

# **SysCom Program Evaluation 2017**

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## Executive Summary

The program of “*Long-Term Farming Systems Comparisons in the Tropics*” (SysCom) compares the performance of organic and conventional production systems in the tropics. SysCom has been undertaken by the Research Institute of Organic Agriculture (FiBL), in collaboration with local partners in Bolivia, India, and Kenya. The program has benefitted from the financial support of the Swiss Agency for Development and Cooperation (SDC), Liechtenstein Development Service (LED), the Coop Sustainability Fund, and Biovision. With additional contributions in kind from FiBL, and a total budget of nearly 11 million CHF, SysCom has been FiBL’s largest international program.

SysCom began work in Kenya 2005, in India in 2006 and in Bolivia in 2007, it is now near the end of Phase 3 (2015-2018). The core of SysCom has been a set of long term experiments (LTE) that has compared the performance of organic and conventional production systems in the 3 countries. The LTEs have been complemented with participatory on-farm research (POR), which has included participatory technology development and on-farm surveys. In Phase 3, about half the SysCom budget was used for local expenses in the 3 countries and half was for FiBL personnel, travel, management, communications, and general services.

### ***Evaluation objectives and methods***

This evaluation has been carried out to assess SysCom’s achievements to date, and to reflect on ways to capitalize on the program’s achievements, to boost future impact. The evaluation has been guided by a set of evaluation criteria, including relevance, effectiveness, achievements / impacts, sustainability, efficiency, and exit strategy. Specific questions were formulated for each criterion. The evaluation has been mainly concerned with SysCom-related activities carried out during Phase 3 (2015-18), but has also taken into account relevant work carried out during Phases 1 and 2.

The evaluation approach has combined external evaluation with peer review. “*Horizontal Evaluation*” (HE) workshops were organized in each country for participants and external peers to assess the work carried out by SysCom, the results in each country, and options for capitalizing on the results achieved to date. The external evaluator participated in these workshops. He also reviewed program documents and publications, interviewed program members and other stakeholders, and visited field sites in each country.

### ***Main findings***

The main findings of the evaluation are summarized here, in relation to the evaluation criteria.

#### ***Relevance***

The program is highly relevant to issues of sustainable agricultural development (Section 2.1). It is on track to make some important contributions to knowledge in the field of “sustainability science” (science for sustainable development). Local stakeholders value SysCom’s work and consider it relevant for local needs.

#### ***Effectiveness***

The program is on track to achieve the main objectives set out for Phase 3 (Section 2.2 and Annex 7).

#### ***Achievements and impact***

The program has an impressive list of achievements – some tangible, others intangible; some intended, others unanticipated – which are summarized in Section 2.3 and detailed in Sections 3 -5. It is too early to judge the program’s impacts on sustainability, since the research is long-term in nature and many outputs are only now emerging.

### *Sustainability*

If the program completes the publications in the pipeline, and those recommended, it will make a useful contribution to scientific knowledge, which, in turn, could eventually influence policy decisions and practical actions (Section 2.4). To have a more direct, short-term influence on agricultural systems in the study countries, more work will be needed with partners to influence policy making, farming practices, and public opinion in favor of OA.

### *Efficiency*

The country projects appear to have been carried out in a cost-conscious and cost-effective manner (Section 2.5). In Phases 1 and 2, the FiBL-based program team was very small, and could have benefited from a somewhat larger scientific input. In Phase 3, the expanded team has experienced some confusion of roles and responsibilities, which need to be resolved.

### *Exit strategy*

As outlined in Section 2.6, there are 2 basic options. The *first option* is to use the period 2018-2020 to wind things up, emphasizing:

- analysis, synthesis, and publication of results; and
- preparing to hand over facilities and responsibility for all activities to local partners by the end of 2020.

With this option, it is likely that most or all activities related to the LTE and POR would cease when SysCom funding and leadership ends. The LTEs might be maintained for some time, in some condition, but with greatly reduced or no data collection, preservation, or analysis. The *second option* is to continue with a Phase 4, which would focus on three main tasks:

1. generation, consolidation, and dissemination of knowledge on the long-term effects of OA and CA production systems;
2. generation, consolidation, and dissemination of knowledge of practical value to farmers, which addresses their most important priorities; and
3. empowerment of local partners (researchers, value-chain actors, and policy makers) to ensure the continuity of relevant R&D on organic agriculture after CCD funding ends.

### **Recommendations**

The main recommendation for SysCom's donors is to provide resources and support for a fourth phase of SysCom, along the lines outlined in this report.

Detailed recommendations for the country project teams and the FiBL program team are presented in Section 2.8 and in the country assessments (Sections 3.3, 4.3, and 5.3).

# 1. Introduction

## 1.1. Background and context of the evaluation

The program of “*Long-Term Farming Systems Comparisons in the Tropics*” (SysCom) compares different agricultural production systems in the tropics, with the aim of expanding knowledge on the performance of organic and conventional production system in contributing to sustainable agricultural development. SysCom was undertaken by FiBL, to increase knowledge of the potentials and limitations of organic agriculture (OA) and conventional agriculture (CA) production systems in developing areas. With SysCom, FiBL built on its extensive experience with a long-term trial comparing organic, biodynamic, and conventional agriculture in Switzerland,<sup>1</sup> and extended this type of comparative systems research to developing regions of the world.

Now in its third phase, SysCom is implemented by FiBL’s Department of International Cooperation, together with local partners in Bolivia, India, and Kenya. The program has benefitted from the financial support of four organizations, which are represented on a Coordination Committee of Donors (CCD).

From 2005 until 2016, the Swiss Agency for Development and Cooperation (SDC) provided 3.5 million CHF, Liechtenstein Development Service (LED) provided 3.2 million CHF, the Coop Sustainability Fund provided 1.9 million CHF, and Biovision provided 800,000 CHF. During this same period, FiBL provided 1.5 million CHF in in-kind contributions. With total funding of nearly 11 million CHF, SysCom has been FiBL’s largest international program.

### **Country context**

SysCom’s preparatory work started in Kenya in 2005, in India in 2006 and in Bolivia in 2007. In each case, farming systems were selected that are locally relevant and that were assumed to have high potential for organic production. In Kenya, the system under study includes maize, beans and horticultural crops. In Bolivia, cacao is the main crop. In India the main crop is cotton.

In Kenya, the LTE is being conducted at 2 sites and includes conventional and organic treatments that are being compared at two input levels in a 3-year, 6-season crop rotation with maize, beans, vegetables and potatoes. In India, the LTE compares organic, bio-dynamic, conventional, and conventional with genetically modified Bt cotton<sup>2</sup> cropping systems in a two-year crop rotation, with cotton, soybean and wheat as the main crops. In Bolivia, conventional and organic cocoa production systems are being studied in mono-crop (full sun) and agroforestry (shaded) systems.<sup>3</sup>

The socio-economic context of SysCom’s research has varied across the countries. In particular, there were strong export markets for organic Bolivian cocoa and organic Indian cotton already before the research projects began. In contrast, there was not yet a viable market for organic vegetables, potatoes, and corn in Kenya. As a result, issues of value-chain development have been much more important for the Kenyan project than for the Bolivian and Indian ones.

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<sup>1</sup> Known as the DOK trial. For information on this trial, see Mäder et al. (2002) and <http://www.fibl.org/en/switzerland/research/soil-sciences/bw-projekte/dok-trial.html>.

<sup>2</sup> Bt cotton is a genetically modified organism (GMO) cotton variety, which produces an insecticide to bollworm ([https://en.wikipedia.org/wiki/Bt\\_cotton](https://en.wikipedia.org/wiki/Bt_cotton)).

<sup>3</sup> Additional information on the SysCom program is available on the program website: <http://www.systems-comparison.fibl.org/>.

### ***Program objectives, components, and budget***

The main thrust of the LTE work is to produce scientific evidence on the benefits and drawbacks of organic vs. conventional agriculture for sustainable development. POR complements the LTEs by promoting the development and dissemination of locally adapted technologies for organic agriculture.

The Program Document for Phase 3 (Bhullar et al., 2014) states that the overall goal is to enhance knowledge and knowhow about the sustainability of different agricultural production systems in three tropical countries. SysCom has had two program components: (1) long term experiments (LTE), conducted on research stations; and (2) participatory on-farm research (POR). The expected outcomes of these program components are, respectively:

1. dissemination of solid agronomic, economic and ecological data on major organic and conventional agricultural production systems in selected project regions, which will enhance the knowledge base that can be used by different stakeholders; and
2. adoption of newly developed, locally-adapted technological innovations addressing organic farmers' needs, leading to improved yields and rural livelihoods in the mid- and long-term perspective (Phase 3 Program Document, page 17).

In the Phase 3 Program Document (Table 6 and Annex 6), 39% of the budget for country operations was allocated to Kenya, 16% to India and 44% to Bolivia. The bulk of the local expenses in the 3 study countries was for research and support personnel (48%), lab and related work (12%), travel (12%), and field expenses (8%). Only about 3% was allocated to dissemination, farmer training, and events; and 1% to capacity building of staff and students.

### ***Previous evaluations and program responses***

The SysCom program has evolved over time, in response to changing circumstances, lessons learned from experience, and the recommendations of periodic external evaluations. Near the end of Phases 1 and 2, external evaluations were carried out to take stock of SysCom's achievements and provide guidance for future work.

The evaluation of Phase 1 (Scheidegger, 2010) concluded that the program was highly relevant to a wide array of stakeholders, and the combination of LTE with on-farm work promised to produce useful results for farmers. Stakeholders acknowledged that the program's systems comparisons and long-term approach to assessing sustainability were unique for the tropics, and partners were highly committed to the program and its objectives. The trials were considered to be well-designed and implemented, but the reviewers felt that the effects of systems on parameters other than yield (e.g., produce quality and system resilience) should be measured to provide a more holistic picture of the different systems. The participatory technology development (PTD) component had started off well, but staff capacity for on-farm research needed to be strengthened. Program management was considered to be well organized, both at local level and at FiBL. All project sites were found to manage funds efficiently, but budgetary restrictions were severe, especially in Bolivia and Kenya. The review team's overall conclusion was that,

“the Project has excellent potential to reach its objective and to turn out results that will help to make mainstream agriculture more sustainable. International and especially domestic demand for organic products is increasing and the Project will be in a good position to provide answers on how this opportunity can be exploited” (pages iii-iv).

In response to this evaluation, SysCom strengthened the design of the LTEs, broadened the collection of information for system comparisons, and strengthened staff capacities for PTD. The evaluation of Phase 2 (Studer, 2014) concluded that SysCom was very relevant at global as well as local level, with regard to the production systems as well as the specific

commodities under study. Overall, the program was seen as efficiently implemented, having made commendable progress, and being on track in achieving its outputs, outcomes, and objectives. “Huge amounts” of data had been collected on the systems investigated. The evaluators felt that some management practices in the LTE should be adjusted, to better depict reality and represent “best practices.” Some LTE documents needed to be further elaborated and updated. PTD activities were seen as addressing key issues of interest to farmers and other stakeholders, and were considered to be very useful for enhancing the local relevance and image of the project. Validation trials were increasing the confidence of farmers and others in the project and its results. It was recommended that validation trials be included in the program document for Phase 3, and that more detailed research concepts and plans be prepared, to enhance the rigor and utility of PTD and validation activities. Delays were noted in analysis and interpretation of the data collected and the publication and dissemination of research results. It was recommended that publication and dissemination strategies be further elaborated, and that more effort go into public relations and networking. The evaluators noted that available resources had been used efficiently, thanks to the dedicated, capable, and well-organized professionals in the three countries and at FiBL. The evaluation team’s main recommendation was that

“the donors continue and possibly expand their financial support (to allow for the allocation of sufficient human resources) for the SysCom project – a unique research project that undoubtedly fills an important knowledge gap and is well on track in achieving its objectives” (page vi).

Operational recommendations contained within the main evaluation report were taken into account in planning Phase 3. The Phase 3 Program Document (Bhullar et al., 2014) includes an increase in the program budget, and allocates a larger share of the budget to scientific staff based at FiBL, to support the three country teams and facilitate data analysis and publication of research results. Three new scientists were hired to work full-time on SysCom during Phase 3. Emphasis was placed on strengthening research methods, analysis of data collected, and publication and dissemination of research results.

Nevertheless, funding available from SysCom’s four donors fell short of the total amount budgeted for Phase 3. FiBL made about 1.5 million CHF worth of in-kind contributions, and attempted to fill the remaining gap with additional funding from new donors, but was unable to do so. As a result, the resources available for some field activities and data analysis fell short of the original goals for the third phase.

## **1.2. Evaluation objectives and methods**

### ***Objectives***

As outlined in the terms of reference (Annex 2), this evaluation has two main objectives:

1. *To assess SysCom’s achievements to date. What have been the main achievements so far? What achievements and impacts may be anticipated in the near future?*
2. *To reflect on ways to capitalize on SysCom’s achievements, to boost future impact. What achievements are most meaningful to boost future impact? How best to capitalize on the results obtained to date?*

The evaluation has been guided by a set of evaluation criteria<sup>4</sup> – relevance, effectiveness, achievements / impacts, sustainability, efficiency, and exit strategy – and specific questions for each criterion (Annex 3).

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<sup>4</sup> These criteria are based on the DAC criteria for evaluating development assistance:  
<http://www.oecd.org/dac/evaluation/daccriteriaforevaluatingdevelopmentassistance.htm>.

The evaluation focuses mainly on SysCom-related activities carried out during Phase 3, at FiBL and in Bolivia, India, and Kenya, but also takes into account relevant work carried out during Phases 1 and 2. The primary intended audience for the evaluation includes the program's donors, implementers and key partners in the 3 countries where SysCom has carried out its work.

### **Methods**

Based on experiences with the two previous external evaluations, CCD members and the SysCom team felt that the present evaluation should be more collaborative and participatory in nature, so that the evaluation process would serve as a learning opportunity for stakeholders, and the evaluation report would better reflect stakeholders' views. An evaluation approach was developed that combined external evaluation with peer review. "Horizontal Evaluation" (HE) workshops were organized in each country for participants and external peers to assess the work carried out by SysCom and the results in each country, and to reflect on options for capitalizing on the results achieved to date.<sup>5</sup> An external evaluator specialized in participatory action research utilization-focused evaluation of agricultural innovation participated in these workshops, as a member of the external peer group (Annex 4).

Participants at each HE workshop included members of the country project team, who worked together as the "internal group," in workshop exercises and individuals who were not directly involved in the country project, who worked together as the "external group". Each group worked independently on two main tasks:

1. to identify the project's main accomplishments, and areas where accomplishments could have been greater; and
3. to identify priorities for completing SysCom Phase 3 and for possible work beyond the end of Phase 3.

In each case, the results of the internal and external groups were strikingly similar. The results of the group work reported in the Horizontal Evaluation Workshop Reports (Bernet, 2017a; 2017b; 2017c) have been major inputs for development of the present report's sections on "achievements/impacts," "exit strategy," and "recommendations."

The external evaluator also reviewed program documents and publications (Annex 5), interviewed program members and other stakeholders, and visited field sites in each country (Annex 6).

Exhibit 1 summarizes the timetable for the evaluation. At the end of each country visit, the evaluator presented preliminary findings and received feedback from stakeholders at debriefing sessions in each country. After the third country visit, in early October, he presented overall findings and recommendations at a meeting of the CCD in Switzerland. Subsequently, a draft report was prepared and submitted on November 15. Based on feedback from the CCD, FiBL, and other program stakeholders, a final version of the report was prepared and submitted on January 23, 2018.

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<sup>5</sup> The horizontal evaluation methodology is detailed in Thiele et al. (2006; 2007).

**Exhibit 2. Timetable for the SysCom evaluation (during 2017)**

<b>Evaluation tasks</b>	<b>Timing</b>
Initial briefing of external evaluator and workshop organizers	March
Sharing of program documents with evaluator	April +
Workshop preparation	April +
Horizontal Evaluation Workshops in the 3 countries Kenya Bolivia India	June 6-7 July 25-27 September 19-22
Workshop reports	Early October
Presentation of main findings to CCD/SysCom (debriefing)	October 2
Presentation draft report	November 15
Preparation of CCD / SysCom comments on draft report	December 6
Submission of final version of the evaluation report	December 22

***Strengths and weaknesses of the evaluation***

The evaluation benefitted greatly from the knowledge and expertise of more than 60 individuals who participated in the HE workshops in Bolivia, India, and Kenya; and from the excellent set of program documents and publications made available by the program team.

On the negative side of the ledger, two weaknesses of the evaluation are that the present report was prepared by a single external evaluator who spent only 7-10 days in each study country; and systematic information on the use of research outputs and resulting changes in production and livelihoods was not available at the time of the evaluation.

In reading the report, it should also be kept in mind that valid comparisons of mature organic and conventional farming systems would require information from LTEs implemented over at least two decades. Since SysCom has only been operating for a decade or so in the study countries, the research results and outcomes reported on here should be considered as preliminary and subject to revision on the basis of future developments.

***Concepts and terms used in the report***

In the present report, following Seufert and Ramankutty (2017, page 1), ***organic agriculture*** is defined as “a farming system that follows organic certification guidelines (for example, avoidance of synthetic fertilizers and pesticides) and that is intentionally organic (that is, excluding organic-by-default systems that do not apply synthetic inputs due to lack of access).” As Adamtey et al., (2016, page 62) note, “organic agriculture combines a number of practices including the application of organic fertilisers, intercropping with nitrogen-fixing trees or legumes or with other crops that produce synergies, extended crop rotations with greater phenological diversity of crops, biological pest control, the use of locally adapted seeds/breeds, and the re-integration of animals on farms. It also precludes the use of synthetic inputs such as pesticides, herbicides, hormones and the preventative use of antibiotics (all defined by organic standards).”

