the least used service and it seems to have little reported contribution to change in farming practices (Figure 4-2).

Notably, 'improved seeds' as a stand-alone service was only used by 2% of respondents who said their practices changed 'only a little' and in combination with 'mechanized land preparation' and 'mechanized threshing' by 3% of those who reported 'a lot' of change in their practices. 3% of those who reported 'a lot of change' also reported using 'improved seeds' in combination with all other services.

'Interaction' observation 5: The degree of reported change in farming practices is associated with the length of interaction between SCFs and SHFs (Figure 4-3).

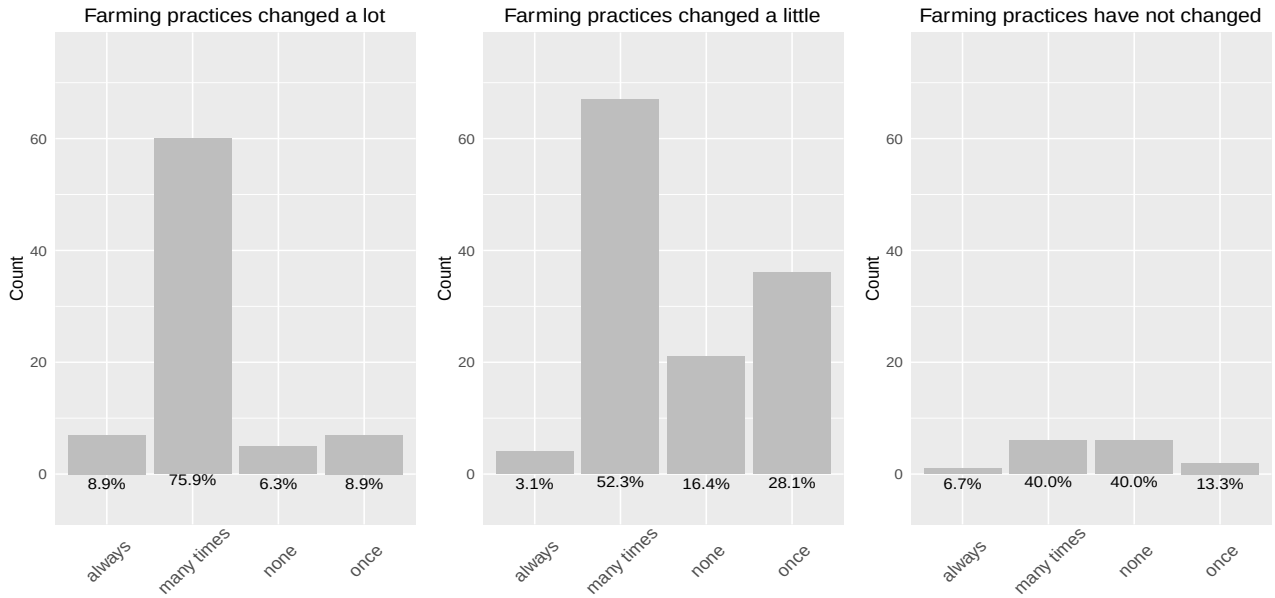
43% and 21% of those who reported 'a lot of change' and 'a little change' respectively had repeated interactions with SCFs for three years (2014-2016). At the same time, interaction for two nonconsecutive years - 2014 and 2016 - appears to have less effect on change (2.5% and 2.3%) than interaction in 2015 only (20% for both groups) (Figure 4-3).

Figure 4-3: Years of interaction between SHFs and SCFs vs. Self-reported change in farming practices, (treatment group only)



'Interaction' observation 6: Higher frequency of interaction between SCFs and SHFs is associated with ahigher rate of change (Figure 4-3).

Figure 4-4: Frequency of interaction between SHFs and SCFs vs. Self-reported change in farming practices (treatment group only)



'Interaction' observation 7: COPAZA members have strong influence on the way treatment group respondents work (Figure 4-5).

Figure 4-5: Biggest influence on decisions related to work (treatment group only)

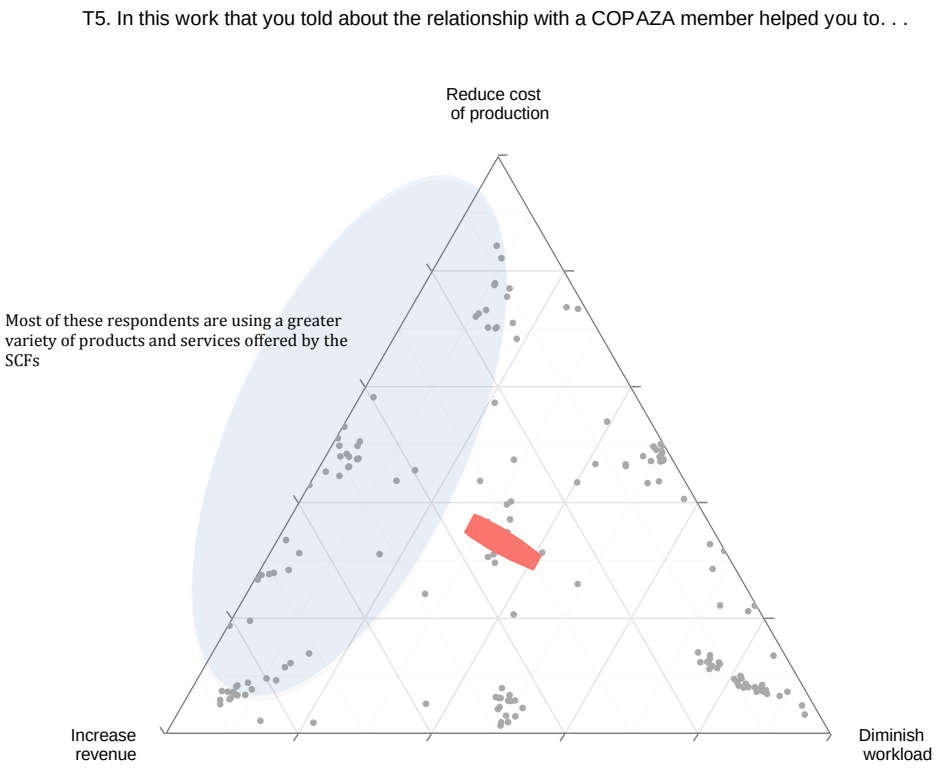
There is a sizeable group of respondents whose work is influenced by COPAZA members only, or by a combination of COPAZA member influence, respondents' own knowledge, and influence of a family or friend. When no COPAZA influence is reported, the work is strongly influenced by either family or friends, the respondents' own knowledge, or both.

'Interaction' observation 8: Relationship of SHFs with the SCFs and COPAZA tends to mostly result in reduced costs and increased revenue (especially for those using a greater variety of products and services) and slightly less so in diminished workloads (Figure 4-6).

The responses tend be skewed towards the left side of the triad - the cluster in the middle of the triad towards the left (Figure 4-6) suggests that the relationship with COPAZA members helped to reduce costs associated with the recent work, as well as increase revenue. Interestingly, those who responded towards this side of the triad tend to use a wider range of services and activities provided by the SCFs compared to the rest of the respondents. This may also suggest that access to mechanical tools available for hire from SCFs reduced the cost of land preparation.

There are a few smaller concentrations of responses, where reduced costs or diminished workload were not achieved. The latter is particularly interesting, as the expectation is that in time interaction with the COPAZA members would allow SHFs to free some of the time for other farming activities.

Figure 4-6: Relationship with COPAZA members, (treatment group respondents only)



Recommendation for further analysis: Focusing on clusters located towards the diminished workload corner and understanding who the respondents are may be helpful in understanding what is it specifically that allows farmers to diminish their workload. At the same time, it may be that other forces (e.g. weather) influenced costs and income levels.

There are also two small clusters of responses that sit between 'increase revenue' and 'diminish workload' and between 'reduce cost of production' and 'diminish workload'. These 'weak signals' can be treated as emergent signs of change. Comparing these two clusters (who these respondents are, how are they different) may provide interesting insights on what aspects of a relationship with a COPAZA member contribute to diminished workload and either increasing revenues, or reduction in cost, and why not both.

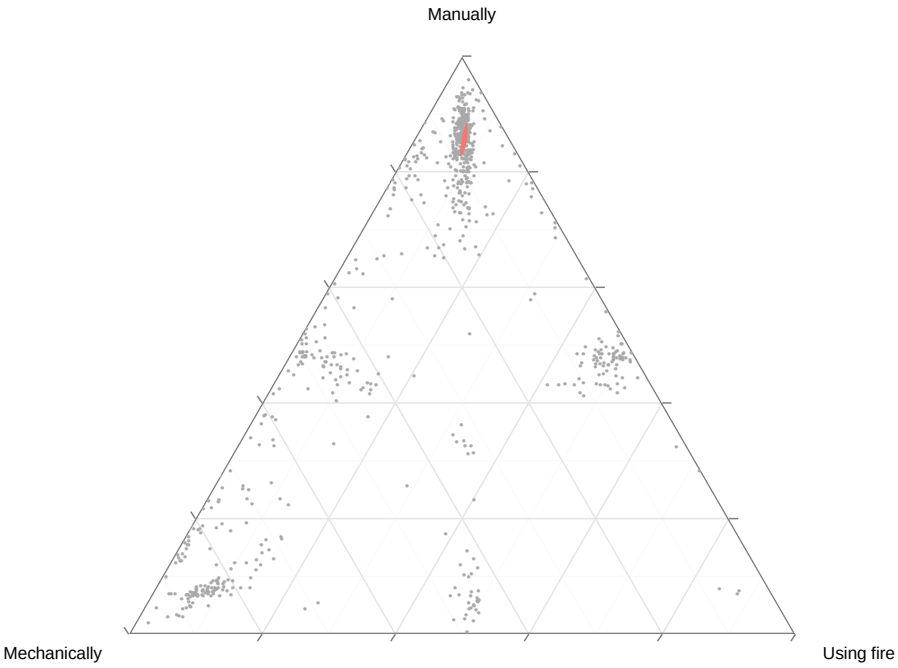
F. GENERAL COMPARISON BETWEEN TREATMENT, SPILLOVER AND CONTROL GROUPS.

'General' observation 1: Use of mechanical land preparation is associated with access to and information about COPAZA products and services.

Overall, land preparation is still mostly done manually, and is often done by combining manual land preparation techniques with using fire (Figure 4-7). The use of mechanical techniques, however, is mostly reported by the treatment group respondents (Figure 4-8). This may be attributed to the availability of mechanical tools and increased access to these techniques due to the presence of COPAZA. High levels of manual land preparation, and combined use of mechanical and manual land preparation by this group can be explained by the season cycle and type of crop – some work can only be done manually. Availability of mechanical tools and machinery, as well as suitability of land for mechanical preparation is also an important factor that may prevent transition from manual to mechanical land preparation techniques.