In contrast, ***conventional agriculture*** is defined as “mainstream agriculture as dominantly practiced today. This can represent both high-input and low-input systems, depending on the region” (Seufert & Ramankutty, 2017, page 1).

***Agroforestry*** is a land use management system that intentionally combines agriculture and forestry to create integrated and sustainable land-use systems. Agroforestry takes advantage of the interactive benefits from combining trees and shrubs with crops and/or livestock, in order to create more diverse, productive, healthy, ecologically sound, and sustainable land-use systems (NAC, n.d.).

**Successional agroforestry systems** (SAFS) “seek to mimic the diverse structure of natural forests and at the same time produce marketable products. In comparison with other agroforestry systems, SAFS strive to create food producing systems in advanced stages of succession, managing subclimax or climax plant communities where high niche variability results in high biodiversity and efficient use of resources. Utilizing native as well as introduced plant species, a forest is created that is structurally analogous to a natural forest of the local area, providing the same ecosystems services, restoring the environment and sustaining local communities. SAFS are designed to follow natural succession, leading to increased complexity and structural diversity in time. Pioneer species, apart from producing marketable goods, create conditions for the successful establishment of climax species. This way, potential productivity of every particular site can be maximally reached” (Selecky et al., 2017, pages 1-2).

**The SysCom program** refers to all the activities carried out by professionals affiliated with SysCom, including both country-level and global or cross-cutting activities. In contrast, **SysCom’s projects** refer specifically to work in Bolivia, India, or Kenya (SysCom-Bolivia, SysCom-India, and SysCom-Kenya).

In this report, depending on the context, the term **sustainability** may refer either to sustainable development or to the sustainability of SysCom’s results. In the broadest sense, following Clark et al. (2017, page 4570), we use “sustainability” and “sustainable development” interchangeably as the “promotion of inclusive human well-being; this is to say, well-being that is shared equitably within and across generations and is built on the enlightened and integrated stewardship of the planet’s environmental, economic, and social assets.” In assessing the sustainability of SysCom itself, we refer to the potential for program or project activities and/or benefits to continue after the formal termination of SysCom as it is currently funded and managed.

### **1.3. Organization of the report**

After this Introduction, Section 2 presents the main findings of the evaluation in relation to the evaluation criteria and guiding questions, and recommendations, for consideration by FiBL and the CCD. Sections 3, 4 and 5 present more detailed findings and recommendations for SysCom-Kenya, SysCom-Bolivia, and SysCom-India. Annexes 1 – 7 provide a list of acronyms and abbreviations used in the report, the evaluation terms of reference, the evaluation criteria and questions, information on the evaluator, individuals interviewed for the evaluation, field visits, program documents consulted, and results of a self-assessment by the SysCom team, carried out in early 2017.

## 2. Main Findings and Recommendations

This section presents the main findings of the evaluation, in relation to SysCom’s relevance, effectiveness, achievements and impacts, sustainability, and efficiency. These findings are followed by reflections on possible exit strategies, general observations and issues identified during the evaluation, and recommendations for consideration by FiBL and the CCD. More detailed findings and recommendations for individual country projects are presented in Sections 3 – 5.

In keeping with the format used for the self-assessment of outputs and outcomes presented in SysCom’s Annual Report for 2016 (Annex II), in this section, the overall assessment in relation to each evaluation criterion or question is indicated with traffic-light colors:



Indicates a positive assessment



Indicates a generally positive assessment, with some reservations



Indicates serious concerns

### 2.1. Relevance

#### *How relevant has the program been?*

Highly relevant

- SysCom is working within the dynamic new field of sustainability science.<sup>6</sup>
- SysCom is contributing to global knowledge on organic agriculture (OA) in the tropics – an area in which there has been very little research, in relation to conventional agriculture (CA).
- SysCom’s long-term experiments (LTE), comparing OA and CA systems, are unique in the tropics.
- Participatory on-farm Research (POR) is helping to identify key production constraints, and to develop solutions to them.

#### *Continuing / future relevance of the program?*

Highly relevant

- The OA treatments in the LTEs have not yet reached maturity (especially the cocoa trial in Bolivia). Stopping at this point would truncate the work prematurely, and results would underestimate the contributions of OA to sustainable development.
- “Best practices” for both OA and CA are evolving, as technical knowledge advances. In particular, more adaptive research is needed to improve OA practices, both on farms and in the LTEs.
- At present, none of the partner institutions in the 3 countries has the capacity to assume full responsibility for the SysCom agenda. In Kenya, ICIPE and KALRO are research organizations, but without mandates for OA. In Bolivia, ECOTOP is an NGO, El Ceibo is a producer’s organization, and the Institute of Ecology (National San Andres University) is a specialized university program. None of these has the mandate or capacity for research on OA or for comparative research on production systems. In India, bioRe-India Ltd. and bioRe Association are production and marketing-focused organizations.

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<sup>6</sup> For information on this emerging field, readers are referred to the web page of the Proceedings of the National Academies of Science (<http://sustainability.pnas.org>); Harvard’s Sustainability Science Program (<https://www.hks.harvard.edu/centers/mrcbg/programs/sustsci>); and Wikipedia ([https://en.wikipedia.org/wiki/Sustainability\\_science](https://en.wikipedia.org/wiki/Sustainability_science)).

- Workshop participants and representatives of the organizations involved with SysCom express strong interest in continued leadership and support from FiBL in the immediate future, with a gradual phasing out of leadership.
- Workshop participants see capacity development and empowerment as essential for SysCom to phase out without a collapse of local activities, and a loss of potential future benefits of the work underway.
- The work is highly relevant, locally. Organic cotton is a key crop in Madhya Pradesh, India. Maize, potatoes, and vegetables are important crops in the Kenyan highlands and there is strong concern for the dangers of conventional production of these food crops. Organic cocoa is an important crop in the Alto Beni region of Bolivia, and there is considerable interest in developing agroforestry (AF) and successional agroforestry systems (SAFS) systems.

## 2.2. Effectiveness

### ***To what extent have the objectives been achieved?***

On track

There has been good progress toward achievement of most objectives. This augers well for achievement of the program's objectives by the end of Phase 3:

- Impressive LTE's have been established and maintained at the 3 research sites.
- A massive amount of quality information has been collected on relevant system parameters:
  - *Agronomic*: Yield, pests and diseases, soil fertility ...
  - *Ecological*: Biodiversity, carbon balance ...
  - *Economic*: Economic yield, costs and benefits ...
- The trials serve as platforms for complementary studies, student research, and knowledge-sharing events.
- Local staff and students have increased knowledge on research for sustainable development.
- On-farm trials, which address important bottlenecks in OA, are being used to disseminate information to farmers, extension agents and other stakeholders.

On the other hand, dissemination of research results, via publications, policy briefs, and other formats has lagged behind initial, perhaps unrealistic, expectations. Dissemination of research results has increased sharply in 2016 and 2017, auguring well for the full achievement of these objectives by the end of Phase 3.

### ***Have there been additional, unanticipated achievements?***

Many

Yes. See the following section on achievements and impacts.

## 2.3. Achievements / Impacts

### ***What types of achievements have there been?***

Many

Each country project has registered numerous achievements – many unanticipated. A selection of the main achievements follows for each country.<sup>7</sup>

<sup>7</sup> The main source of information on these achievements is the group work carried out during the Horizontal Evaluation workshops.

### *Kenya:*

- Getting OA “on the radar” at several local, national, and international organizations working in Kenya (e.g., creation of the Soil Health Program at ICIPE, increasing KALRO’s OA research)
- Effective networking and teamwork, to mobilize expertise in different organizations, to address a common research agenda on OA
- Strengthening two-way communication between OA researchers and key stakeholders, including dissemination of research results to farmers, researchers, policy makers, and others, through field days, workshops, and conferences
- Uptake of some organic practices on the farms of collaborators and their neighbors, and some livelihood improvements

### *Bolivia:*

- Development of the research and training facilities at Sara Ana
- Development of the SAFS research and demonstration plots, which are unique in the world
- Knowledge exchange among cocoa farmers, researchers, extension agents, development workers, and public officials via meetings at the Sara Ana facility
- Training and empowerment of Sara Ana’s personnel, which is highly committed to SysCom’s research and development objectives and approaches
- Large and high-quality publication output on diverse topics

### *India:*

- Extensive program of POR, which addresses relevant problems.
- Establishment and smooth operation of a Farmer Advisory Board, to assess research plans and results, with stable membership of 10 organic and 10 conventional farmers
- Development of research infrastructure (including soil and entomology laboratories)
- Excellent working relations, commitment, and support of bioRe India Ltd.
- Commitment, competence, and stability of local staff, many of who were previously bioRe extension agents.

### ***What more could have been achieved?***

Participants at all the HE workshops identified the following things that would have been useful, generally:

- Keeping analysis of all collected data up to date
- Integration of results of individual studies
- Collection of systematic information on dissemination and adoption of innovations
- Greater empowerment of local organizations to conduct systems research, analyze the data generated, prepare research publications, and disseminate results in appropriate formats
- More work on pests and diseases
- More work on environmental services and health issues<sup>8</sup>

In India, it was felt that it would have been important to complete negotiation of an agreement with the Government of India, and to involve more Indian students in the research.

In Kenya, participants would have liked to see more work on marketing and value-chain development for organic produce.

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<sup>8</sup> These issues were not included in plans for Phase 3, but are becoming recognized as more important over time.

In Bolivia, participants would have liked to see the construction of better facilities for cocoa fermentation and drying and better living quarters for workers.

### ***What factors have influenced achievements?***

#### *Challenges:*

In their systems comparison work, the project teams faced a number of general challenges, including the following:

- Inherent novelty and complexity of the research undertaken.
- Limited scientific knowledge base on OA in the tropics,
- Limited engagement of public research, extension, and educational institutions in organic agriculture (“Green Revolution” paradigm).
- Lack of appropriate varieties and seed supplies for OA

In Kenya, an additional and very significant challenge was the loss of local and international project managers during Phases 1 and 2, leading to staff demoralization, delays, and accumulation of a backlog of data that had to be processed and analyzed in Phase 3

The Bolivian team faced several specific challenges:

- Isolation of Sara Ana, and need to build research and support facilities, virtually from scratch
- Absence of a local research organization able to manage research work
- Inability to hire and retain a qualified local scientific coordinator
- Weak institutional support for Bolivian university students and limited incentives for them to complete theses
- Difficulty of establishing a functional Steering Committee

In India, two specific challenges were identified:

- Lack of a formal agreement between FiBL and GOI, which has limited involvement of national institutions, and access to national funding and to expertise and laboratory infrastructure in the public-sector research organizations
- Remote location of the bioRe campus, which makes it difficult to attract and retain research personnel, students, and visitors from other parts of the country

#### *Factors that have favored SysCom’s achievements:*

During the workshops, four general factors were identified as having facilitated SysCom’s work:

- Stable, long-term funding
- High-level of commitment of participating researchers (and their organizations)
- SysCom’s emphasis on learning and capacity development<sup>9</sup>
- Stable research leadership, coordination and support during Phase 3

In specific cases, additional favorable factors have included:

- Stable and highly committed leadership at FiBL and Ecotop (Bolivia)
- Working in the heart of India’s organic cotton industry (which accounts for a large part of global cotton supplies (India))
- Being hosted and supported by bioRe, and based at their campus (India). Since bioRe and its partner organizations work with the entire value chain for organic cotton, this has provided a positive environment and practical orientation for SysCom’s work.

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<sup>9</sup> The apparent inconsistency between this observation and the small fraction of the SysCom budget allocated to learning and capacity development (see again page 8 above), results from the relatively heavy involvement of students, working on thesis projects, in SysCom research work.

- Strong national Steering Committees/Advisory Boards (India, Kenya)
- Strong system-based research approach missing in Kenya during Phases 1 and 2, and introduced in Phase 3

**Potential future impact: How to capitalize on achievements?**

2 pathways

There are 2 broad impact pathways:

1. *Contributions to global knowledge on the comparative performance of organic and conventional farming systems, and on related topics* (e.g. crop, nutrient, and pest management, varieties, and seed sources). To make these contributions, SysCom needs to make its research results widely available to scientific and policy-making communities, through peer-reviewed publications that are available on the Internet. Placement of a few key papers in high-impact journals will be important (e.g., Science, Nature, PNAS).
2. *Contributions to local innovation in organic crop production.*
  - In *India*, to have a significant future impact on organic cotton production, SysCom needs to work more closely with bioRe India Ltd. in applied research that addressed farmers' most pressing production problems.
  - In *Bolivia*, to promote innovation in cocoa farming, SysCom will need to strengthen its adaptive research and its links with El Ceibo and other producer organizations. In light of the small program investments in POR, the results have been promising. But more will be needed.
  - In *Kenya*, where there are no established markets for organic produce (with premium prices), more work will be needed to influence policies and develop organic market chains.

With the current staffing and resources, SysCom cannot work intensively and effectively in both of these areas. Therefore, in the future, and especially if the program has fewer resources, sharper priorities will need to be set, and/or greater synergies achieved between the 2 pathways.

**2.4. Sustainability**

**To what extent is SysCom contributing to sustainable development?**

Early contributions

SysCom is generating valuable information on important sustainability issues, which is serving as “global public goods” – being freely available to all interested parties. In this way, it is contributing to the knowledge base in the field of sustainable science. To the extent that SysCom’s information is used by researchers, development professionals, and policy makers, it will contribute to sustainable development. Since SysCom’s publications are only recently being produced, it is too early to assess this type of impact.

To date, the direct impact of the project on environmental sustainability in the study countries has been limited, for at least 2 major reasons. First, the LTE’s have not been in place long enough for the systems under study to reach full maturity (particularly the case with AFS in Bolivia). Second, SysCom’s emphasis, reflected in the budget and activities, has been on research (the LTE), rather than on the development impacts through POR. The dissemination of SysCom’s results to farmers has been limited and localized. Due to the inherently small reach of its on-station and on-farm research, SysCom should not be expected to make significant direct contributions to environmental sustainability in the study countries.

**How sustainable are SysCom’s achievements?**

Not very, not yet

SysCom’s is beginning to make useful contributions to scientific knowledge, which can be put to use in future in policy-making and development efforts. The project needs to continue to

publish the results of specific studies and put more priority on summary reports that address the program’s main hypotheses.

SysCom will produce sustainable benefits at the country level to the extent that:

- its results are used in farmer extension and education, inform policy makers, and influence their decisions in favor of OA;
- local partners develop needed capacities and become empowered to continue with SysCom research activities; and
- there are viable market chains for organic produce.

The close working relations between SysCom-India and bioRe, and bioRe’s strong interest in disseminating results, auger well for the continuity of activities and benefits in India. In Kenya and Bolivia, more work will be needed to develop effective dissemination strategies and mechanisms.

Capacity development has not been priorities of SysCom to date, but the program may wish to place more emphasis on this in future. There has been some progress with capacity development, particularly at the local level, but much less so at organizational level.

There are viable market chains for organic cocoa in Bolivia and for organic cotton in India. However, there are not yet organic markets that pay premium prices for the associated or rotation crops in the Bolivian cocoa systems and the Indian cotton systems. Similarly, Kenyan farmers cannot yet obtain premium prices for organic potatoes, vegetables, and maize. This highlights the importance of VCD for organic crops in all the study countries.

### ***What will happen in case the project’s activities stop?***

Work would stop

If SysCom were to suddenly cease activities, it is likely that ongoing SysCom research and development work would cease, or be very sharply reduced in scope in the 3 countries. (See “Exit Strategy” below).

## **2.5. Efficiency**

### ***How efficiently has the program been implemented? Were the available resources used efficiently?***

#### *Efficiency of country projects*

High

Overall, the use of resources seems to have been efficient. Exemplary trials and facilities have been developed at the research sites. In **India**, the stability of local project personnel and the fact that several staff members worked previously with bioRe’s extension team have contributed to the project’s overall efficiency. SysCom-**Bolivia** has developed and operated the Sara Ana facility with limited resources. Staff at Sara Ana are clearly committed to their work and perform at high levels. Members of the SysCom-**Kenya** team, both in Switzerland and in Kenya, have been highly committed to the project and have often gone “beyond the call of duty” to resolve critical situations and complete research and related activities effectively and efficiently.

#### *Efficiency of the global program*

Reasonable

During Phases 1 and 2, the SysCom core team, at FiBL, was understaffed, relative to the program’s growing research agenda and unanticipated needs for extensive data analysis. Limited staffing and some staff changes led to some delays in data analysis and publication of research results.

During Phase 3, as three junior scientists joined the FiBL program team, roles and responsibilities have sometimes been unclear. Mounting pressures to synthesize results and prepare publications, while continuing to supervise country-level work and analyze new

information generated in the trials, has also led to some frustrations and tensions that may be limiting productivity and efficiency.

***Did the budget cut have any negative effects?***

Yes

At all sites, budgetary limitations have limited the analysis of soil, plant, and other samples that have been collected. In some cases, this has resulted in a backlog of samples that have not been analyzed to date. In India and Bolivia, development of laboratory facilities has been slower than anticipated.

***How efficiently have partners/beneficiaries been involved?***

Variable

Success in partnering has varied over time and across research sites, and requires continuous attention. In **Bolivia**, it has proven difficult to bring the local partners together for regular meetings of the Steering Committee, and the representatives have changed from meeting to meeting. In **India**, relations with bioRe have been very solid, but it has not been possible to successfully conclude negotiations for a formal agreement between FiBL and the Government of India, limiting collaboration with local organizations and access to funding sources. In **Kenya**, partners expect honoraria for time spent on SysCom work.

## 2.6. Exit Strategy

***What challenges will need special consideration, and what measures could be useful for coping with them? How should an effective exit strategy be designed (i.e. when phasing out the funding of CCD)?***

There was a consensus among project team members in the 3 countries that they have benefitted greatly from working with FiBL, and hope to continue with this relationship in the future. At the HE workshops, participants expressed that, although they felt it was important to continue with the LTE, it would be impossible at present without FiBL's leadership and support.

FiBL has played particularly important roles in:

- international networking,
- identifying funding opportunities and negotiating grants,
- research leadership, and
- mentoring of local scientists and students.

On the other hand, the country teams have learned and benefitted relatively little from SysCom work in other countries. In future, SysCom should either: strengthen interaction, cross-site visits/work, and synergies among the 3 country project teams; or develop independent bilateral projects involving FiBL and country teams.

In **Kenya**, FiBL has two relatively strong research partners in ICIPE and KALRO – relatively, because even in these organizations research leadership is highly personalized, and if a few key individuals left, the situation could change quickly. Moreover, OA is not yet a recognized research priority in these organizations. This might be an opportune moment to pursue more formal organizational commitments to OA and to SysCom within ICIPE and KALRO. Formal institutional commitments would improve access to local and international funding sources and pave the way for FiBL to hand over leadership of SysCom to ICIPE and KALRO a few years from now.

In **India**, bioRe's work is focused on contract farming, extension, and farmer education. It is beginning to build up its capacity for applied research (illustrated by its taking on responsibility for cotton breeding); and it intends to continue to expand its applied research work. However, for bioRe to take over leadership of the SysCom work, it would need to significantly improve the capacity of key staff members in research design, analysis and

statistical skills. It is not clear if bioRe is willing or able to make the needed investment in scientific skills.

In **Bolivia**, through the involvement of university professors and students, and particularly the involvement of Ecotop (with trainings for farmers and technicians), the project has helped to develop a cadre of knowledgeable applied researchers and development workers who are committed to organic cocoa production in AFS, and who can be expected to continue to work along these lines after the project ends. However, no institutional partner has been identified that could lead SysCom research activities in the immediate or near future. On the other hand, local partners express strong interest in further development of Sara Ana as a training and educational facility. In light of these institutional realities, the most realistic course of action might be to implement a two-pronged extension of SysCom-Bolivia, led by FiBL, that would:

- continue with the LTE and produce peer-reviewed research publications that respond to SysCom’s core research questions; and
- further develop Sara Ana as a center for applied research and capacity development related to sustainable cocoa production, AFS and environmental education, which could eventually be taken over by El Ceibo and other local partners.

## 2.7. General observations and issues

This section presents a number of general observations and issues that have emerged during the evaluation, which do not fall neatly under one evaluation criteria or question.

### 1. *The objectives and type of research done by SysCom are more ambitious, complex, and demanding than those for conventional agricultural research programs.*

Whereas conventional agricultural research generally compares the performance of individual agricultural practices, and aims to bring about changes in such practices, SysCom’s research seeks to compare the performance of entire agricultural production systems and bring about systems change. In conventional agricultural research, the practices or technologies in question tend to be input-intensive ones that embody knowledge within the inputs (such as hybrid varieties and chemical fertilizers and pesticides). In comparison, SysCom is mainly concerned with knowledge-intensive technologies, such as the use of mulch, crop rotations, and organic fertilizers, which require considerable knowledge on the part of farmers. Finally, whereas conventional research has short research cycles – often a single crop cycle – SysCom’s research is concerned with the performance of different production systems over the long term.

	<b>Conventional research</b>	<b>SysCom research</b>
Unit of comparison	Practices	Systems
Goal	Change of practices, within system	System change
Type of technology	Input-intensive	Knowledge-intensive
Time frame of research	Short	Long

### 2. *There is some confusion over SysCom’s ultimate objectives and how they are to be achieved.*

Members of the SysCom team – at FiBL and in the study countries – generally view SysCom as a “research” program, aimed at generating new knowledge on the performance of organic and conventional agricultural production systems. This view is consistent with SysCom’s budget for local costs in SysCom’s Program Document for 2015-2018 (Bhullar et al.,

2014, Table 6), which allocates 82% of funds to the LTE and only 18% to POR. In this budget, only 3% of the funds is ear-marked for dissemination, farmer training and related events; and only 1% is for capacity building of staff and students.

In contrast to these views and budgetary allocations, SysCom's expected outcomes refer to "**dissemination** of solid agronomic, economic and ecological data on major organic and conventional agricultural production systems" (LTE component) and "**adoption** of newly developed, locally-adapted technological innovations addressing organic farmers' needs" (POR component) (Bhullar et al., 2014, page 17, emphasis added).

The impact chain presented in the Program Document (Annex 7), seems to assume that SysCom's research results will automatically be taken up by extension and training agencies and adopted by farmers, without significant effort by SysCom to influence policies or promote the dissemination and use of its research results, for example, by working with policy makers, extension agencies and farmers groups.

If SysCom's objectives include the adoption of new, organic practices and changing production systems (i.e., shifting from conventional to organic production), then more explicit strategies should be developed to achieve these goals, and more resources should be provided for the dissemination of research results and working with policy makers, farmers' organizations, and other relevant stakeholders. Engagement with a range of stakeholders and more effective two-way communications will be needed to ensure that POR is focusing on farmers' most pressing concerns and that relevant research results are being promoted and disseminated effectively.<sup>10</sup>

**3. How does POR relate to the LTEs?** Related to the previous point, there is also some confusion over how POR does, or should, relate to the LTEs. In agricultural research and development programs, POR is often used to identify problems that merit on-station research, or to test and validate technologies developed on research stations. In SysCom, the link between POR and LTEs is not so clear. Since the LTEs were designed to make **long-term** comparisons of organic and conventional production systems, there has been a tendency to maintain treatments over time. On the other hand, POR is intended to respond to farmers' immediate needs, which may change rapidly over time. As a result, the LTEs and POR activities have been rather independent lines of research, with little relation among them. This evaluator would encourage the team to explore ways to improve the overall effectiveness and efficiency of the SysCom program by strengthening the links between the LTEs and the POR.

**4. Allocation of resources to the LTEs vs. the POR.** There are three main arguments for expanding POR activities, which relate to strategic, practical, and ethical considerations. First, as argued in the previous point, if the program is expected to promote the adoption of OA practices and bring about changes in production systems, the program's strategy needs to place more emphasis on POR. Second, it is unlikely that SysCom could partner and work effectively with local institutions or farmers in Bolivia, India, or Kenya if it did not promise and deliver significant benefits to the country's farmers. Third, it would be unethical to operate a research project in these countries with the exclusive purpose of producing new knowledge of interest and use to researchers or producers in other parts of the world, which had no direct benefit for local farmers. For these reasons, it is not surprising that participants in the HE workshops encouraged the project teams to expand POR activities that would be of benefit to local producers.

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<sup>10</sup> Clark, et al. (2017), Cash et al. (2003), Diaz Anadon et al. (2016), and Hering (2016) identify key aspects of crafting useful knowledge and making technological innovation work for sustainable development.

**5. Allocation of resources to the three country projects.** The time and resources needed to run LTEs and generate useful research results vary widely from case to case, depending on characteristics of the crop (e.g., annual vs. perennial) and also on attributes of the local physical, socio-economic, and institutional environment (costs of reaching and working at local sites, local availability of facilities, etc.). As noted in the Section 1 of this report, during Phase 3, Bolivia was assigned 44% of the SysCom budget for in-country expenses; Kenya was allocated 39%, and India 16%. Part of this disparity was due to the costs of developing the Sara Ana research facility in Bolivia. Additionally, Bolivian workers are more costly, due to minimum wage and benefit requirements, and the surface area of the research trials is larger. Nevertheless, this might be an appropriate time to reassess the relative costs and benefits of R&D activities at the 3 sites and to make appropriate readjustments if indicated.

**6. Is the whole greater than the sum of the parts?** SysCom is a global program with 3 country projects. During Phase 3, the projects are producing valuable research results, documented in publications and other formats and disseminated in national, regional and international events. So far, little effort has gone into synthesizing SysCom's global research results. Synthesis work is beginning, but faces the challenge that country teams have worked in relative isolation, and none of the SysCom team members is personally familiar with the work conducted at the 3 sites. To capitalize on the opportunities for comparative analysis presented by SysCom as a global program, FiBL needs to promote more effective teamwork, knowledge sharing, and cross-site learning. Members of the FiBL core team should be personally familiar with the work being conducted at all the research sites, and country project personal should be encouraged to travel to other sites, on specific missions.

The HE workshops should have provided an excellent opportunity for program-level knowledge sharing and learning. However, only 1 of FiBL's junior scientists and 2 of the country team members participated in all 3 of the workshops. FiBL's Senior Staff members participated only in the HE workshops for which they were personally responsible. Travel between the study countries is difficult, time-consuming, and costly, and some researchers were unable to participate in some workshops because of difficulties in obtaining visas and making the needed travel arrangements. As a result, this opportunity for knowledge exchange presented by the HE workshops was not fully exploited.

**7. Urgency of synthesizing and clarifying SysCom's overall results.** As Phase 3 draws to a close, there are two important reasons to synthesize the results of SysCom research: to provide the information needed for research reports, publications, and other vehicles for disseminating results comparing the performance of OA and CA; and to identify knowledge gaps that should be addressed in future research. The hypotheses presented in Section 4.2.1. of the Phase-3 Program Document (Bhullar et al., 2014) provide a useful framework for the needed synthesis work.

**8. Value of face-to-face supervision, collaboration, and mentoring.** While the use of Internet-based communication has certainly facilitated the organization and management of international research efforts like SysCom, collaborators in all the countries emphasized the essential role of face-to-face interaction for developing research designs, refining procedures and supervising fieldwork, reviewing and consolidating data, and mentoring local researchers. Local collaborators value the visits made by FiBL researchers, and generally feel that more frequent and lengthy visits would be valuable – particularly for senior staff members.

**9. Interests of young professionals in learning about OA and agroforestry.** Where young professionals have been involved in SysCom work (mainly in Bolivia and Kenya), it has become clear that many students in agricultural colleges are eager to learn more about organic agriculture and other novel topics such as agroforestry. However, in the study countries, there are few university courses and far fewer university-based programs on these

topics. Providing this type of training goes beyond the mandate of SysCom, but FiBL may wish to explore options for supporting formal and informal educational opportunities in organic agriculture and related topics in the countries.

**10. Need for capacity development.** SysCom's local teams are eager to play larger roles in the program. However, at present, they lack some crucial capacities (e.g., those related to research design and statistics) and resources needed to lead the work. If the system-comparison work is to continue after FiBL's leadership and CCD funding ends, SysCom will need to expand its efforts to strengthen local research capacities, gain the commitment of local organizations for SysCom's mission, and mobilize resources.<sup>11</sup>

**11. Potential value of complexity and systems frameworks and perspectives.** Ultimately, SysCom aims to contribute to change in agricultural systems – shifting farmers away from conventional production systems that rely heavily on mono-cropping and industrial inputs, to organic production systems. Such radical systems change involves highly complex processes with unpredictable, emergent results. Researchers in the fields of sustainability science and innovation are increasingly working with frameworks and perspectives related to complexity and systems. The expertise of SysCom team members in agronomy, biology, statistics, and related agricultural fields, could be usefully complemented with expertise in complexity and systems change. The program might want to explore ways to gain this type of expertise through, for example, internships, visiting researchers, or professional development workshops.

## 2.8. Recommendations

### ***Recommendation for the CCD***

The main recommendation for the CCD is to provide resources and support for a fourth phase of SysCom that would (a) consolidate knowledge on the long-term effects of OA and CA systems; (b) generate and disseminate knowledge of practical value to farmers, which addresses their priority needs; and (c) empowers local partners to conduct relevant R&D.

### ***Recommendations for completing Phase 3***

These recommendations are intended to stimulate discussions and decisions based on available time and resources.

#### ***Recommendations for country project teams***

1. Prepare a research report / publication for each site, summarizing research findings at the site, in relation to SysCom's key research questions. These reports should say in as clear a manner as possible, what this case tells us about the performance of OA and CA for sustainable development.
2. Document main research findings of the various studies in formats that are appropriate for reaching intended audiences
3. Provide support and encouragement for students to complete their studies and produce the respective theses / final reports
4. Make all information outputs available on the websites of SysCom, FiBL and partner organizations
5. Complete the collection, storage, and analysis of data as per research protocols, prioritizing variables essentials for the publications mentioned in points 1-3

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<sup>11</sup> Rogers and Coates (2015) identifies the following factors as critical to sustainability of program activities and benefits in USAID food and agricultural programs: (1) a sustained source of *resources*; (2) sustained technical and managerial *capacity*; (3) sustained *motivation* (of service providers and beneficiaries); and (4) *linkages* to governmental organizations or other relevant entities. These factors would seem to be generally relevant for the sustainability of SysCom projects.

6. Organize a final symposium to present results and future plans
7. Work with both women's and men's groups to identify research priorities that are relevant for them
8. Prepare a proposal for further work that reflects organic farmers' priorities and the resources that are likely to be available

And if resources can be mobilized:

9. Conduct a study of dissemination of innovations from the project (this initial study could employ "informal survey" methods)

#### *Additional recommendation for SysCom program team*

1. Provide local teams with support and motivation for analysis of research results and for the technical writing needed to produce research reports, publications, policy briefs, conference presentations, leaflets and other formats for reaching intended audiences. ("Writesops" may prove useful.)
2. Produce a research report / publication summarizing results of the 3 country cases, in relation to the program's key research questions. (Say, in as clear a manner as possible, what the 3 cases tell us about the performance of OA and CA in sustainable development.)

### **Recommendations for future work beyond Phase 3**

#### *Recommendations for country project teams*

In a possible Phase 4 (2019+), SysCom country teams should work on 3 broad fronts:

1. *Generate knowledge on the long-term effects of OA and CA systems.* This work, centered on the LTE, could include studies of such critical system issues as management of beneficial and harmful pests, soil physics, biology and chemistry, nutrient and resource efficiency, and supplies of appropriate varieties and seeds for OA.
2. *Generate knowledge of practical value to farmers, which addresses their priority needs.* Research aimed at promoting farm-level innovation, should be based on farmers' production needs. More effective communication / feedback mechanisms will need to be developed between SysCom researchers, extension, and farmers. Approaches and activities to consider in this area include:
  - Involvement of researchers in extension activities and vice versa
  - Continuous monitoring of diffusion / adoption of innovations, and periodic assessment of broader changes (livelihood studies)
  - Expand use of Mother-and-Baby trials to new, priority topics (e.g., new varieties and seed, ways to increase nitrogen supplies in organic crops, management of pests, and weather uncertainty/climate change).
  - Develop mechanisms to gain feedback from men's and women's groups to researchers on a frequent / continuous basis
3. *Empower local partners to conduct relevant R&D.* Approaches and activities to consider in this area include:
  - Secondment of researchers to work with extension teams, and vice versa
  - Periodically have researchers visit farmers with extension agents, and have extension agents participate in planning, monitoring, and evaluation.
  - Train local staff members in research design and analysis and assist them in taking more responsibilities for research studies
  - Establishing stronger links with relevant national R&D organizations
  - Exchange visits / programs between local and international organizations
  - Empowerment of women to take on research roles

- Establishment of an interdisciplinary “Scientific Advisory Board” for country projects that would assist in marshaling expertise in needed areas, including economics and the social sciences

*Additional recommendations for SysCom program team*

1. Prepare and negotiate a comprehensive proposal that is acceptable and workable for the countries, FiBL, and the donors
2. Develop a “light” management system that allows for independent development of the cases within an overall agreed-on conceptual, administrative, and reporting framework.
3. Involve social scientists in design and analysis of trials and socio-economic studies, analysis of results, and preparation of information outputs.



## 3. Assessment of SysCom-Kenya

### 3.1. Introduction

#### **Context**

The book, *Transformation of Agricultural Research Systems in Africa* (Ndiritu et al., 2004), begins with a clear-eyed analysis of the challenges faced by the region's agricultural research and extension systems and of priorities for change:

“On no other continent is the need for agricultural research greater than it is in Africa; similarly, nowhere are the complexities of producing well-adapted agricultural technologies more binding than in Africa, and yet the basic institutions supporting agriculture are some of the weakest in the developing world.” (Lynam, 2004, page 3)

The environmental and institutional context of agricultural development in Africa differs significantly from those of Asia and Latin America. African farming is almost exclusively carried out in tropical environments, where the agricultural research base remains extraordinarily weak. The inherent productivity of agricultural resources is generally poorer than in Asia and Latin America, being limited by poor soils or insufficient rainfall. Since most farms are small and most food is produced on small farms, increasing food production in most of Africa will require increasing the productivity of small-holder farming systems. Yield increases on such farms will not have to rely as heavily on purchased inputs and irrigation as in Asia and Latin America.

“Rather, yield gains will be based on the production of crop varieties better adapted to their environment, exploitation of ecosystem services for plant nutrient supply, and pest and disease control ... The research and extension systems ... must adapt more traditional areas of agricultural science (e.g., crop breeding and soil science) to a low-resource context, develop new disciplines (e.g., agroforestry), and adapt other sciences to agriculture (e.g., ecology and molecular biology). Thus, much of the science that will drive African agriculture will need to be developed around the particular needs of African farming systems, especially within the context of tropical, rain-fed agro-ecosystems” (ibid, page 5).