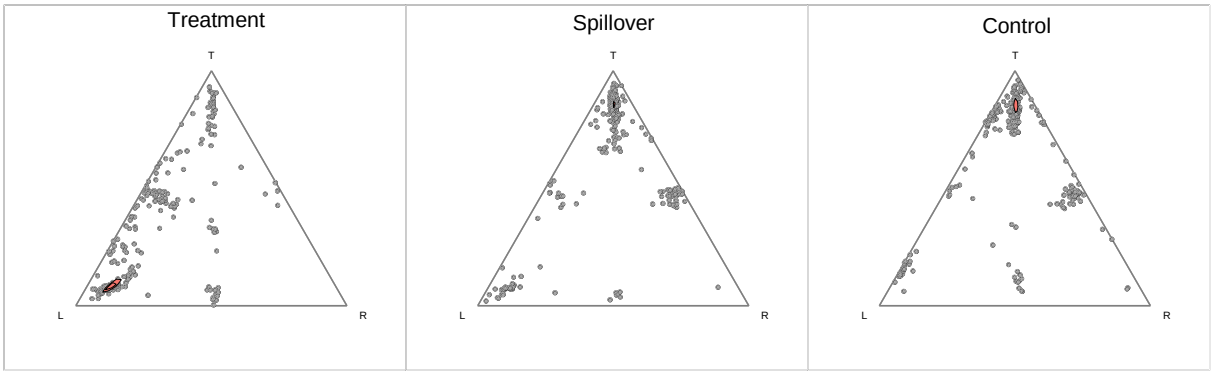
Figure 4-7: Land preparation techniques used, all sampling groups

T1. In the work you just told me about how was the land preparation done?



Some level of mechanization is also observable in the control group land preparation techniques. This may be attributed to access to services and mechanization tools available via other channels.

Figure 4-8: Land preparation techniques, by sampling group

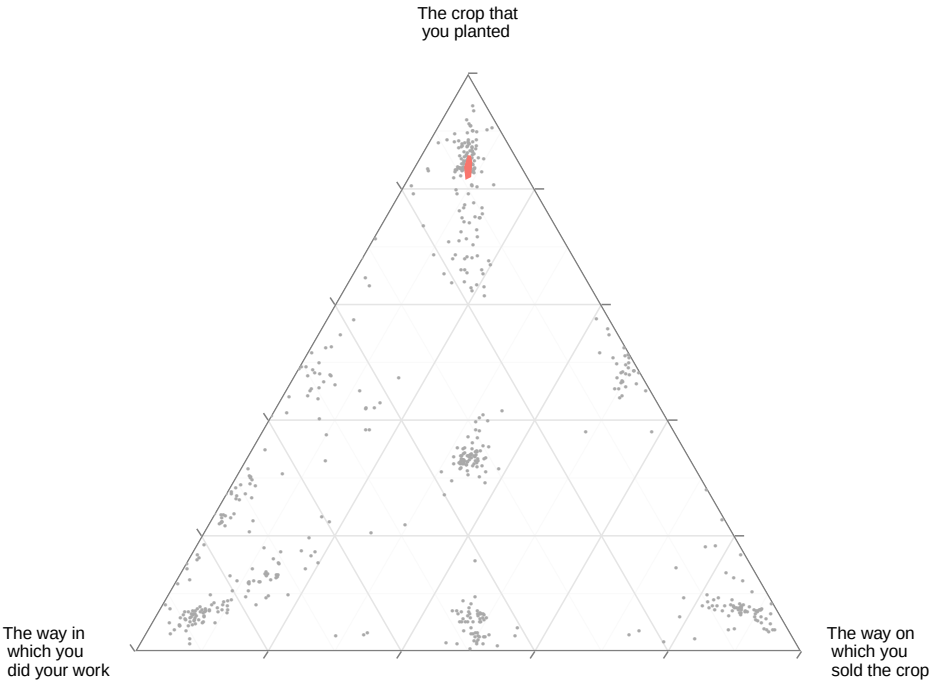


'General' observation 2: Fewer control group respondents reported using a new technique in the work they had recently completed.

Outputs produced by using new farming techniques and planting new crops need to be marketed and sold. While there seems to be a general tendency to innovate in how people work and the types of crops they use, marketing remains a weak area across all sampling groups (Figure 4-9).

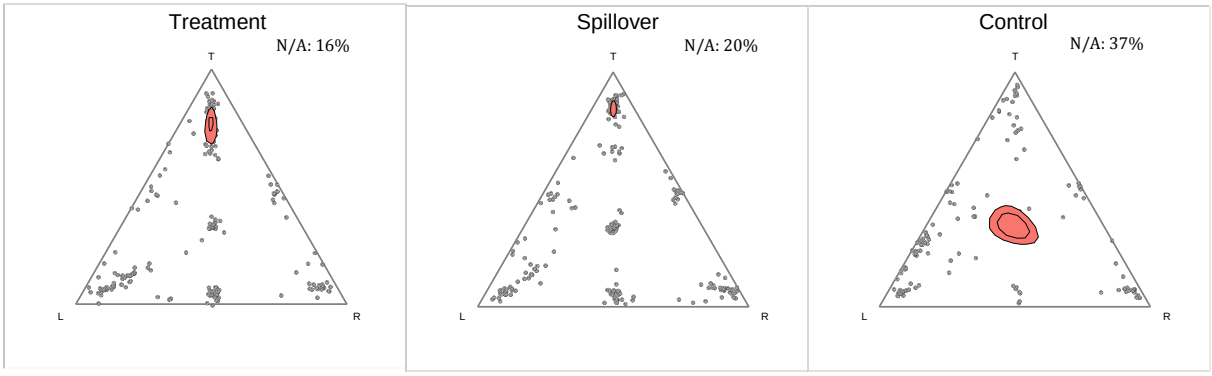
Figure 4-9: New behaviors, by all sampling groups