No single country or system is representative of sub-Saharan Africa. But, with care, lessons learned from appropriately designed and interpreted research in Kenya can be usefully extrapolated to other parts of the region.<sup>12</sup>

As in sub-Saharan Africa generally, most Kenyan farmers are small holders who grow crops and raise livestock under rain-fed conditions. They generally use few purchased inputs and have limited access to financial services or extension. As elsewhere in the region, most of Kenya's population continues to rely, at least partly, on agriculture for their living, and recurrent crises, such as droughts, exacerbate the vulnerability of basic livelihoods.<sup>13</sup> One way in which Kenya stands out from most of its neighbors is the size of its agricultural research system, which ranks third in the region, after those of Nigeria and South Africa. Kenya is also home to the national, regional or global headquarters of numerous research and development-related organizations, including the International Center for Insect Pests (ICIPE) and several centers affiliated with the Consultative Group on International Agricultural Research (CGIAR), and numerous non-governmental organizations engaged in the promotion of agricultural development and rural poverty reduction.

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<sup>12</sup> Nandwa (2004) and Dixon et al. (2001) identify characteristics of farming systems in Kenya and in sub-Saharan Africa more broadly, which are relevant for extrapolating findings of research conducted at specific Kenyan sites.

<sup>13</sup> See *Feed the Future - Kenya Country Profile*: <https://www.feedthefuture.gov/country/kenya>).

### **Main actors**

In Kenya, ICIPE and the Kenyan Agricultural and Livestock Research Organization (KALRO) have been the main actors in the SysCom program. ICIPE has served as the administrative host for the program. It has employed the program's Kenyan staff, and has provided office space and related facilities. KALRO has provided land for one of the two LTE in Kenya and has served on the program's national Steering Committee since the earliest days of the program. The Kenya Organic Agriculture Network (KOAN), the Kenyan Institute of Organic Farming (KIOF) and Kenyatta University have also served as long-term members of the Steering Committee, which has provided strategic guidance for SysCom-Kenya.

### **Main activities**

In Kenya, as in Bolivia and India, SysCom's core activities relate to LTEs and POR. One unique feature of SysCom-Kenya is that LTEs are conducted at 2 sites (Thika and Chuka), whereas in the other two countries there is single trial site. Both the Thika and Chuka sites are at approximately 1,500 m.a.s.l., and have average temperatures of around 20 degrees C. Chuka soils are better, with higher pH and organic carbon and lower clay content. Rainfall is around 2000 mm per year at Chuka but only about half that at Thika (bimodal in both locations). Consequently, the yield potential of the Chuka site is higher than that of Thika. The Thika LTE is conducted on KALRO's Horticultural Research Institute. The Chuka trial is carried out at Kiereni public primary school.

The input levels and rotations used in the Kenyan LTEs were designed on the basis of a farm-level survey carried out in 2005-2006. The "Low" treatments were designed to represent smallholder rain-fed production for home consumption and local markets; 45 kg of N and 60 kg of P<sub>2</sub>O<sub>5</sub> are applied per year. The "High" treatments represent commercial production on irrigated land for urban and export markets, employing 225 kg of N and 286 kg of P<sub>2</sub>O<sub>5</sub> per year. The "Conventional" treatments both employ organic and synthetic fertilizers and chemical pesticides. In contrast, the "Organic" treatments employ only organic inputs.

POR has been carried out on farms around Kangari since 2009, and around Thika and Chuka since 2012. At these sites, focus groups were used to identify farmers' challenges and interests concerning OA. Based on these findings, farmers were trained to improve their knowledge of potentially useful OA approaches. On-farm trials and demonstrations were then implemented. Exchange visits were organized to familiarize neighboring farmers with the on-farm trials and their results.

Focus groups identified several priorities for improving OA, including:

- pest and disease management;
- animal housing and manure handling;
- low soil fertility due to inadequate quantity and quality of organic material.

Farmer training has been provided on:

- ways to improve composting;
- manure handling;
- livestock feeding and housing;
- fodder production and conservation;
- vermiculture; and
- using a planting calendar to meet market demands.

On-station "Mother Trials" were designed and managed by scientists. These trials were replicated on-farm in "Baby Trials" managed by farmers.

In addition to the LTEs and POR, as issues emerged, a number of specific studies have been carried out on several topics, including:

- the effects of farming system on nitrogen dynamics;
- the diversity of soil microbes, nematode, and termite populations;
- pesticide residues in OA and CA systems; and
- management of rock phosphate to enhance phosphorus availability.

### **3.2. Assessment**

Based on the HE workshop, a review of program documents, key informant interviews, and direct observations, the main findings of the assessment of SysCom Kenya are summarized in the following points, grouped under the main evaluation criteria.

#### ***Relevance***

The Kenyan stakeholders interviewed concur that SysCom's research is highly relevant to ongoing debates concerning food safety and environmental sustainability. The topics being studied – related to the performance of organic and conventional cropping systems – are important for farmers, consumers and policymakers in Kenya and beyond. The LTEs, POR and related studies are unique in Sub-Saharan Africa. The research results and information “in the pipeline” address many practical and policy-relevant issues related to the performance of OA vis a vis CA in sub-Saharan African agriculture.

#### ***Effectiveness***

Good progress has been made toward most of the project's objectives (See Annex 7). The LTE, POR, and related studies are producing high-quality data that could inform the decision making of farmers, market agents, consumers, and policy makers at local, regional and international levels.

For various reasons – including the unfortunate discontinuities in key personnel due to death and disability – there have been delays in the analysis of data collected and in the publication, and broad dissemination of research results. On the other hand, some important unanticipated outcomes have been achieved, as noted in the following section.

#### ***Major achievements and impacts***

This section summarizes the main achievements of SysCom Kenya to date, identifies key factors that have influenced the achievements, and reflects on potential future impacts of the work. Since the Kenyan LTE were initiated in 2005, the results reported here should be considered short- and medium-term in nature

#### ***Main achievements to date***

The main achievements can be summarized in 6 points:

1. Accumulating relevant scientific information on key topics
2. Getting OA “on the radar” at several local, national, and international organizations working in Kenya (e.g., creation of the Soil Health Program at ICIPE, increasing OA research agenda at KALRO)
3. Effective networking and teamwork, to mobilize needed expertise at different Kenyan and Kenya-based organizations, to address a common research agenda on OA
4. Building two-way communication and synergy between OA researchers and farmers, including the dissemination of research results to farmers, researchers, policy makers, and others, through field days, workshops, and conferences
5. Strengthening capacities for OA (knowledge, skills and attitudes) of farmers, researchers, and university students

## 6. Uptake of some organic practices on the farms of collaborators and their neighbors, and some livelihood improvements

In Kenya, several crops are included in the LTE's associations and rotations at two trial sites, with differing growing conditions, it is difficult to draw simple and generalizable conclusions from the research conducted to date. A study of the effect of organic and conventional farming systems on nitrogen use efficiency of potato, maize, and vegetables (Musyoka et al., 2017) concludes that for maize and vegetables, conventional and organic farming systems had similar effects on nitrogen use efficiency. For potato, conventional systems improved nitrogen use efficiency compared to organic systems, largely because of the yield reductions caused by pests and diseases in organic potato production.

A study of the effectiveness of different farming systems in managing plant parasitic nematodes demonstrated the potential of organic farming in suppression of parasitic nematodes at farmer level (Atandi et al., 2017).

The first general synthesis of results of the LTE (Adamtey, et al., 2016) reports that generally, there were no significant differences in the dry matter yields and nutrient uptake by maize, baby corn, or beans between the conventional and organic systems at either site. Similar maize grain and baby corn yields were also obtained at Chuka. At Thika, in the early years of the trial, maize grain yields were lower in the organic as compared to the conventional systems. However, by the third year, the yields for maize grain and baby corn had become similar in the two systems.

When maize was sole cropped, the profit from the low-input conventional system exceeded that of low input organic systems. However, when maize was intercropped with beans, the profit from the low-input conventional system was similar to that of the low-input organic systems.

In the high-input systems, in the first and second years of cultivation, the profit from the conventional treatment was 2.1 to 3.8 times higher than that of organic treatment, when organic produce was sold at the going price in local and regional markets. Thereafter, the profit from the conventional treatment was similar to that of the organic treatment. If organic produce could be sold at a 20 to 50% premium price, the profit from the organic treatment would be 1.3 to 4.1 times higher than that of the conventional treatment. However, in Kenya premium prices are not yet being paid for organic produce, highlighting the need to develop value chains for organic produce in the country.

### *Areas where more could have been achieved*

Participants at the HE workshop identified several areas in which they felt SysCom-Kenya could have achieved more:<sup>14</sup>

- *Socio-economic study.* The planned study was initiated, but not terminated.
- *Value-chain development.* VCD was not included in the project's objectives, but marketing problems and the lack of price differentials for organic produce are seen as key constraints to OA in Kenya and elsewhere.
- *Pest and disease management.* Pests and diseases have emerged as major problems for organic farmers who would like to grow potatoes and vegetables. While not contemplated in the project's plans, applied research and dissemination are needed to provide farmers with effective means to manage pests and diseases.
- *Carbon stabilization.* Carbon stabilization has not yet been achieved in the trials, and this has emerged as an important topic for future research.

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<sup>14</sup> Readers should note that while some of these areas were included in the project's objectives, others were not.

- *Human health.* While concerns for human health are potentially important drivers of OA in Kenya and beyond, the project has not addressed this area to date.

There is anecdotal evidence of changes in resource use, soil quality, productivity, and livelihoods on the farms where POR has been conducted and on neighboring farms. However, systematically collected information on the diffusion of innovative OA practices and wider impacts is lacking. The trials are long-term in nature, and the analysis, publication, and dissemination of results have proven more challenging than anticipated. Publications and related information outputs (e.g., posters, policy briefs, and articles targeting the consumers and the general public) are still “in the pipeline.” Consequently, it is too early to expect significant impacts on scientific knowledge, policies or agricultural practices.

### *Factors that have influenced achievements*

SysCom researchers report having faced a number of challenges, including:

- inherent complexity of the research being undertaken,<sup>15</sup>
- extremely limited research and knowledge base on OA in the tropics,
- discontinuity of local and international project managers (as noted above),
- lack of adequate research support at FiBL during SysCom Phases 1 and 2, and
- reduction in the budget during Phase 3, which (among other things) reduced funding for analysis of plant material and other samples, resulting in a backlog of samples that have not been analyzed to date.

Factors that have favored SysCom’s achievements have included:

- high level of commitment of participating researchers and their organizations to SysCom;
- SysCom’s emphasis on learning and capacity development;
- establishment and operation of a strong Kenyan Steering Committee; and
- stable research leadership, coordination and support in Phase 3.
- strong system-based research approach introduced in Phase 3

### *Potential for future impacts*

The main direct impacts of SysCom-Kenya are likely to be contributions to the knowledge base on the performance of OA and CA in the context of sustainable agricultural development. For this reason, it is extremely important that the project team publishes and widely disseminates their research results. For the project to have significant impacts on agricultural production systems in Kenya, its research would have to be complemented with much larger and better funded interventions that influence agricultural policies and promote VCD for OA.

### **Sustainability**

This section assesses the contributions SysCom has made to sustainability, the sustainability of SysCom contributions and benefits, and the future actions that might be taken to promote the magnitude and continuation of benefits over time.

#### *Contributions of SysCom to sustainability*

SysCom-Kenya is generating valuable information on important sustainability issues. By contributing to the knowledge base in the field of sustainable science, the project’s research reports and publications may eventually influence policies and practices related to OA in Kenya and more broadly. Due to the inherently small reach of its on-station and on-farm research, SysCom should not be expected to make significant direct contributions to environmental sustainability in Kenya.

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<sup>15</sup> This complexity is reflected in publications comparing organic and conventional agriculture, such as Adamtey et al. (2016), Musyoka et al. (2017) and Seufert & Ramankutty (2017).

### *Sustainability of SysCom's contributions*

Even though SysCom-Kenya's trials are yet to reach their maturity, SysCom has provided Kenyan university students, researchers, and collaborating farmers with training and practical experience that will allow them to play useful roles in assessing and promoting OA in the future. To date, less progress has been made in influencing agricultural policies and priorities, which would be essential for OA to play a significantly larger role in agricultural research agendas and in agricultural value chains (e.g., through certification or other mechanisms that allow the development of markets for organic produce). As already noted, SysCom-Kenya could make meaningful and sustainable contributions to scientific knowledge in the field of sustainability science, to the extent that its research results become available in reports and publications that are widely available on line.

### *What could be done to enhance sustainability?*

Every knowledgeable Kenyan stakeholder in the HE workshop and those interviewed personally, expressed the view that the LTE and POR should be continued for several years, both to adequately address the hypotheses presented in the Programme Document 2015-2018 and also to address new questions that have emerged during Phase 3 (e.g., those related to resilience of cropping systems, pests and diseases, soil organic carbon, and phosphorus availability). Stakeholders also emphasized the importance of analyzing and publishing results of the LTEs and POR, completing on-going thesis research, and publication of the results.

### **Efficiency**

Overall, SysCom-Kenya's use of resources seems to have been efficient. Members of the project team, both in Switzerland and in Kenya-based organizations, have been highly committed to the project and have often gone "beyond the call of duty" to ensure that research and related activities were completed effectively and efficiently. Two factors that have limited progress are the turnover of key personnel at FiBL and in Kenya in earlier phases of the project, and the budget cut in Phase 3.

### **Exit strategy**

Since the LTE has not yet reached its long-term stage, Kenyan stakeholders feel strongly that the LTE at both sites (Thika and Chuka) should be continued, with the planned level of data collection and timely analysis of samples. Ideally, more research sites would be added, to expand the representativeness of results. In the worst-case scenario, the Thika trial (which is conducted under more representative environmental conditions) should be continued with minimal data collection and storage of samples, until adequate funding can be obtained to analyze the samples collected and implement the trials as planned.

Kenyans feel they have benefitted greatly from working with FiBL, and hope to continue with this relationship in the future. FiBL has played particularly important roles in international networking, developing and negotiating funding, research leadership and mentoring of local scientists.

On the other hand, Kenyans feel they have learned and benefitted relatively little from the SysCom work in Bolivia and India. In future, SysCom should either strengthen interaction and synergies among the 3 country-projects or consider independent bilateral projects involving FiBL and country teams.

In ICIPE and KALRO, FiBL has two strong research partners. However, OA is not a recognized research priority in these organizations. This might be an opportune moment to pursue more formal organizational commitments to OA and to SysCom. This could improve access to local and international funding sources and pave the way for FiBL to hand over leadership of SysCom to ICIPE and KALRO few years from now.

### **3.3. Recommendations**

Based on the foregoing assessment, the following recommendations are offered for consideration by the CCD and the Kenyan Steering Committee:

#### ***Recommendations for completing Phase 3***

1. Prioritize the analysis of the biophysical samples and related information already collected in the LTE and POR, and prepare relevant information outputs. These could include research reports, peer-reviewed publications, policy briefs, extension bulletins, and other appropriate formats for effectively disseminating research results to intended users.
2. Support the present thesis students and ensure the completion of their research and preparation of related research reports and/or peer-reviewed publications.
3. Arrange for specialized publication support to aid in producing the large number of expected information outputs.
4. Carry out a systematic study of dissemination of innovations from the research trials to intended users, to serve as an input into future planning, and to publish a research report on the topic.
5. Develop an organizational and funding framework that ensures continuation of the LTE and POR through 2022.

#### ***Recommendations for beyond Phase 3***

1. *Clarify the project's scope and boundaries, particularly with respect to the inclusion of more development-related activities (particularly those related to VCD).*
2. *Develop / refine the project's research-for-development strategy, to ensure that research results contribute optimally to the project's long-term goals. Plan future activities accordingly.*
3. *Develop a strategy to shift lead responsibility for SysCom Kenya to local partners, by 2022, with FiBL continuing to play backstopping, mentoring, and facilitating roles afterward.*



## 4. Assessment of SysCom-Bolivia

### 4.1. Introduction

#### *Context*

In 2007, funding became available for SysCom to include a research site in Latin America. After reviewing the options (Bolivia, Cuba, and Nicaragua),<sup>16</sup> it was decided to work in the Alto Beni region of Bolivia, where cocoa is the dominant crop in local farming systems.

In the global cocoa market, Bolivia is a very small player, producing only about 5,000 tons per year. However, cocoa is a key crop in the Alto Beni region, and Alto Beni is Bolivia's largest cocoa-producing region. Notwithstanding the small size of Bolivia's cocoa harvest, in relation to the world's major producers, Bolivia is among the largest producers of organic cocoa and its cocoa is recognized as being among the best in the world.

#### *Global cocoa production and markets*

Cocoa originated in the Americas over 5000 years ago, but its popularity and production have spread widely. At present, most of the world's cocoa is cultivated in Africa, where Ivory Coast and Ghana alone account for about half the world's production. South America supplies only about 15% of the world's cocoa, with Brazil, Ecuador, and Peru being the three largest South American producers.

Cocoa is generally grown by small farmers in forest areas. Over the years, production has been increased mainly by expanding the area under cultivation. In contrast, yields per hectare have remained stagnant. Consequently, there is large scope for increasing the efficiency and intensity of cocoa production.

Most of the cocoa grown in the world is of "Forestero" varieties. However, Bolivia and other Latin American countries produce "Trinitario" cocoa, which is of better quality and aroma, and is generally used for premium and single-origin chocolates for which higher prices are paid.