T2. What there anything new that you did for the first time in the work you just told me about?



There is some evidence that treatment group respondents used more innovative techniques, new crops, or a combination of both compared to the spillover group, who mainly focused on new crops (Figure 4-10). Control group respondents, at the same time, do not seem to exhibit similar behavior – 37% of all respondents reported that they did not use anything new during their last farming activity.

Figure 4-10: New behaviors, by sampling group



Recommendation for further analysis: 16% of treatment group respondents reported that there was nothing new in what they produced, their techniques, or the way they marketed. This may be related to the type of work or crops, but is worth investigating further in case this provides an insight on what prevents people from adopting innovative ways of farming.

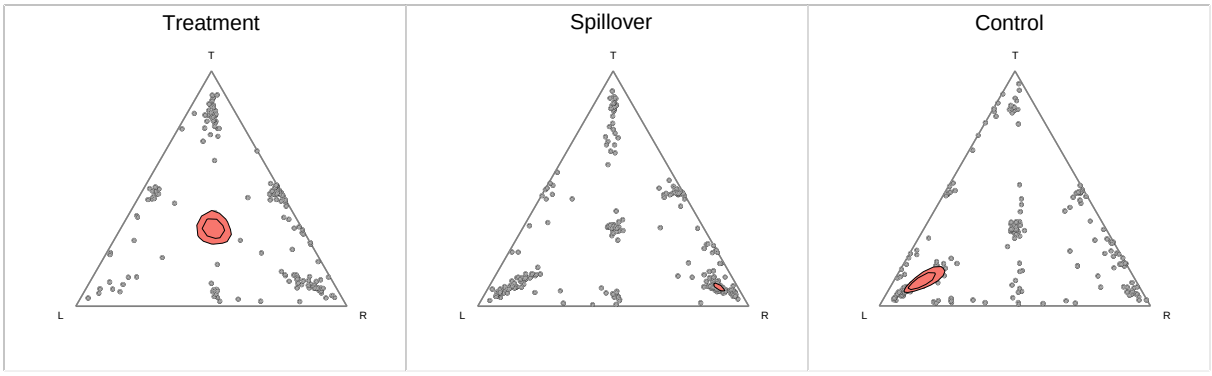
'General' observation 3: Access to SCFs and COPAZA members seem to be associated with good quality information that is important to farmers, but this information may not be that accessible.

Although a substantial cluster of responses in the middle suggests that good quality and important information was generally easy to obtain, there seems to be higher concentration of responses in the lower half of the triad, suggesting that important and easy to obtain information may sometimes be lacking quality (Figure 4-11).

Figure4-11: Information, all sampling groups

However, those who reported that information in their example was of good quality and important mainly belong to the treatment sampling group, with some respondents representing the spillover group (Figure 4-12). At the same time, for the control group, information was more easily obtainable than any other sampling group. In certain cases, this variation across groups can be explained by the type of information required. For example, the information on when the tractor is available for use, as well as details related to renting equipment, or using it, can be quite difficult to obtain due to the lack of electronic record systems and manuals – this would explain difficulties experienced by COPAZA member clients.

Figure 4-12: Information, by sampling group



Recommendation for further analysis: There are two small clusters of treatment group responses that sit between 'easy to obtain' and 'important' and between 'easy to obtain' and 'of good quality'. The former cluster is bigger than corresponding cluster on the other two sampling groups, indicating the availability or increased access to important information. Understanding the properties of this cluster may provide some insights into what kind and source of relevant information seem to be accessible. Exploring the latter cluster of responses may explain what easily obtainable good quality information is not perceived as important and what can be done to increase its relevance.

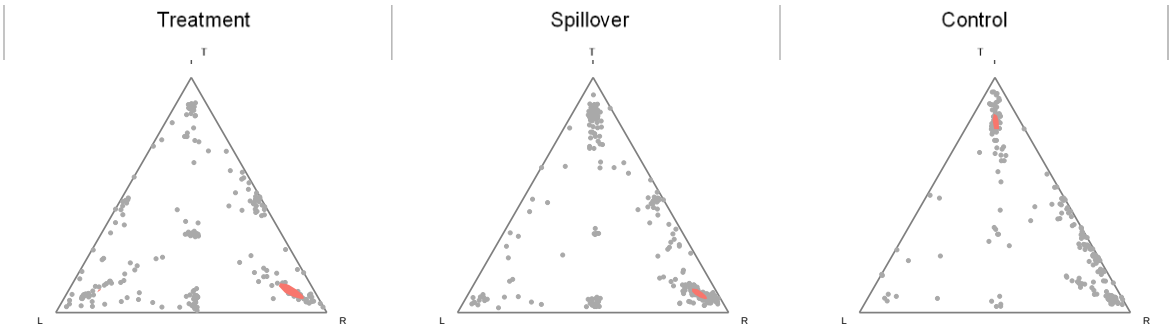
'General' observation 4: Treatment group is more likely to report that people looked for innovation compared to the other two sampling groups.

Most of the respondents in the overall dataset reported 'respecting tradition', 'following the others', or both (Figure 4-13). There are few respondents who reported that people involved in their recent work 'looked for innovation and took risks'.

Figure 4-13: Behaviors and attitudes, all sampling groups

More treatment group respondents say that people look for innovation than any other sampling group (Figure 4-14).

Figure 4-14: Behaviors and attitudes, by sampling group



'General' observation 5: Trust and listening to others are less influential in how SHFs do their work than is a desire to increase earnings. This especially applies to the treatment group.

Most of the respondents did their work in a way that would allow them to increase their earnings, relative to doing so because they trusted someone (Figure 4-15). Similarly, very few respondents reported doing their work in a specific way purely because someone advised them to – they are more likely to go with their own experience, follow the other's examples, or go with a combination of all three factors (Figure 4-17).

Control group respondents seem to be more open to listen to someone and trust someone compared to other sampling groups (Figure 4-16). Trust on its own seems to feature very little across all groups. The spillover sampling group is least likely of all the groups to respond to someone's advice unless they can also do things in the way they have always done them (Figure 4-18).

Figure 4-15: The reason work was done in a particular way, all sampling groups

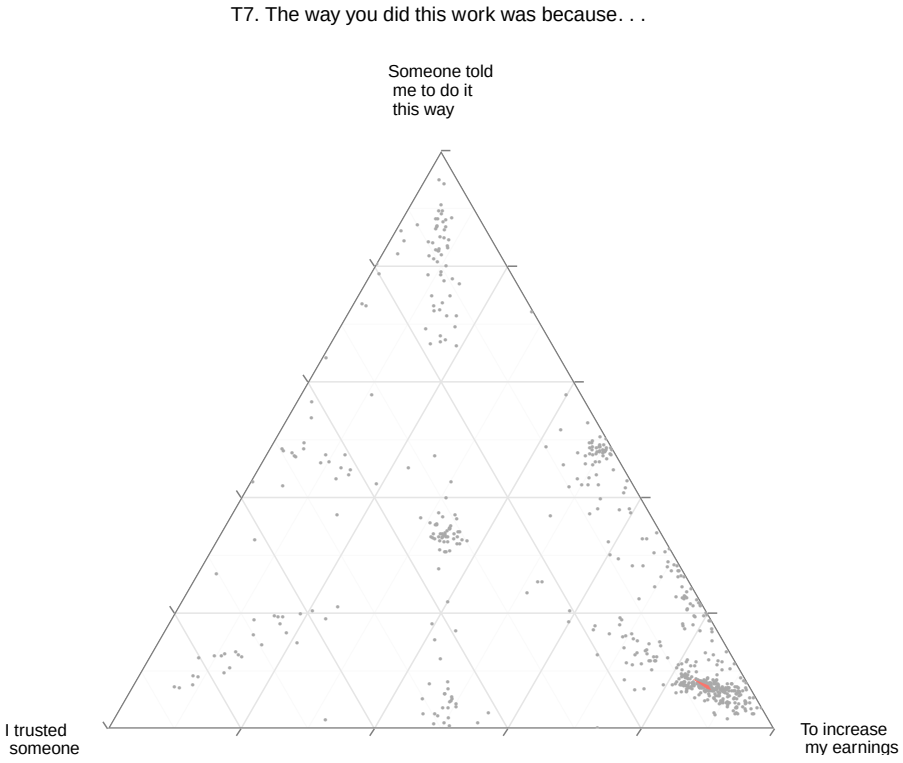


Figure 4-16: The reason the work was done in a particular way, by sampling group

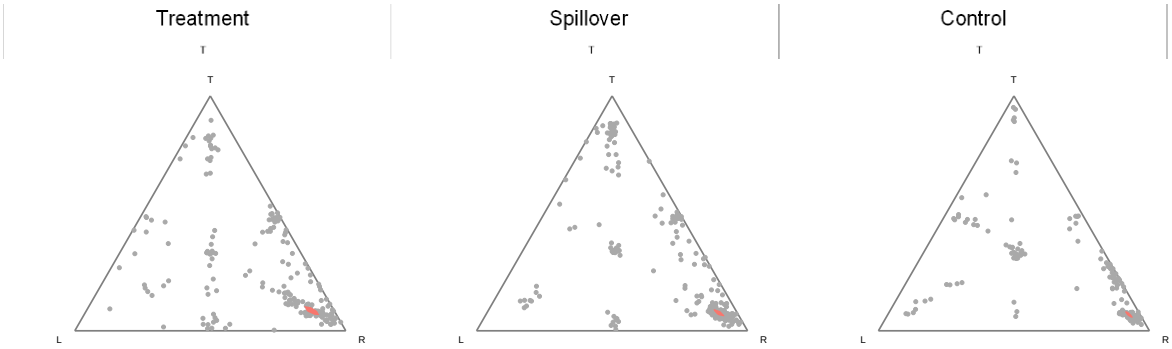


Figure 4-17: The reason work was done in a particular way, all sampling groups

T8. In what you told me about you did it because. . .