A recent market intelligence report (CBI, 2016) notes that cocoa production is growing faster in Latin America than in other regions, because of the growing demand for the premium, specialty, and fine-flavored Trinitario cocoa that is cultivated in this region. As stated in the same report, global

"cocoa production is faced with serious challenges. Changing weather and climate conditions, falling productivity, little innovation, technology transfer and knowledge transfer, declining soil fertility, pests and diseases, and competition with other cash crops is threatening future supplied. Furthermore, poverty among cocoa farmers is high due to the low and volatile prices of cocoa and the great power wielded by multinationals... Most farmers are still living below the poverty level."

Cocoa prices have declined very substantially in recent years do to increased production and inelastic demand. Europe is a dominant force in the cocoa market, accounting for more than half of global cocoa bean imports. Historically, chocolate consumption has been highest in Western Europe, with Switzerland taking the lead. Cocoa processing has generally been done in Western Europe. Grinding is increasingly taking place in the country of origin. However, grinders are often owned by Western multinational corporations, who hope to stimulate increased cocoa consumption in emerging markets (CBI, 2016).

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<sup>16</sup> These were priority countries for SDC at the time.

### *The Alto Beni region*

The Alto Beni region is located in the eastern foothills of the Andes, less than 300 km north of La Paz, at an altitude of 300-800 meters above sea level (Jacobi et al., 2015). Until the 1950s, the area was sparsely populated by the indigenous mosen people. After Bolivia's National Revolution and Land Reform in the 1950s, the government promoted resettlement of landless rural people from the highlands to the Alto Beni and two other parts of the Bolivian lowlands. Resettlement was seen as a way to provide "land without people to people without land." Trunk roads were built to facilitate the movement of people and produce, and governmental and non-governmental agencies (NGOs) began to provide the new migrants with agricultural extension, medical services, primary education, and credit.

Life for colonists in the Alto Beni was by no means easy, and more than half the initial immigrants are reported to have returned to their places of origin, because they found conditions intolerable, "complaining of the climate, the savage animals, diseases, and the difficulty of controlling the jungle vegetation" (Stosch, 2014: Chapter 4). Nevertheless, the resettlement scheme prompted a flow of migrants that has continued until today. Presently, the vast majority of the area's residents, and farmers, are immigrants from highland Quechua and Aymara communities, or descendants of immigrants.

The indigenous mosen people of the Alto Beni traditionally practiced subsistence agriculture, along with hunting and gathering. Cash cropping has largely been introduced by migrants. Settlement agencies and NGOs have introduced new crops and farming practices, including cocoa varieties from Ecuador, the Dominican Republic, and elsewhere.<sup>17</sup> Cocoa is now the most important cash crop in the region, and Alto Beni is Bolivia's main cocoa-producing region.

Settlers in Alto Beni practiced slash-and-burn agriculture, using machetes and saws to cut down trees and brush on virgin or (more commonly) regrown land, burning the trash, and then planting crops. Often rain-fed rice was planted first, followed by maize and other crops. When the fertility of the land declined, farmer moved on and started the slash-and-burn cycle in new areas. More recently, after the initial slashing and burning, many farmers have established agro-forestry systems centered on cocoa, and with an array of other crops.

In Alto Beni, cocoa is generally grown without the use of chemical fertilizers and pesticides, mainly in agro-forestry systems but sometimes also in monoculture (full sun). Cocoa plantations are subject to several pests and diseases that limit productivity. Since cocoa in other parts of the world are grown under similar conditions, cocoa research in Alto Beni has potential benefit for producers in other regions. In cocoa production, men are generally responsible for field work and pruning, while women take responsibility for post-harvest operations (fermentation and drying).

### **Main actors**

Many of the region's farmers are members of producer cooperatives affiliated with the El Ceibo.<sup>18</sup> Established in 1977, el Ceibo provides technical assistance for organic cocoa growing, through its Program for Agro-ecological and Forestry Implementations (PIAF), and purchases the cocoa produced. El Ceibo processes the cocoa and produces a range of quality chocolate

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<sup>17</sup> The cocoa crop originated in the Amazon basin and spread from there to other parts of the Americas, Africa, and Asia. Nevertheless, many of the cultivars presently grown in Bolivia have been introduced from other countries. Alto Beni is home to a cocoa gene cluster known as "*cacao nacional boliviano*," which has generally been considered to be poor in quality, due to its small grain size.

<sup>18</sup> Information on El Ceibo is available at the organization's website (<http://www.elceibo.com>). A number of publications also provide information on this highly successful cooperative. See, for example, Bebbington et al. (1996), and Jacobi et al. (2017).

products in its own facilities in El Alto, near La Paz, for both domestic sale and export. El Ceibo was the first organization in the world to export certified organic cocoa to Europe, and it is still the main Bolivian organization to export certified organic cocoa.

Beginning in the 1980s, SDC supported the establishment and development of the PROINPA Foundation,<sup>19</sup> and it was assumed that the Foundation would be the lead research organization in SysCom-Bolivia. However, after an initial feasibility study, it was decided that PROINPA would not play this role, because the Alto Beni was difficult to reach from PROINPA's headquarters in Cochabamba, and because leading this project would have diverted PROINPA away from its core research mandate, centered on highland Andean agriculture. PROINPA had no research experience with tropical agro-forestry systems.

To implement SysCom-Bolivia, a partnership was developed with FiBL and five Bolivian organizations. FiBL developed a bilateral agreement with El Ceibo for use of the land at Sara Ana for 20 years; and a general agreement of mutual understanding with four other entities. **Ecotop** is a small foundation and associated consultancy firm, based in Alto Beni, that offers services in rural development, particularly focused on "sustainable agriculture based on the natural dynamic of ecosystems (Successional Agroforestry Systems)" (SAFS). Ecotop took on the leadership for the development of the Sara Ana research facility and for establishment and management of the LTE.<sup>20</sup> **PIAF** agreed participate in SysCom's on-farm activities (POR). **The Institute of Ecology**, of Bolivia's Universidad Mayor San Andres <sup>21</sup> agreed to carry out research on local ecosystems and the effects of cocoa production practices on biodiversity. **Bolivia's Association of Ecological Producers Organizations** (AOPEB) agreed to disseminate SysCom results to farmers outside the Alto Beni. **PROINPA** agreed to serve as a member of the project's Steering Committee, along with the other five organizations

### **Main activities**

The 40 hectares of land that has been developed into the Sara Ana research site is part of a 350-hectare parcel owned by El Ceibo. In 2007, the area was regrown forest and scrub that had previously been used for pasturing livestock. The land was on a small dirt track and had no access to, telephone, or the Internet. There were no facilities for housing workers, preparing meals, or any aspect of producing crops or conducting research or training. For this reason, SysCom- Bolivia needed to develop research facilities essentially from scratch. No budgetary provisions had been made for developing Sara Ana, and this task has been carried out with minimal investments spread over a decade and Improvements are still underway.

The LTE has compared the performance of five cocoa production systems and fallow:

1. Conventional monoculture system
2. Organic monoculture system
3. Conventional AF system
4. Organic agroforestry system
5. SAFS

In Alto Beni, cocoa farmers seldom use chemical fertilizer or pesticides. In this sense, their production is "organic by default." In the LTE, chemical fertilizers and pesticides are applied in the "conventional" treatment, to simulate a non-organic production system, which is not representative of farmers' practices in Alto Beni, but of practices in other cocoa producing

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<sup>19</sup> Information on PROINPA is available at the organization's website (<http://www.proinpa.org>) and Gandarillas et al. (2007).

<sup>20</sup> Information on Ecotop and its philosophy and services is available at the website: [http://www.ecotop-consult.de/thats\\_ecotop/13](http://www.ecotop-consult.de/thats_ecotop/13).

<sup>21</sup> Information on the Instituto de Ecologia is available in this presentation: <https://prezi.com/hzaeauylyjky/instituto-de-ecologia-umsa/>.

areas. The “organic” treatments comply with the European Union’s standards for producing certified organic cocoa.

The trial was arranged in a full-factorial, randomized complete block design with four replications (Schneider et al., 2016). The factors tested are:

- crop diversity (monoculture vs. agroforestry);
- management practice (monoculture vs. organic); and
- cultivar (12 different cocoa cultivars/hybrids are include in each treatment).

A fallow system without crops was installed to serve as a control/reference system for studies of soil fertility, biodiversity, and natural species succession. Plots are 48 m x 48 m (gross plot size = 2,304 m<sup>2</sup>), providing enough space for a 12 m border on each side, and leaving 576 m<sup>2</sup> for data collection, considered a minimum for multi-strata AF research.

In the LTE, data on three types of parameters have been systematically collected:

- *Agronomic parameters*: Yield, pests and diseases, micro-climate, , heavy metals and cadmium, canopy openness, tree growth
- *Ecological parameters*: Biodiversity, carbon balance, soil fertility, water cycle, , efficiency (vis a vis energy, land, water and nutrients)
- *Economic parameters*: Economic yield, costs and benefits, and labor use

FiBL and Ecotop have worked out (and periodically revised) the agricultural management of the trial and procedures for data collection. Ecotop has employed staff for managing the trial, routine data collection, set up and maintenance of infrastructure, and dissemination and training activities. Project staff members reside at Sara Ana during the work-week, and return to their homes in nearby communities on the weekend. The Institute of Ecology has brought national experts on tropical flora and fauna and students to collect data on soils and biodiversity, and to monitor selected flora and fauna groups. El Ceibo has led the evaluation of genetic material and cultivars in on-farm trials. Doctoral students have collected carbon balance and water cycle data. Data on product quality, fermentation, heavy metals and cadmium have been collected and analyzed through satellite projects.

A unique feature of the Sara Ana LTE is the inclusion of a SAFS treatment. The SAFS concept was introduced to Alto Beni in the mid-1990s by the renowned agroforestry expert, Ernst Goetsch.<sup>22</sup> As described by Selecky et al. (2017, page 1),

“SAFS seek to mimic the diverse structure of natural forests and at the same time produce marketable products. In comparison with other agroforestry systems, SAFS strive to create food producing systems in advanced stages of succession, managing subclimax or climax plant communities where high niche variability results in high biodiversity and efficient use of resources. Utilizing native as well as introduced plant species, a forest is created that is structurally analogous to a natural forest of the local area, providing the same ecosystems services, restoring the environment and sustaining local communities. SAFS are designed to follow natural succession, leading to increased complexity and structural diversity in time. Pioneer species, apart from producing marketable goods, create conditions for the successful establishment of climax species. This way, potential productivity of every particular site can be maximally reached.”

SysCom’s LTE is one of the few trials in the world where a SAFS has been rigorously compared to other production systems.

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<sup>22</sup> See his official website: <http://agendagotsch.com>.

POR activities have been carried out on priority topics identified in workshops involving cocoa producers and field technicians:

- Evaluation of cocoa clones/varieties
- Management of cocoa pests and diseases (partially supported by a grant from INIAF)
- Documentation of the practices of exemplary cocoa producers
- Evaluation of native cocoa varieties, known as Bolivian National Cocoa (*Cacao Nacional Boliviano*)
- Socio-ecological resilience of cocoa production systems in the context of climate change
- Socio-economic studies

Staff members and students at the Institute of Ecology have carried out complementary studies on the effects of different cocoa production systems on the several dimensions of biodiversity, including: vegetation, bird populations, insects, amphibians, and microbial biomass in the soil.

As new topics related to cocoa production and marketing have emerged, students have been recruited to carry out in-depth studies on such things as carbon and nutrient stocks and water stress and water cycles

As research results have become available, Ecotop and El Ceibo have informed farmers, extension workers, and public officials about AFS. They have also provided training and advice to farmers. Most of the beneficiaries have been Bolivians, but Ecotop Consult has also incorporated research results into its training and advisory work with cocoa producers in other countries in Latin America, Africa, and Asia.

SysCom-Bolivia has produced a large number of Spanish- and English-language posters and presentations that have been presented at national, regional, and global workshops, seminars, and scientific conferences, as well as high-quality, peer-reviewed research publications (mainly in English).

The Sara Ana research station has served as a focal point for meetings and training events on topics related to ecology, organic agriculture, and environmental sustainability, which have been attended by Bolivian researchers, extension workers, farmers, and students from primary and secondary schools as well as universities. International meetings and training events on similar topics have also been held there.

## **4.2. Assessment**

Based on the HE workshop, a review of program documents, key informant interviews, and direct observations, the main findings of the assessment of SysCom Bolivia are summarized in the following points, grouped under the main evaluation criteria.

### ***Relevance***

The stakeholders who participated in the HE workshop and those who were interviewed generally believe the work of SysCom-Bolivia is highly relevant for the development of agricultural systems in Alto Beni and of Bolivia's organic cocoa industry more broadly. Those familiar with the global cocoa industry also believe that the LTE is producing results that are broadly relevant to organic cocoa production and AFS in major producing countries. The central place of AF and SAFS in the work of SysCom-Bolivia increases its relevance for agricultural development and environmental sustainability in Bolivia and internationally.

## ***Effectiveness***

As can be seen from Annex 7, SysCom-Bolivia is well on its way toward the achievement of its main objectives. Up to the beginning of 2017, the project had produced the following knowledge outputs:

- 13 peer-reviewed articles and book chapters published
- 4 submissions to journal and book editors, and 2 under preparation
- 40 papers and posters presented at conferences

Additionally, as of the same date, 29 students had received training at Sara Ana, including 2 who had completed doctoral dissertations and 1 who is working on his dissertation.

Most of the publications are so recent that few have been widely cited. Moreover, little information is available on the uptake of the research results by extension services or cocoa producers. A planned farm survey is important, as it should provide more systematic information on the dissemination and utilization of the project's results.

Due in part to limited staffing – particularly scientific staffing at the Sara Ana research site – data collection and processing have proven challenging, and there have been some delays in analysis and reporting. Nevertheless, as already noted, and expanded on further in the next section, the project has an impressive record of peer-reviewed publications. The inclusion of SAFS in the LTE and in SysCom-Bolivia's capacity development and information diffusion work is an innovative aspect of the project, that offers the potential for knowledge generation and impacts that go beyond those originally envisioned in project plans.

## ***Main achievements and impacts***

This section summarizes the main achievements of SysCom-Bolivia to date, identifies key factors that have influenced the achievements, and reflects on potential future impacts of the work.

### ***Main achievements to date***

Based primarily on results of the HE workshop, the main achievements of SysCom-Bolivia to date fall into eight areas:

1. Development of the facilities at Sara Ana for carrying out research and training, and which serve more broadly as a focal point for the exchange and dissemination of information and knowledge on organic cocoa production
2. Development of the SAFS research and demonstration plots, which are unique in the world
3. Production of scientific results on agronomic, economic, and environmental dimensions of cocoa production systems
4. Knowledge exchange among farmers, researchers, and other service providers via meetings at the Sara Ana facility
5. Stimulation of local interest in the research and results of SysCom-Bolivia, among farmers, development workers, and local officials
6. Dissemination of research results through English-language publications
7. Professional capacity development for undergraduates and graduate university level students
8. Training and empowerment of Sara Ana's personnel, which is highly committed to SysCom's research and development objectives and approaches
9. Leaflets prepared by the Institute of Ecology on reptiles, amphibians, and birds

SysCom-Bolivia has excelled in the production of peer-reviewed publications that serve as vehicles for disseminating its research results globally. Up to the beginning of 2017, professionals associated with the Bolivia project had published 13 journal articles and book chapters; they had four additional papers under review, and were preparing two others.

Additionally, 40 presentations or posters had been presented in national or international conferences. Publications draw mainly on results of the LTE, but also on experiences with POR and on complementary studies. 3 manuals for technicians and farmers.

The project's publications cover a range of topics related to conventional and organic management of cocoa in AFS and monoculture systems:

- Cocoa and total system yields (Schneider et al., 2016)
- Returns on labor (Armengot et al., 2016)
- Farm and agro ecosystem resilience (Jacobi et al, 2013, 2015, 2017)
- Carbon stocks and tree diversity (Jacobi et al., 2014)
- Cadmium uptake by cocoa trees (Gramlich et al., 2017)
- Microbial biomass and cellulase activity (Alfaro-Flores et al., 2015)
- Bird populations in different cacao production systems (Naoki et al., 2017)

Papers synthesizing the results of the LTE and POR to date (Schneider et al., 2016; Armengot et al., 2016) conclude that:

- Cocoa yields were 48% lower with organic compared to conventional monoculture.
- In the AFS, the organic-conventional yield gap is substantially smaller – 16% and is statistically insignificant.
- The cumulative yields of all products harvested were significantly higher in the AFS (161%) compared to monoculture.
- The productivity of complementary crops in AFS may contribute to food security and reduce smallholder risks.
- Although cocoa yields were 48% lower with organic management compared to conventional farming, the return on labor was similar, due to the higher costs associated with conventional management.
- The return on labor was roughly twice as high in the AFS compared to monocultures.

There have been several well-attended sessions/events (national level) at Sara Ana to introduce farmers, technicians and development workers to the LTE and POR, to disseminate research results, and to foster knowledge exchange among participants. Several attractive Spanish-language posters have been prepared to present research results and associated information at these events and at conferences in Bolivia and other Latin American countries. However, to date few Spanish-language publications have been issued. Many of the stakeholders interviewed would value short summaries of research results, for distribution to project participants, farmers, policy-makers, NGOs and other interested parties. At international level research results have been presented at several conferences, and at the International symposium of cocoa research to take place in Nov 2017 there will be 6 oral presentations out of LTE.