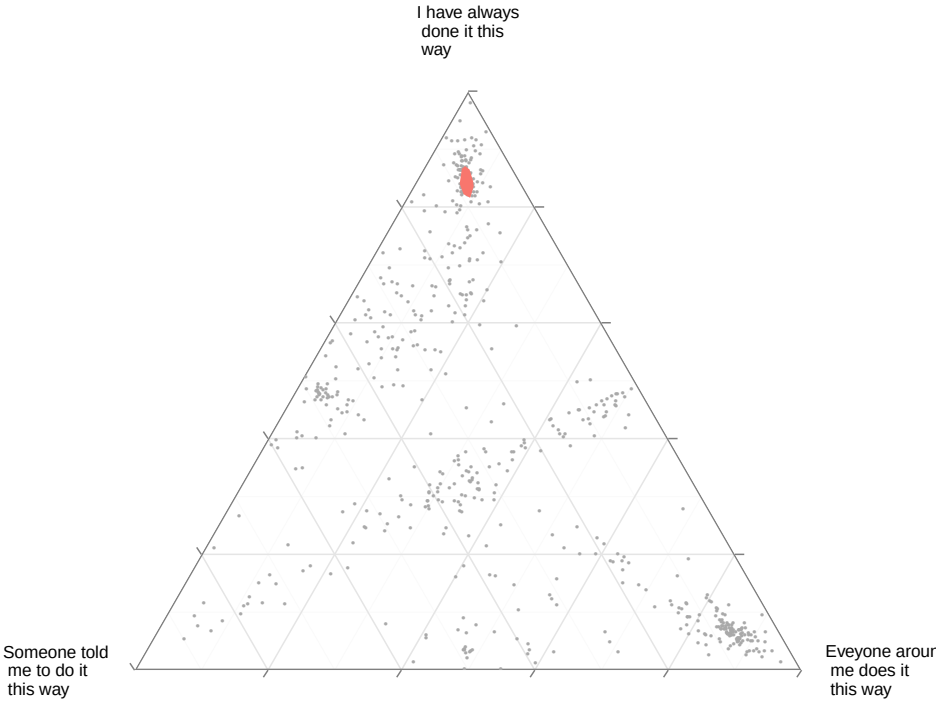
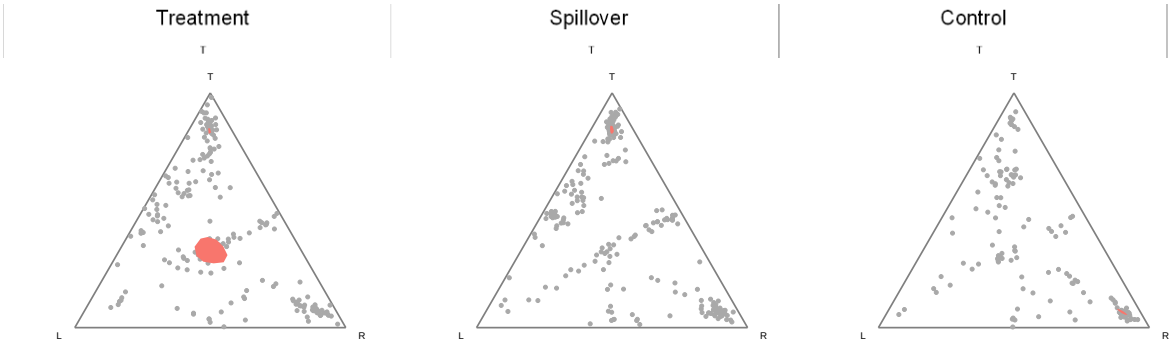


Figure 4-18: The reason work was done in a particular way, by sampling group



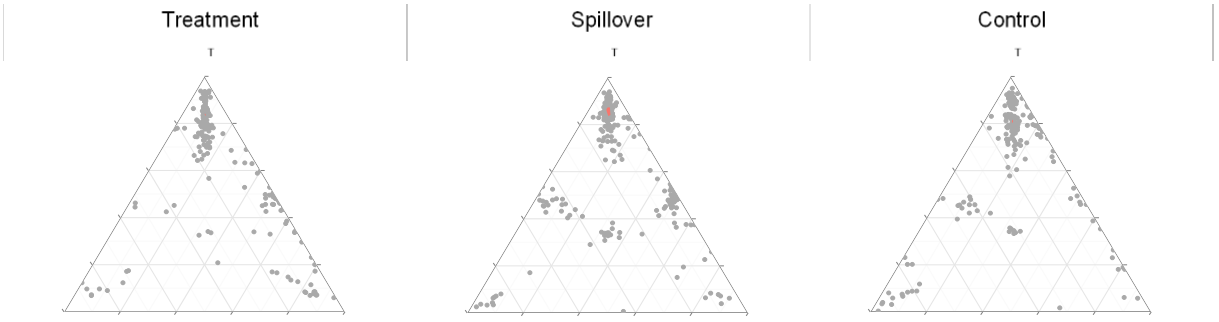
'General' observation 6: Lack of resources is the main reason (when compared to knowledge and health) farmers experience work-related difficulties.

A lack of resources is a dominating contributor to making work difficult, followed by a combination of a lack of resources and a lack of knowledge and skills (Figure 4-19).