Many farmers, as well as development professionals working in Alto Beni have visited Sara Ana and have learned about ways to improve the production of organic cocoa in AFS. Ecotop has also incorporated lessons and results from the LTE and POR work into its national and international courses and development programs. There is anecdotal evidence of changes in farming practices (for example, avoiding burning of organic “waste,” increasing the diversity of crops included in AF systems, and increasing the frequency of harvesting cocoa pods, to avoid the spread of diseases) as a result of farmers' learning from what they have seen in the LTE or experienced with POR. However, information on the diffusion of innovative OA practices and wider impacts has not been systematized.

### *Areas where more could have been achieved*

Project team members and external participants at the HE workshop identified the following areas where they would have liked to see greater achievements:

1. Construction of better facilities for cocoa fermentation and drying, and better living quarters for workers
2. Complete analysis of data collected to date
3. Integration of results of individual studies
4. Collection and analysis of additional data, for more thorough analysis of the systems under study (e.g. data on environmental services, pests and diseases, livelihoods, costs and benefits associated with complementary crops, and projection of costs and benefits to estimate long-term system viability)
5. More dissemination of research results to cocoa producers, service providers, and market-chain actors in other parts of the country

### *Factors that have influenced achievements*

SysCom researchers and collaborators have faced a number of challenges, including:

- Physical and virtual isolation of Sara Ana – time and costs of traveling to and from the site, limited access to Internet and telephone, occasional disruption of road transportation.
- Time and energy needed to build the Sara Ana research and research support facilities, virtually from scratch
- Absence of a local research partner organization able to manage the research program
- Inability to hire and retain a qualified local scientific coordinator for Sara Ana
- Weak institutional support for Bolivian university students and limited incentives for students to complete their theses
- Difficulty of engaging farmers in POR
- Difficulty of establishing an effective Steering Committee, with stable representation of the participating organizations

Factors that have favored the achievements of SysCom-Bolivia have included stable and highly committed leadership for SysCom-Bolivia at FiBL and Ecotop; stable and highly committed personnel at Sara Ana (with the exception of the Scientific Coordinator position); and long-term funding from the CCD, which has been essential for development of the LTE.

### *Potential future impacts*

As SysCom-related publications become read and utilized, they will contribute to knowledge on the performance of organic and conventional cocoa production systems, on AFS, and on environmental and ecological aspects of these systems in the context of sustainable agricultural development. The project's strong track record of peer-reviewed publication to date augers well for SysCom-Bolivia's future contributions to global knowledge.

As extension agents and farmers have visited Sara Ana and become familiar with the systems research underway, the project is contributing to changes in knowledge, attitudes, and skills, which will bear fruit in the future. The work on AFS and SAFS is offering new approaches for the sustainable intensification cocoa production systems, and to reduce biodiversity losses. In future, as these approaches spread, they should help stabilize the population in the Alto Beni and reduce the movement of people into the lower Amazon basin.

In light of the small investments made in POR, the results to date have been quite significant. Nevertheless, for the project to have significant impacts on cocoa production systems in Bolivia, its research would need to be complemented with interventions that influence agricultural policies and promote sustainable intensification of cocoa production systems.

## ***Sustainability***

This section assesses SysCom's contributions to environmental sustainability, the sustainability of its contributions, and the actions that might be taken to promote the magnitude and continuation of benefits.

### ***Contributions of SysCom-Bolivia to environmental sustainability***

SysCom-Bolivia is generating valuable scientific information on organic and conventional cocoa production in monoculture and AFS. Through its research reports and peer-reviewed publications, the project is making contributions to the knowledge base on these topics, which will be available for future researchers and development workers, and may eventually contribute indirectly to changes in agricultural policies and practices related to OA and AFS in Bolivia and more broadly.

To date, the direct impact of the project on environmental sustainability in Bolivia has probably been of limited scope, for several reasons. First, the LTE has been in place for only nine years – not long enough for the AFS under study to reach full maturity. Consequently, the results reported to date should be considered works in progress, to be revised on the basis of future research. Additionally, the emphasis of SysCom, reflected in the budget and activities, has been on research (the LTE), rather than on the achievement of development impacts in Bolivia. Much of the project's dissemination work has been in the Alto Beni, although participants from other regions have been involved in some important events at Sara Ana and at national conferences. For example, a national agroforestry congress was held in Sara Ana in 2013, and Bolivia's National Soil Platform also organized an event in there. Hundreds of people have visited Sara Ana, many of whom have come from other cocoa-producing regions, and results from the LTE and POR have been presented at national cocoa events. Due to the inherently small reach of its on-station and on-farm research, SysCom should not be expected to make significant direct contributions to environmental sustainability in Bolivia.

### ***Sustainability of SysCom-Bolivia's contributions***

FiBL staff members have supervised several university students who conducted thesis work based on information from the LTE, POR, or related activities. Through the involvement of university professors and students, and particularly the involvement of Ecotop (with trainings for farmers and technicians), the project has helped develop a cadre of knowledgeable applied researchers and development workers who are committed to organic cocoa production in AFS, and who can be expected to continue to work along these lines after the project ends.

### ***What could be done to enhance sustainability?***

Measures that could enhance the impact of the project on environmental sustainability and the continuity of benefits after the end of Phase 3, include the following:

- Make research results widely available internationally, by continuing to publish in peer-reviewed publications, and making publications available Open Source
- Make research results widely available in Spanish, by preparing Spanish-language summaries of all publications, depositing hard copies of them with appropriate organizations and libraries, and making them available on the SysCom website.
- Pursue the completion of all thesis projects and the publication of results
- Analyze the interests of partner organizations and local farmers in relation to the goals and strategies of the project, and make adjustments needed to reinforce commitments to continue with and potentially expand key activities

## **Efficiency**

In general, SysCom-Bolivia has employed the available resources with a high degree of efficiency. There is no sign of waste in the development and operation of the Sara Ana facility. Staff at Sara Ana are clearly committed to their work and perform at high levels.

Two areas of concern are related to the engagement of local partners. It has proven difficult to bring the local partners together for regular meetings of the Steering Committee, and the representatives have changed from meeting to meeting. This has hampered the operation of the Steering Committee, which has not met in recent years. The second area of concern is that El Ceibo has not always demonstrated strong commitment to the POR work. At the time of the evaluation, El Ceibo was not involved in any of SysCom-Bolivia's POR activities.

These issues with the Steering Committee and POR should be addressed, as they could jeopardize the overall effectiveness of the project and the scope and sustainability of its local benefits.

## **Exit strategy**

The Program Document for Phase 3 (Bhullar et al, 2014, page 35) recognizes that in Bolivia, the project should continue

“for at least a further phase, since the trials here started later and cocoa trees will only be coming into full yield at the end of Phase 3. In addition, there is no institutional partner there with the capacity to run the trials with the current intensity. Therefore, FiBL aims to raise sufficient funding to continue in Bolivia for a further phase.”

At the time of the HE workshop, it was clear that Ecotop, the local organization that has been most actively engaged in SysCom, is highly committed to OA and AFS, and greatly values its partnership with FiBL in implementing the LTE. However, Ecotop is not a research organization and would not be able to manage the LTE and produce research reports on its own. El Ceibo is also committed to OA, but has limited interest and capacity to manage production systems research. It's main interest is VCD for organic cocoa. The Institute of Ecology provides a home for university-based researchers for carrying out studies related to ecology and environmental sustainability, but it has neither the mandate nor the administrative capacity to manage the LTE.

At present, there appears to be no Bolivian research organizations with the capacity to assume responsibility for the LTE, except perhaps PROINPA. It might be worthwhile to explore possibilities with PROINPA again. However, even if PROINPA were interested, it would be necessary to obtain funding to support its management of the LTE.

In light of these institutional realities, the most realistic course of action might be to implement a fourth phase of SysCom-Bolivia, led by FiBL, that would have two main components:

Component 1 would be a continuation of the LTE that would aim to produce peer-reviewed research publications that respond to SysCom's core research questions.

Component 2 would involve further development of Sara Ana as a center for applied research and capacity development related to sustainable cocoa production, AFS and environmental education more broadly. Such a center could:

- prepare summary publications tailored to the needs and interests of Bolivian public officials, development/extension professionals, cocoa producers and other value chain actors;
- provide training for development professionals, to equip them with the knowledge, skills, and attitudes needed to work effectively with El Ceibo, Ecotop, other agricultural service providers, farmers, and other value-chain actors in developing production and marketing systems for organic cocoa in Bolivia; and

- organize more events on organic agriculture, agroforestry, ecology, and environmental sustainability, to satisfy the growing local demands for information and training on these topics.

### **4.3. Recommendations**

Based on the foregoing assessment, the following recommendations are offered for consideration by the CCD and the Bolivian project team:

#### ***Recommendations for completing Phase 3***

During the remainder of Phase 3, the project team should make every effort to complete all studies currently underway and prepare the relevant research reports. Efforts should be made to present the key results of system comparisons in clear and understandable form, emphasizing economic viability and environmental sustainability. Six more specific recommendations:

1. Analyze, in an open and participatory fashion, the current partnership, and establish agreed-on norms for future partnering, including realistic roles and responsibilities and expectations. By-products of this exercise should be renewed functioning of the Steering Committee, and re-initiation of POR activities.
2. Issue Spanish-language summaries of the project's research publications.
3. Place all research papers and English- and Spanish-language summaries on SysCom's website, to ensure their wide availability to interested parties.
4. Conduct a study of the dissemination of innovations from Sara Ana to cocoa cultivators in Alto Beni, and elsewhere.
5. Organize a "writeshop" to catalyze the integration of results of the various studies carried out to date, and provide inputs one or more synthesis papers on results of the project.
6. Wrap up Phase 3 with a conference in Sara Ana, to share major results with potentially interested parties from throughout Bolivia (and possibly from other countries in the region).

If time and resources were available, during the remainder of Phase 3, the project team should also:

7. develop a manual on SAFS, summarizing key concepts and principles, experiences to date, and indicative costs and benefits for establishment and operation of a SAFS; and
8. document and systematize experiences with the development of the Sara Ana facility and the associated research, training, and dissemination activities, to preserve the institutional history and draw lessons.

#### ***Recommendations for work beyond Phase 3***

1. Develop clearer goals and strategies for POR, dissemination, and related development-oriented activities, which clarify how these activities relate to the overall goals of the project and to the LTE.
2. Clarify roles, responsibilities, and realistic resource commitments for the above-mentioned activities.
3. Prioritize topics for complementary studies.
4. Expand the scope of (particularly economic) data collection and analysis in the LTE, to allow more comprehensive comparisons of the systems under study (including their complementary crops)
5. Conduct a study of system resilience in the context of climate change.
6. Promote the development of specialized services for farmers operating AFS (for example, for trimming of shrubs and trees).

7. Foster more active involvement of public entities (local, municipal and national) and private enterprises in the project's activities (particularly those related to agricultural innovation and VCD), to foster the relevance of work conducted, the utilization of results, and the sustainability of activities and benefits after the eventual completion of the project.
8. Improve housing facilities for workers at Sara Ana.

## 5. Assessment of SysCom-India

### 5.1. Introduction

#### **Context**

Cotton was first cultivated in India approximately 6,000 years ago, and it has become the world's most important fiber plant for textile production. India is the world's largest cotton producer, but its contribution to global supply has declined recently, relative to other producers.

As cotton cultivation expanded and intensified, it has become subject to numerous pests, the most devastating of which is the boll worm (*Helicoverpa* spp.). To combat pests, cotton farmers have become heavy users of chemical pesticides. Recently, genetically modified *Bt* cotton varieties have been developed to protect the crop from bollworms (Andres et al., 2016).

In India, over 90% of the planted area crop is now under *Bt* varieties. Less than 2% of India's cotton is cultivated using organic methods. But India exports more than half of the world's organic cotton. The state of Madhya Pradesh is the most largest producer of organic cotton in India.

Market demand for organic cotton is growing rapidly, particularly in Western Europe and the USA.<sup>23</sup> To expand the production of organic cotton to supply these markets, several corporations and NGOs have undertaken projects that promote and support organic cotton cultivation and processing, in India and elsewhere.

#### **Main actors**

**BioRe India Ltd.**<sup>24</sup> is a commercial enterprise dedicated to the promotion of fair-trade organic cotton, from production, through processing, to marketing of finished products. It emerged from a Swiss-based pilot project that began in 1991, and works mainly with farmers in the Nimar valley of Madhya Pradesh. The core activity of bioRe is a contract-farming scheme that involves 3,900 small and medium-sized cotton producers.

**The bioRe Association**<sup>25</sup> was set up in 2003 as the social wing of bioRe India. It seeks to empower organic and biodynamic farmers and their communities, by facilitating education and promoting infrastructure development that addresses local needs and leads to holistic and sustainable development. It provides training in organic and biodynamic farming for bioRe farmers, as well as health services for needy families and education for children who lack access to quality public schooling in the areas where bioRe works.

Together, bioRe Ltd. and bioRe Association work to improve the production and livelihoods of Indian growers of organic cotton.

The BioRe Association, which has been responsible for implementing SysCom's activities in India, is a farmers' association with a farmer president.

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<sup>23</sup> Systematic information on the international production and use of organic cotton is not widely available. The Textile Exchange produces a useful annual *Organic Cotton Market Report*: <http://textileexchange.org/downloads/2017-organic-cotton-market-report/>

<sup>24</sup> Information on bioRe India Ltd. is available on the organization's website: <http://www.bioreindia.com>.

<sup>25</sup> Information on the bioRe Association is available on the organization's website: <http://www.bioreassociation.org>.

### **Main project activities**

As in Kenya and Bolivia, the main activities of SysCom-India have been the establishment and operation of a LTE comparing the performance of organic and conventional cropping systems and POR that seeks to develop and promote the adoption of technological innovations that address organic farmers' needs. Since 2015, the research activities have been financially supported by the Coop Sustainability Fund.

Work with the LTE, which began in 2007, has been conducted on the bioRe research station in Madhya Pradesh, in the central Indian cotton belt. At this site, the climate is semi-arid, and the main crops are cotton, soybeans, and wheat. BT cotton, initially introduced in 2002, has expanded rapidly, and is now grown on more than 90% of all cotton farms in the state.

The LTE simulates cash-crop production systems with cotton, soybeans, and wheat in two-year rotation. Four management systems are included as experimental treatments:

1. an organic system;
2. a biodynamic system;
3. a conventional system; and
4. a conventional farming system with Bt cotton.

The same varieties are used in all treatments.<sup>26</sup> In 2015, based on a recommendation of the Farmer Advisory Committee and after discussions with the SysCom Scientific Advisory Board, the rotation used in the treatments was modified to follow more closely farmers' recent practice of including a second wheat crop after cotton.

Core data collection for the LTE includes:

- *Productivity*: yield, biomass, growth, and phenology
- *Profitability*: costs for labor and inputs, and returns
- *Product quality*: fiber quality, nutrient content
- *Soil fertility*: pH, macro- and micro-nutrients, organic matter
- *Soil physics*: aggregate stability, bulk density
- *Weather*: Temperature, relative humidity, rainfall

Based on farmer focus groups, farmer surveys and results of the LTE over time, the following priorities have been identified for POR:

- Improving the efficiency of rock phosphate on high-pH soils (concluded in 2014)
- Improving agronomic management (beginning in 2015): evaluation of different crop geometries for improving cotton yield, mechanization studies, soybean nitrogen and phosphorus trials, and studies of effects of different sowing times and seed rate on wheat yields after cotton)
- Organic pest management
- Sustainability of organic cotton (survey)
- Evaluation of GM-free cotton varieties
- Alley cropping

The work to improve the efficiency of rock phosphate is especially relevant because of the alkaline vertisols in the area sharply reduce the effectiveness of rock phosphate as a fertilizer. Interactions with cotton farmers through focus groups as well as farm surveys showed that there was great yield variation from farm to farm and year to year, suggesting the potential value of improving agronomic practices for organic cultivation. This led to the beginning of applied research on agronomic management in 2015. In organic cotton production, pest management is a major challenge for farmers. Work in this area has been conducted throughout the life of the project, and continues to be a high priority. In 2015, a farmer survey

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<sup>26</sup> In the Bt-cotton treatment, the same variety with a Bt gene is used.

was carried out to identify the motivations of organic and conventional cotton farmers for following their respective farming practices. The lack of appropriate varieties and planting material is an important constraint for the expansion of organic cotton cultivation, and so the evaluation of GM-free cotton varieties is an important area of research.

## **5.2. Assessment**

### ***Relevance***

Participants at the HE workshops and other stakeholders consulted feel that the project has been highly relevant for several reasons:

- There is rapidly growing demand for organic cotton in world markets, and India is the largest producer of this commodity in the world. Indian organic producers face numerous technical challenges to production, which SysCom is addressing.
- Very little research has been conducted on organic cotton, in India or elsewhere, limiting the supply of scientific information for improving organic cotton production. SysCom's unique research, on various aspects of organic cotton production is generating valuable new information for improving organic cotton production, in India and elsewhere.
- SysCom's research expertise serves as a valuable complement to bioRe's strength in addressing economic and institutional barriers to organic cotton production and marketing.
- There is no other platform to address the challenges facing OA in Madhya Pradesh, and no other LTE comparing organic and conventional agricultural production systems in the country.

Since a number of issues related to the comparative performance of organic and conventional cotton production systems remain unanswered, stakeholders believe that the LTE continues to be relevant. In the HE workshop, a consensus emerged that to enhance its relevance, POR should expand the use of Mother and Baby trials focused sharply on key priorities of organic producers. At present, farmers' priorities include:

- management of major pests (especially boll worm);
- supply of quality seed of appropriate varieties;
- means of increasing the supply of nitrogen for organic crops; and
- coping with uncertain weather / climate.