Figure 4-19: Barriers, all sampling groups

Lack of knowledge and skills have been reported by the treatment sampling group more than any other groups, while the spillover group, more than any other group, suggested that it was both lack of resources and lack of knowledge/skills that made their work difficult. A combination of health issues and lack of resources was reported more by the treatment group (Figure 4-20). Although marginal, these differences may suggest that the treatment and spillover groups are more aware about the need to acquire new knowledge and skills, but may not have the means or resources to do so.

Figure 4-20: Barriers, by sampling group



Recommendation for further analysis: Exploring a small group of treatment group responses close to the 'lack of knowledge and skills' corner may indicate space for program improvement and provide insights on barriers to change.

V. IMPLICATIONS FOR SMP

The results and insights generated by a combination of methods used to analyze data in this study are:

A. OBSERVATIONS RELATED TO CHANGE IN FARMING PRACTICES:

- More self-perceived change in farming practices is reported by treatment group;
- Significantly more changes in farming practices, compared with control and spillover sampling groups were reported by the treatment group;
- Significantly more 'none' responses indicating no change to their farming practices were reported by the control group, compared with other sampling groups;
- Significantly fewer spillover respondents, compared to the other sampling groups, reported 'a lot' of changes in their farming practices;
- Participation in treatmnet group increases the likelihood of changes in farming practices;
- The scale of adopting new farming practices is related to the length of program participation and exposure to interventions.

B. OBSERVATIONS RELATED TO INTERACTION BETWEEN SCFS AND SHFS:

- All of the services provided by SCFs are used by SHFs, although to a varying degree;
- Out of machinery services, 'mechanized land preparation' on its own appears to be the biggest contributor to changes in farming practices;
- A combination of information-based services is the second largest contributor to changes in farming practices;
- 'Improved seeds' is the least used service and it seems to have little reported contribution to change in farming practices;
- The degree of reported change in farming practices is associated with the length of interaction between SCFs and SHFs;
- Higher frequency of interaction between SCFs and SHFs is associated with higher rate of change;
- COPAZA members have strong influence on the way treatment group respondents work;
- Relationship of SHFs with the SCFs and COPAZA tends to mostly result in reduced costs and increased revenue (especially for those using a greater variety of products and services) and slightly less so in diminished workloads.

C. OBSERVATIONS RELATED TO COMPARISON BETWEEN TREATMENT, SPILLOVER AND CONTROL GROUPS:

- Use of mechanical land preparation is associated with access to and information about COPAZA products and services;

- Fewer control group respondents reported using a new technique in the work they had recently completed;
- Access to SCFs and COPAZA members seems to be associated with good quality information that is important to farmers, but this information may not be that accessible;
- Treatment group is more likely to report that people looked for innovation compared to the other two sampling groups;
- Trust and listening to others in how to do work is not something people tend to follow. This especially applies to the treatment group;
- Lack of resources is the main reason (when compared to knowledge and health) farmers experience work-related difficulties.

D. STUDY SPECIFIC:

- Significant time is required for testing the research instruments prior to roll-out;
- For a study like the one that was seeking to interview project beneficiaries, it is important to pre-identify those beneficiaries before applying SenseMaker. That information was not available in this case, which impeded the selection of the sample and the collection of data;
- The selection of enumerators needs to be carefully considered to avoid any potential bias in the results. SMP originally intended to use SCFs or their children as enumerators, which would have biased the results, particularly relating to the relationship between the SHFs and the SCF;
- It is critical that there is adequate institutional buy-in for a successful trial. That requires that the requisite human and financial resources are allocated to the trial to enable the study to have an adequate level of rigor and to reach its desired sample size. Those resources need to be made available not only for the collection of micro-narratives, but also for the subsequent transcription of narratives and analysis;
- The role of the external facilitator, who leads the data collection and analysis process, is critical to ensuring a successful trial. To be able to make the trial useful, the facilitator should deeply understand the specific type of project that is being examined (in this case, market systems development) and the types of systemic changes that are being sought. Moreover, the facilitator needs to be very skilled in leading the discussion around the findings that are generated from the tool, to avoid confirmation bias and jumping to conclusions.

E. PROGRAM SPECIFIC

A number of program-specific recommendations are captured below. These are primarily derived from the analysis workshop discussions.[12]

- It may be profitable to invest in heavy machinery (e.g. bulldozer) to build capacity to provide services to SHFs with land that is difficult to access;

[12] These observations emerged from the discussion with the project team during the review of the initial findings of the trial application. They in some cases have built off of additional data provided in the narratives, but also clearly rely heavily upon the interpretation of the project team based on their own understanding of the context and not just on the data generated from SenseMaker itself.

- There seems to be an immediate need to have a sales and customer database and tracking system to enable scheduling to meet high demand and guarantee reliability of service;
- It would make sense to set up a back-up system for providing service with extra machinery, back-up driver and shared service technician;
- There seems to be a lack of market information which would allow people to make the best use of innovative farming techniques. This may potentially be a new service line for COPAZA members;
- There seems to be a need to establish trust with current and potential clients;
- Spillover group farmers (potential customers) tend to follow advice only when they also have some place to do things their way;
- Often people in this particular cultural environment need to see things and how they work before they adopt them, therefore the route to introducing more innovation and new farming practices is more likely to succeed if a 'showing' and 'giving examples' strategy is adapted by SCFs;
- People may find it difficult to not only book a piece of equipment, but also to access information about its availability, functionality, or use. Transparent scheduling and some guidance may help clients utilize this equipment better.