To ensure the relevance of POR priorities over time, SysCom and bioRe Ltd. should establish more formal and effective feedback mechanisms from farmers and extension workers to researchers.

### ***Effectiveness***

In general, project implementation has been highly effective. As shown in Annex 7, good progress has been made toward the achievement of nearly all of the project's objectives. One area in which achievements have lagged relates to the publication of research results in peer-reviewed journals. As noted in the following section, SysCom-India has also had several important unanticipated achievements.

## ***Achievements / impacts***

### *Main achievements to date*

Participants at the HE workshop identified the following major achievements:

- Establishment and implementation of an impressive and accessible LTE, and well-organized collection and storage of research samples
- Accumulation of solid scientific information comparative system performance and relevant topics for local organic cotton producers, some of which has been published
- Extensive program of POR, including Mother-and-Baby Trials that address relevant problems.
- Establishment and smooth operation of a Farmer Advisory Committee, with 10 organic and 10 conventional farmers (one of which has switched to organic cultivation), with stable membership, to guide research and assess results
- Development of valuable research infrastructure (e.g., the soils and entomology laboratory)
- Excellent working relations, commitment, and support of bioRe India Ltd.
- Commitment, competence, and stability of local staff, many of whom joined the project from bioRe Association (strengthening communication and relations between SysCom and bioRe)
- Contributions to development of capacity of several foreign university students through thesis research and internships
- Dissemination of research results via scientific publications, leaflets, posters, and regular farmer field days and exposure visits.

The SysCom-India team has recently completed an analysis of productivity and profitability of the treatments in the LTE during SysCom Phases 1 and 2 (Bautze et al., 2017, pages 18-19). Without considering premium prices farmers receive for organic cotton, the main conclusions are that:

- On average, yield and gross margin for cotton crops were lower in the organic systems (Treatments 1 and 2) compared to the conventional systems (Treatments 3 and 4).
- Average yield and gross margin for soybean crops were similar in all the systems.
- Wheat yields and gross margins were lower in the organic systems compared to the conventional systems.
- On average, the benefit/cost ration is significantly higher for organic systems compared to conventional systems.
- “Organic systems can be equally profitable and a less risky investment for assets-poor and small-holder cotton farmers... [Considering] the premium price, gross margins and benefit-cost rations for organic systems will be much higher.”

In the POR work, research on efficiency of rock phosphate, combined with results of work to improve the management of farm-yard manure resulted in the development of an approach for farmers to incubate rock phosphate in buttermilk and then produce a high-quality phosphorous-rich compost, in the form of “rock phosphate-enriched farm-yard manure” (Andres et al, 2016, page 138). This technology has been disseminated by bioRe since 2014.

Interactions with cotton farmers, both through focus group meetings and farm surveys, showed that there was great yield variation from farm to farm and year to year. This suggested the potential value of improving agronomic practices for organic cultivation, and led to the initiation of applied research on agronomic management in 2015.

In organic cotton production, pest management is a major challenge. Work in this area has been conducted throughout the life of the project, and continues as a high priority.

In 2015, a farmer survey was carried out to identify the motivations of organic and conventional cotton farmers for following their respective farming practices. Organic farmers were motivated by the sustainability of cotton production and growing safer food without pesticides. Smaller organic farmers were more concerned with obtaining premium prices, whereas larger organic farmers were more concerned about reducing their dependence on external inputs. Conventional farmers were mainly concerned with achieving higher productivity and were more sensitive about their reputation in the community (Riar et al. 2017).

The lack of appropriate varieties and planting material is an important constraint for the expansion of organic cotton cultivation, and so the evaluation of GM-free cotton varieties is an important area of research. Initiated with the support of a FiBL colleague, this is one area of research that has now been transferred to bioRe Ltd, as a strategic area of the organization's research in support of the organic cotton sector.

#### *Areas where more could have been achieved*

Workshop participants felt that more could have been achieved in the following areas:

- It has not been possible to conclude an agreement between FiBL and the Government of India (GOI) / Indian Council of Agricultural Research (ICAR). This has limited SysCom's partnering beyond bioRe.
- Few Indian university students have been involved in SysCom research, largely due to the absence of a research university nearby bioRe's campus, making it difficult to attract promising students.
- Links between research (SysCom) and extension (bioRe India) could be better structured and more highly formalized. Notwithstanding progress on this front, there is still room for strengthening local engagement.
- There is a backlog of soil and plant samples awaiting analysis.
- Pest management, particularly control of the cotton boll worm, has emerged as an area requiring more research.
- More work is needed on environmental benefits of organic cotton production
- More systematic information on dissemination of innovations from the project would be useful. It appears that there has been limited adoption of technologies developed / tested through POR.

#### *Factors that have influenced achievements*

Factors that have favored SysCom-India's achievements include:

- Working in the heart of India's organic cotton industry, which contributes significantly to global supplies of this commodity
- Being hosted and supported by bioRe, and based at their campus. Since bioRe and its partner organizations attend to the entire value chain for organic cotton – from the farmer's field all the way to the retailer – this working with bioRe has provided a positive environment and practical orientation for SysCom's work.
- Competence, commitment, and stability of local staff members

SysCom-India has faced the following challenges:

- Limited global research / knowledge base on organic cotton production
- Limited interest and engagement of India's public research, extension, and educational institutions in organic agriculture ("Green Revolution" paradigm), reflecting the scant importance of this sector at present.
- The lack of a formal agreement between FiBL and GOI, which would facilitate engagement with a range of national institutions (e.g., State Agricultural Universities and public entities); access to expertise and laboratory infrastructure in the public-

sector research organizations; and access to national funding sources, to which national organizations could apply, in partnership with SysCom/FiBL.

- Remote location of the bioRe campus, which makes it difficult to attract and retain research personnel, students, and visitors from other parts of the country
- The near universal prevalence of Bt cotton varieties in India
- Lack of appropriate varieties and seed supplies for organic production

### *Potential future impacts*

There are 2 potential paths for future impact:

- **Contributions to global knowledge** on the comparative performance of organic and conventional farming systems for producing cotton, and on related topics (e.g. crop, nutrient, and pest management, varieties, and seed sources). To make these contributions, SysCom-India would need to prioritize the completion and publication of peer-reviewed publications.
- **Contributions to local innovation in organic cotton production.** To make these contributions, SysCom-India should prioritize working more closely with bioRe India in applied research that addressed farmers' most pressing production problems.

With the current staffing and resources, it would be difficult for SysCom-India to work intensively and effectively in both of these areas. This highlights the importance of setting clear priorities for future work, and of establishing strong partnerships to mobilize the resources and expertise of other relevant actors.

### **Sustainability**

Since SysCom-India is working directly within the field of sustainability science, its contributions to sustainability are essentially the same as its impacts, as discussed in the previous section.

#### *Sustainability of SysCom-India's contributions*

The extent to which SysCom-India's actions lead to sustainable benefits will depend on the extent to which:

1. it contributes to scientific knowledge that becomes widely available;
2. its results are taken up by bioRe in its education and extension programs;
3. bioRe develops the commitment, capacities, and resources needed to continue with the LTE and POR activities; and
4. other individuals and organizations in India become more fully engaged in SysCom's activities and empowered to continue them after CCD funding for the project ends.

The project has begun to contribute to scientific knowledge through its research reports and peer-reviewed publications, and it is beginning to make useful information available to practitioners in formats that are appropriate for them. If the project completes the publications now in the pipeline, it will make significantly larger contributions to knowledge by the end of Phase 3.

The close working relations between SysCom-India and bioRe are one of the hallmarks of this project, which augers well for the uptake of SysCom's results in bioRe's education and extension programs. Although bioRe's work has until now focused on contract farming, extension, and farmer education, it is building up its capacity for applied research (illustrated by its taking on responsibility for cotton breeding); and it intends to expand its applied research work. Expansion of bioRe's research capacity improves the possibilities that bioRe may be able to continue the systems research that SysCom has initiated.

Aside from bioRe, few other individuals and organizations in India have been engaged in SysCom activities, and this limits the possibilities that they will continue with systems

research after CCD funding for the project ends. Expanding the scope of partnering in India could enhance the sustainability of SysCom's activities and benefits.

### ***Efficiency***

Overall, the use of resources seems to have been very efficient. Exemplary trials and facilities have been developed in India with minimal use of project resources, and they have been well integrated into bioRe's campus and facilities. The stability of local project personnel and the fact that several staff members were previously with bioRe's extension team has contributed to the project's overall efficiency.

One factor that may have limited efficiency has been the inability to successfully conclude negotiations for a formal agreement between FiBL and the Government of India, which has limited collaboration with local organizations and access to funding sources.

The budget shortfall in Phase 3 has limited SysCom's activities and accomplishments in several ways. Some studies that were planned could not be initiated. Development of laboratory facilities has been slower than anticipated, leading to a backlog of unprocessed samples, and having to send some samples to Germany, at considerable cost.

## **5.3. Recommendations**

### ***Recommendations for completing Phase 3***

These suggestions are intended to stimulate discussions and decisions, consistent with available time and resources:

1. Complete the collection, storage, and analysis of data as per research protocols
2. Ensure that students complete their studies and submit theses and final reports
3. Document main findings of the research studies conducted to date, in research reports, peer reviewed publications, policy briefs, leaflets and other formats that are appropriate for reaching and influencing intended audiences.
4. Make the project's informational outputs widely available on the websites of SysCom, FiBL and bioRe.
5. Work with both women's and men's groups to formulate research proposals that respond to their needs and interests.
6. Conduct a study of dissemination of innovations from the project (this initial study may employ "informal survey" methods)<sup>27</sup>
7. Prepare a summary report on the project's key findings to date. This report should relate to the project's research hypotheses and respond to the research questions. It should state in clear and accessible terms how organic and conventional cotton production systems perform in the context of sustainable development.
8. Organize a final symposium to present results, define knowledge gaps, and formulate priorities for future research
9. Prepare a proposal for Phase 4 that reflects the knowledge gaps and farmer's priorities

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<sup>27</sup> See, for example, "The Art of the Informal Agricultural Survey" by Robert Rhoades, <http://cipotato.org/wp-content/uploads/2014/09/TrainingDoc21062.pdf>.

### **Recommendations for work beyond Phase 3**

It is recommended that, in a possible Phase 4 (2019 – 2022), SysCom work on 3 broad fronts:

1. **Generating knowledge on the long-term effects of organic and conventional systems for producing cotton.** This work, associated with the LTE, could include more detailed studies on such topics as:
  - management of beneficial and harmful pests;
  - soil physics, biology and chemistry;
  - nutrient and resource efficiency; and
  - pollination (to quantify GM contamination)
2. **Generating knowledge of practical value to farmers, which addresses their priority needs.** Research aimed at developing innovations (POR) should be based on farmers' production needs. A more efficient communication / feedback system needs to be developed between researchers (SysCom) and extension (bioRe). Approaches and activities to consider in this area include:
  - Involvement of researchers in extension activities and vice versa
  - Continuous monitoring of diffusion / adoption of innovations, and periodic assessment of broader changes (livelihood studies)
  - Expand use of Mother-and-Baby trials to new, priority topics (e.g., new varieties and seed for organic cotton, ways to increase nitrogen supplies in organic cotton production, management of pests (particularly boll worm), and weather/climate uncertainty).
  - Develop mechanisms to gain feedback from men's and women's groups to researchers on a frequent / continuous basis
3. **Empowering local partners to conduct relevant R&D.** Approaches and activities to consider in this area include:
  - Secondment of researchers to work with extension teams, and vice versa
  - Periodically have researchers visit farmers with extension agents, and have extension agents participate in planning, monitoring, and evaluation.
  - Train local staff members in research design and analysis and assist them in taking more responsibilities for research studies
  - Establishing stronger links with relevant Indian R&D organizations
  - Exchange visits / programs between local and international organizations
  - Empowerment of women to take on research roles
  - Establishment of an interdisciplinary "Scientific Advisory Board" that would assist in marshaling Indian expertise in needed areas, including economics and the social sciences

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# Annexes

## Annex 1. Acronyms and abbreviations

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AFS	Agroforestry system
AOPEB	Asociación de Organizaciones de Productores Ecológicos de Bolivia (Association of Ecological Producers Organizations in Bolivia)
CA	Conventional agriculture
CCD	Coordinating Committee of Donors, SysCom
CGIAR	Consultative Group on International Agricultural Research
DAC	Development Advisory Committee, Organization for Economic Cooperation and Development
DOK	The DOK Trial assesses biodynamic (D), organic (O) and conventional (K for German “konventionell”) production of arable crops.
FiBL	Research Institute of Organic Agriculture
HE	Horizontal evaluation
ICIPE	International Center for Insect Pests
KALRO	Kenya Agriculture and Livestock Research Organization
KIOF	Kenyan Institute of Organic Farming
KOAN	Kenyan Organic Agriculture Network
LED	Liechtenstein Development Service
LTE	Long-term experiment
OA	Organic agriculture
PIAF	Programa de Implementaciones Agro-ecológicas y Forestales, (Program for Agro-ecologica and Forestry Implementations),
POR	Participatory on-farm research
PROINPA	Fundación para la Promoción e Investigación de Productos Andinos (Foundation for the Promotion and Research on Andean Products)
R&D	Research and development
SAFS	Successional Agroforestry Systems
SDC	Swiss Agency for Development and Cooperation
SysCom	Long-term systems comparisons in the tropics
VCD	Value-chain development
UMSA	Universidad Mayor San Andres, Bolivia

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## Annex 2. Terms of Reference for SysCom Program Evaluation 2017

SysCom Team FiBL, May 192017

### Introduction

Since 2007, the SysCom program fully entitled ‘Farming Systems Comparison in the Tropics’ aims at comparing different agricultural production systems in the tropics to generate evidence on the contribution of organic versus conventional production system towards sustainability (see goal and outcomes below). For that purpose, the program has implemented projects in Kenya, India and Bolivia with two components (a) on-station system comparison trials, so-called ‘Long Term Experiments’ (LTE), and (b) ‘Participatory On farm Research (POR)’. While the LTE work aims to produce scientific evidence on the benefits and drawbacks of organic agriculture for sustainable development, the POR work seeks to promote the development and dissemination of locally adapted technologies and innovations.

**Overall Goal** – Enhanced know-how on advantages and limitations of different agricultural production systems in three tropical countries contributes to sustainable agriculture.

**Outcome 1** – Solid agronomic and socio-economic data on major organic and conventional agricultural production systems in selected project regions are collected, published and disseminated.

**Outcome 2** – New locally-adapted technology innovations for major organic production systems are available and ready for dissemination.

SysCom is implemented by the Research Institute of Organic Agriculture (FiBL) with different local partner organisations. It is funded by donors, who together form the Coordination Committee of Donors (CCD): Biovision Foundation, Coop Sustainability Fund, Liechtenstein Development Service (LED), and Swiss Agency for Development and Cooperation (SDC). For further information see: <http://www.systems-comparison.fibl.org/>. The program is currently in its third phase (2015 – 2018), and will undergo an evaluation during 2017. In contrast to previous evaluations, CCD members have agreed with FiBL that this upcoming evaluation should more strongly involve project staff and project stakeholders in the partner countries to better reflect their point of view as part of the evaluation report and use this process as a learning opportunity for all involved actors. In this logic, this document outlines the concept of a **project evaluation that combines external evaluation with peer evaluation**. For this purpose, the so-called *Horizontal Evaluation* methodology will be used as the basic methodological framework for the participatory assessment, among peers, while an external evaluator will be part of this process with the additional task to write up an evaluation report that builds upon this participatory assessment, respectively its findings.

The Program Evaluation has two objectives.

1. The first objective is to assess SysCom’s achievements to date. What have been the main achievements so far? What achievements and impacts may be anticipated in the near future?
2. The second objective is to reflect on ways to capitalize on SysCom’s achievements, to boost future impact. What achievements are most meaningful to boost future impact? How best to capitalize on the results obtained to date?

The intended audiences for the evaluation report includes program donors, implementers and key project partners.

This document specifies the Terms of Reference (ToRs) that applies for (1) the external evaluator, (2) the moderator of the three Horizontal Evaluation workshops, and (3) the SysCom teams that will be organizing the workshops in each county.

**Tentative timetable:**

› Briefing of external evaluator and workshop implementers	March 17
› Sharing of first documents with evaluator	April 17
› Workshop preparation	April onwards 17
› Holding the workshops in the countries	June – September 17
› Workshop reports	early October 17
› CCD/SysCom FiBL team debriefing (presentation draft report)	October 17
› External evaluation report, first version	October 17
› Comments on draft report by donors and implementers	November 17
› Final version evaluation report	December 17

**Terms of Reference for the External Evaluator**

*Main tasks and responsibilities:*

- Get acquainted with the SysCom Program by revising different key documents (April onward)
- Participate in the 3 Horizontal Evaluation workshops as an external participant, i.e. using the workshops’ information for the evaluation but not dominating the workshop (June-September)
- Interview key project stakeholders during and after the workshops (June-September)
- Write and share a first version of the evaluation report (approx. 20 – 30 pages), reflecting the guiding questions and workshop reports (October-November); the report could be structured according annex 1
- Refine the evaluation report after having received comments from the side of FiBL, main local partners and the CCD (October-December)

*Evaluation Criteria and guiding questions to be used by the External Evaluator*

**Effectiveness – how effective has the program been implemented?**

- To what extent have the expected outputs been achieved?

**Efficiency – how efficient has the program been implemented?**

- Were the available resources used efficiently?
- Were there any negative impacts because of the budget cut?
- How efficiently were project partners and beneficiaries involved in the project?