F. SELECTED RECOMMENDATIONS FOR FURTHER ANALYSIS:

- There is a small group of farmers from the spillover group that implied that people 'looked at others' and 'looked for innovation'. It would be interesting to see what makes this group be more open to innovation and risks. It may also be useful to understand the treatment group respondents who suggested people only 'respected tradition'.
- Valuable insights may be generated by exploring which respondents suggested that 'they did their work in a specific way because they trusted someone'. Similarly, it would be useful to explore what are the characteristics of those SHFs whose responses sit in the lower half of triad T8 (Figure 4-22).
- Focusing on clusters located towards the diminished workload corner (T5) and understanding who the respondents are may be helpful in understanding what is it specifically that allows farmers to diminish their workload. At the same time, it may be that other forces (e.g. weather) influenced costs and income levels.

VI. USES AND LIMITATIONS BY THE BROADER MARKET SYSTEMS COMMUNITY

The trial uncovered a number of findings regarding the applicability of SenseMaker to inform systemic change measurement efforts. These include:

- **SenseMaker typically requires supplementation with additional tools**. The findings that emerge from SenseMaker often provide interesting insights into perceptions and challenges. However, these

findings rarely can be used directly to inform projects on how to adapt their existing activities. For instance, the fact that a lack of resources is the main reason that farmers experience work-related difficulties raises a number of supplementary questions that a project would need to explore. For example, what type of resources is the constraining factor? Are these financial constraints, labor constraints, equipment constraints or other types? Each type would require different approaches to resolve it. Moreover, the systemic constraints that are causing that lack of resources do not come out of the tool findings. While the narratives can be listened to so as to gain further insights, this depends greatly on what the respondent chose to discuss in the narrative, so will usually not provide further insight into these supplementary questions. Importantly, unlike using standard qualitative measurement tools (e.g., in-depth interviews), in which responses can be probed, the SenseMaker process does not enable such follow-up questions to be asked at the time of the initial interview.

- **Interpretation of findings without supplementary research can lead to erroneous conclusions**. Given the less direct nature of the SenseMaker findings, it is critical that the people interpreting the findings have strong analytical capacity. The 'Program Specific' findings that are presented above derive from the analysis workshop discussions, and represent an attempt to hypothesize how the findings could impact the project's future programming decisions and translate into interventions. Yet without an understanding of the systemic constraints that have caused the responses, the proposed solutions can easily be unhelpful or even counterproductive. For example, investing in heavy machinery to address hard-to-reach smallholder farmers rests on a large number of assumptions that have not been confirmed or denied by the tool findings.

- **SenseMaker has a limited capacity to look at issues of attribution on a single application.** The Mozambique trial was intended to provide an opportunity to test SenseMaker's ability to ascertain the project's contribution to the observed results, by comparing across three cohorts of farmers that had been with the project for one, two or three years, and also by comparing with spillover and "control" groups. The latter approach can yield some interesting comparisons, but cannot control for any initial differences in the initial status of the groups. The comparison across cohorts might have been more likely to reduce that error (if project participants joining across cohorts are likely to have similar characteristics), but inadequate demographic information was collected to ascertain if this was the case. In such cases, a second application would have been required to compare both control and treatment groups over time.

- **It is often difficult to interpret triads**. The general observation 3, above, notes that a cluster of responses in the middle of the triad indicates that the three triangle aspects are equally strong. But given that triads cannot indicate the strength or weakness of an observation – only the comparative strength relative to other factors – such responses could equally indicate that none of the three options were particularly strong.[13] In such cases, additional work is required to understand whether good quality and important information is easy to obtain, or whether all of those three factors were similarly weak. Similarly, general observation 5 noted that farmers are mostly oriented to increasing their earnings over trusting someone and listening to others. This does not necessarily mean though that trust is weak, so much as the financial orientation is paramount.

[13] It can be inferred that all were at least somewhat strong if the triad options were all worded positively, as they were in this case, and that someone who feels negatively about all three options should answer n/a. This relies on a well-trained enumerator to guide the respondent on this.

- **SenseMaker requires significant capacity and buy-in to implement**. The SenseMaker application supported the observation of other trials that applying organizations need substantial expertise to be able to apply the tool. Given the high capacity requirements to use the tool and the significant learning curve that exists, it is best-suited for teams that already have strong monitoring systems and spare human resource capacity.

- **Applying SenseMaker to measure systemic changes requires a strong understanding of what types of changes are being sought**. Although SenseMaker's collection of micro-narratives leaves it open to capturing a diverse set of information, the design of the signification framework and related tools (triads, dyads, stones) will determine what types of information are uncovered. This is a less appreciated feature, that SenseMaker users will need to determine upfront how they define systemic change and therefore what they are specifically looking for. For instance, to use SenseMaker to understand norms and networks requires designing specific tools to capture those elements.

- **Some potentially interesting norms were uncovered**. The research uncovered a couple of interesting findings around what factors drive farmer decision-making. The orientation towards making money does potentially shed light on farmers' values. But in hindsight, the design of the triads could have been done differently to investigate norms and networks further.

- **Applying SenseMaker with just a single population makes it challenging to learn about networks.** In the case of SMP, the relationship between the smallholder farmers and the small commercial farmers is critical to the project's success. By applying SenseMaker only with the smallholder farmers, only one perspective on that relationship was captured.