**Impact – what are the programs most important achievements at the international, national and local level?**

- What type of achievements has the project generated, and how important are these and why?
- What were the internal and external factors that fostered and hampered the development of these achievements?
- What achievements are relevant to be further capitalized in the future and how?

**Sustainability**

- To what extent contributes SysCom to improved sustainability and through what achievements?

- How sustainable are the SysCom achievements and findings, i.e. what will happen in case the project's activities stop?
- What future action would be relevant to enhance (a) the sustainability of SysCom's achievement and (b) SysCom's contributions to sustainability?

### ***Exit Strategy***

Based on the information obtained during the workshop and additional interviews, the external evaluator would also share his/her reflections in regard to the program's exit strategy, where the following guiding questions will apply:

- How should an effective exit strategy be designed, i.e. when phasing out the funding of CCD?
- What challenges will need special consideration and measures to cope with them?

### ***Terms of Reference for the Workshop Moderator***

#### ***Main tasks and responsibilities:***

- Propose, discuss and agree on the agendas for the 3 workshops, including logistics and the preparation of material that will be presented/shared during the workshop (March-April)
- Briefing of the external evaluator in regard to workshop implementation and access to additional information (March-April)
- Define and share with workshop organizers a template for workshop reporting (Mai)
- Revise material to be used during the workshop (prior to workshops)
- Moderate the three workshops (June-September)
- Elaborate the workshop reports (early October)

#### ***Evaluation Criteria and guiding questions to be used during the workshop***

##### **1<sup>st</sup> Evaluation Criteria – to assess SysCom's achievements up to date**

- What important achievements have been obtained so far?
- How were these achievements created?
- What were the explicit contributions from the side of the projects helping to produce these achievements, and what contextual factors contributed?

##### **2<sup>nd</sup> Evaluation Criteria – to reflect on important future impact and how it would capitalize on SysCom's achievements (as part of an exit strategy)**

- What type of impact would be important to obtain in the future and why?
- What SysCom achievements are most meaningful for this type of impact and why?
- What are the options, interests and possibilities to consolidate activities and increase local ownership of the program's long-term trials?

#### ***Tasks & Responsibilities for the SysCom teams***

- Propose dates and venues to be agreed with SysCom management and the workshop moderator (March)
- Propose workshop participants and fine-tune budget for the workshop (March)
- Plan and implement the production of material to be used during the workshop (e.g. PPTs, videos from producers) (April-June)
- Implement the workshops (June-September)
- Writing of the workshop minutes and document the visualisations done during the workshop, pictures of the workshop (June-September)
- Support interview process of external evaluator, depending on demand (July-September)

*Note: The SysCom Program Management Team will be supporting and supervising the process, i.e. providing key document, ensuring that workshop dates are defined, contract with external evaluator is signed, CCD is involved where needed etc.*

**Annex: Proposed evaluation report structure**

- **Content page**
- **Abbreviations**
- **Acknowledgements**
- **Executive summary**
- **Introduction**
  - Purpose and objectives of the evaluation
  - Scope of the evaluation, short statement on the evaluation methods used
- **Findings at the country level – Kenya**
  - Context of the interventions
  - Description of the interventions
  - Reflection on the interventions and achievements
- **Findings at the country level – Bolivia**
  - Context of the interventions
  - Description of the interventions
  - Reflection on the interventions and achievements
- **Findings at the country level – India**
  - Context of the interventions
  - Description of the interventions
  - Reflection on the interventions and achievements
- **Overall assessment and conclusions**
  - Effectiveness
  - Efficiency
  - Impact
  - Sustainability
- **Implications for the future**
  - Lessons that may have implication for the future of the program or may be relevant for wider application
- **Recommendations**
  - Proposals for next program phase within the three countries or beyond
- **Annexes:**
  - TORs
  - List of stakeholders consulted
  - Others

### Annex 3. Evaluation criteria and questions for the SysCom Evaluation 2017

#### Relevance

- How relevant has the program been, at international, national and local level?
- Continuing / future relevance of the program?

#### Effectiveness

- How effectively has the program been implemented?
- To what extent have the expected objectives been achieved (outcomes and outputs)?
- What additional or unanticipated achievements have there been?

#### Achievements / impact

- *Types of achievement.* What types of achievements has the project generated? How important are these and why?
- *Success factors.* What internal and external factors have fostered or hampered the development of these achievements?
- *Potential future impacts.* What achievements have greatest potential for the future? How best can they be capitalized on?

#### Sustainability

- *Contributions of SysCom to sustainability.* To what extent is SysCom contributing to improved sustainability, and through what achievements?
- *Sustainability of SysCom's contributions.* How sustainable are SysCom's achievements and findings? What will happen in case the project's activities stop?
- *What future actions would be relevant to enhance:* (a) SysCom's contributions to sustainability; and (b) the sustainability of SysCom's achievements/contributions?

#### Efficiency

- How efficiently has the program been implemented?
- Were the available resources used efficiently?
- Were there any negative impacts because of the budget cut?
- How efficiently have project partners and beneficiaries been involved in the project?

#### SysCom Exit Strategy

The external evaluator will share reflections on the program's exit strategy, guided by the following questions:

- How should an effective exit strategy be designed (i.e. when phasing out the funding of CCD)?
- What challenges will need special consideration, and what measures could be useful for coping with them?

Source: Based on the Evaluation Terms of Reference (Annex 2, above).

## **Annex 4. The Evaluator**

Douglas Horton has more than 40 years of international experience in applied and participatory action research and program evaluation, related mainly to agricultural research and development, innovation systems, capacity development, environmental sustainability, and inclusive value-chain development. From 1975 to 2004, Horton worked for 2 centers affiliated with the Consultative Group on International Agricultural Research (CGIAR). From 1975 to 1990 he led the Social Science Department of the International Potato Center, based in Peru. From 1990 to 2004, at the International Service for National Agricultural Research, based in The Netherlands, he worked mainly in the areas of research planning, monitoring, and evaluation.

Since 2004, Horton has served as a consultant for numerous CGIAR centers and governance bodies, and also for national and international agencies, including the Commonwealth Science and Industrial Research Organization (Australia), the Foundation for Advanced Studies in International Development (Japan), the Inter-American Development Bank, the International Fund for Agricultural Development, Oxfam, the McKnight Foundation, the New Zealand Agency for International Development, Universalia (Canada), and the World Bank.

He has managed or led more than 40 evaluations, and has authored more than 100 publications and reports. A member of the American Evaluation Association, the Canadian Evaluation Society, and the European Evaluation Society, Horton is fluent in English and Spanish and holds a PhD in Economics from Cornell University.

## **Annex 5. Program documents and publications consulted**

### ***Program documents***

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<sup>28</sup> The publications of Eyhorn et al. (2005; 2005; 2007), which were prepared before SysCom began operations, provide relevant information based on FiBL's early work with organic cotton in India.

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## **Annex 6. Field visits and interviews**

In each of the study countries, the evaluator interviewed participants during the HE workshop and participated in the field visits organized for the event. Additionally, he visited a few other field sites and interviewed farmers, market agents, researchers, development professionals, and other relevant stakeholders, including, but not limited to those listed below.

### **Kenya**

- Field visit to the LTE site and 3 farmer collaborators in Chuka
- Interviews with researchers in Nairobi:
  - Dr. David Kamau, KALRO
  - Dr. Anne Muriuki, KALRO
  - Dr. Monicah Mucheru-Muna, Kenyatta University
  - Dr. Catherine Kamau, JKUAT
- Interviews with development professionals and the owners of an organic restaurant and an organic food shop in Nairobi:
  - Dr. David Amudavi, Biovision Africa Trust
  - Samuel Kiruku Ndungu, Marketing Advisor, KOAN
  - Eustace Kiarii Gachanja, National Co-coordinator, KOAN
  - Catherine Mbugua, supply chain coordinator for Bridges restaurant
  - Lilian Kamari, owner, Kalimoni green grocery
  - Martha Musyoka, SysCom-Kenya

### **Bolivia**

- Interview with Windson July, first technical director of SysCom-Bolivia and present leader of Bolivia's national Cacao program (La Paz) in the ministry
- Visit to the organic food market in Plaza Lira (La Paz)
- Exchange with Dr. Johanna Jacobi, former PhD student in SysCom, senior scientist at CDE of University of Bern
- Interview with don Pedro Alvorta, local cacao producer, highly knowledgeable of the development of SysCom-Bolivia and the Sara Ana research station.
- Visit to El Ceibo cooperative and meeting with cooperative officials (Sapecho)
- Visit to Ecotop facilities and SAFS work (Sapecho)
  - Dr. Joachim Milz, director Ecotop SRL
  - Hugo Rocabado, director Ecotop Foundation
  - Ecotop technical staff (Fortunato Velazquez, Beatrice)
- Meeting with researchers at the Instituto de Ecología, UMSA (La Paz)
  - Lic. Miguel Limachi: Biólogo-Entomólogo
  - Dr. Kazuya Naoki: Doctor en Ecología
  - Lic. Mauricio Ocampo: Biólogo-Herpetólogo
  - Lic. James Aparicio: Biólogo-Herpetólogo
  - Dra. María Ripa: Doctora en Biología
  - Lic. Patricia Amurrio: Bióloga-Edafóloga
- Interview with Dr. Olivier Deheuvels, CIRAD/World Agroforestry Center (Lima, Peru)

### **India**

- Vivek Rawal, CEO and Director bioRe-India
- Ginar Singh Dagur Village Choli
- Manjeet Singh and Gyan Singh Village Choli
- Shankar Tejsingh Village Choli

## Annex 7. Progress toward expected outcomes and outputs

### Annex 7a. Summary of the Program self assessment carried out at the end of 2016

	SysCom program (average)	Projects		
		Ken	Ind	Bol
Outcome 1. Disseminate agronomic, economic and ecological data on organic and conventional agricultural production systems (3)	Yellow	Yellow	Green	Yellow
Output 1.1. Well-maintained agronomic field trials are used to collect good quality data (2)	Green	Green	Green	Yellow
1.2. Trial results are published through peer-reviewed journals, scientific meetings, policy briefs and mass and social media (6)	Yellow	Yellow	Yellow	Yellow
1.3. Trials serve as a research platform for students and satellite studies; and for meetings on sustainable agriculture (3)	Green	Green	Green	Green
1.4. Local project staff and students increase knowledge on research for sustainable agriculture (2)	Green	Yellow	Green	Green
Outcome 2. Adoption of innovations addressing organic farmers' needs, leading to improved yields and rural livelihoods (4)	Yellow	Yellow	Green	Yellow
Output 2.1. On-farm trials addressing bottlenecks of organic farming or surveys assessing adoption and farmers' livelihoods (3)	Yellow	Green	Green	Yellow
2.2. Results of on-farm trials and farm surveys are presented in technical leaflets, scientific meetings, mass and social media (4)	Yellow	Yellow	Green	Yellow
2.3. On-farm trials are used for disseminating technologies to farmers, extension officers and other stakeholders (3)	Yellow	Yellow	Green	Yellow
2.4. Farmers and project staff are empowered to conduct participatory research (3)	Yellow	Yellow	Yellow	Green

**Source:** Based on Annex II of Program Annual Report 2016, which presents progress for each indicator in the program logframe (Annex 7b, below).

**Methodological notes:** In the original source, **Green** indicates full achievement; **yellow** indicates there is some delay, but delivery is on the way; and **red** indicates that the implementation has not started or there are serious delays. By applying a score of 0 for indicators in red, 5 for ones in yellow, and 10 for ones in green, the evaluator calculated average scores for each output and outcome, and converted these average scores again to the respective 3 colors.

**Annex 7b. Achievement of expected outcomes and outputs (Program self assessment carried out at the end of 2016)**

Overall goal/impact	Indicators	Kenya	India	Bolivia	Remarks
Enhance knowledge and knowhow about the sustainability of the different agricultural production systems in three tropical countries	1. Policy makers include research results in their policies by 2020				
	2. Scientific community use research findings and build on these results starting from 2015				<b>Kenya:</b> Adamtey et al. (2016) is cited three times <b>India:</b> Dionys et al (2013) cited by 24 studies <b>Bolivia:</b> late publication of the results, not taken yet by the scientific community
	3. Regional and/or national University curriculums incorporate new findings on organic or sustainable agriculture issues starting from 2015				<b>Kenya:</b> Several exchanges of university members with the SysCom team <b>India:</b> Educational tours of students from local institutions to SysCom field site; Dr. Bhullar taught in Summer School of ETH. <b>Bolivia:</b> Field visits from agronomy students from the University of La Paz
	4. Extension services incorporate at least one research findings or developed technology in their programmes starting from 2012				<b>Kenya:</b> Compost technologies are used by extension service <b>India:</b> Rock phosphate methodology incorporated into extension programme <b>Bolivia:</b> Extension services of El Ceibo promote agroforestry systems
	5. Proportion of farmers directly or indirectly involved in the project adopting at least one developed technology increases 5 % per year, in each country starting from 2012				<b>India:</b> Farmers adopting research technologies steadily increasing

Outcome 1	Indicators	Kenya	India	Bolivia	Remarks
The dissemination of solid agronomic, economic and ecological data on major organic and conventional agricultural production systems in selected project regions which will lead to an enhanced knowledge base that can be used by different stakeholders	1. Each published paper is cited at least four times in another peer-reviewed publication				<p><b>Kenya:</b> The paper on productivity and profitability is cited three times until now, but it is one of the most downloaded articles from journal "Agriculture, Ecosystems &amp; Environment" in the last 90 days (March 2017).</p> <p><b>India:</b> First publication from India already cited by 24 articles</p> <p><b>Bolivia:</b> 4 published (3 end of 2016), it is still too early to being cited by other researchers</p>
	2. At least one policy brief in each country submitted by policy makers to redirect agricultural policies by 2020				<p><b>Kenya:</b> Foreseen towards the end of 2017</p> <p><b>India:</b> Foreseen towards the end of 2017</p> <p><b>Bolivia:</b> Foreseen towards the end of 2018</p>
	3. At least one workshop in each country is held by extension workers based on the knowledge developed by the project				<p><b>Kenya:</b> Stakeholder workshop in June 2016 (see Kenya chapter in this report)</p> <p><b>India:</b> Annual stakeholders meeting and workshop at bioRe held and several workshops organised by extension workers</p> <p><b>Bolivia:</b> several workshops in cooperation with El Ceibo/ECOTOP and project events</p>
Outputs	Indicators	Kenya	India	Bolivia	Means of verification
1.1. Well-maintained agronomic field trials are used to collect good quality data	1. Quality data on specified parameters is continuously being produced in each country				
	2. Trial data for all required parameters are available for analysis in due time (within 9 months for laboratory data, 6 months for field data)				<b>Bolivia:</b> Soil data with some delays
1.2. Trial results are published through peer-reviewed journals, scientific meetings, policy briefs and	1. Four peer-reviewed papers per country are submitted (12 in total)				<p><b>Kenya:</b> 2 published papers and 2 under review by co-authors</p> <p><b>India:</b> 1 submitted, 1 under preparation</p> <p><b>Bolivia:</b> 4 published and 1 submitted</p>
	2. One joint publication is submitted to a peer-review journal				<b>All:</b> Preparations started in 2016 and data analysis as well as manuscript writing is on-going in 2017. Submission of

mass and social media					the paper is foreseen for autumn 2017.
	3. One contribution to a scientific conference, seminar or workshop per country per year				<b>Kenya:</b> Tropentag (Vienna) <b>India:</b> 3 contributions by SysCom team and 4 by students in 2016 <b>Bolivia:</b> 8 conference contributions in 2016
	4. One policy brief developed in each country				<b>Kenya:</b> Foreseen towards the end of 2017 <b>India:</b> Foreseen towards the end of 2017 <b>Bolivia:</b> Foreseen towards the end of 2018
	5. One mass-media release (e.g. print, video, radio) per country for each publication				<b>Kenya:</b> Media release on findings from the productivity and profitability paper <b>India:</b> 3 media releases in 2016 <b>Bolivia:</b> TV contribution for local and national TV channel
	6. One news article to be published on the FiBL Facebook and Twitter accounts per country per year				<b>Kenya:</b> About stakeholder workshop in June 2016 <b>India:</b> 3 social media inputs published in 2016 <b>Bolivia:</b>
1.3. Field trials serve as a research platform for students' work and satellite studies, stakeholders are aware of the trials and use the sites for meetings around sustainable agriculture	1. Two satellite studies completed in India and Bolivia, and two initiated in Kenya				<b>India:</b> two satellite studies completed with a master student and a PhD student, two new ones ongoing <b>Bolivia:</b> Cd project is finished with a publication and workshop, two PhD students finished field and lab work, several thesis work finished see list of thesis
	2. Trials to be visited by at least 500 people per year from various stakeholders (farmers, extension officers, policy makers, scientists and students) and one sector-specific meeting or field day is held per country (e.g. main crop, organic sector, etc.)				<b>Kenya:</b> 143 people visited the trial sites in Thika and Chuka <b>India:</b> 547 visitors- 218 male and 179 female farmers, 1 scientist, 96 (32 male and 64 female) students and 53 extension officers. <b>Bolivia:</b> 584 visitors in 2016 (38% female), see detail in text
	3. Number of visits to the web page will increase 1,000 per year to reach 10,000 in 2018 starting from 6,000 in 2014				<b>All:</b> 3556 people visited the website in 2016

1.4. Local project staff and students increase knowledge on research for sustainable agriculture	1. Local staff and BSc/ MSc /PhD students receive training on at least one research and/or management relevant topic per year in each country				<p><b>Kenya:</b> Students were trained on pesticide trial establishment and phosphorus solution and sorption</p> <p><b>India:</b> Staff trained on mechanised field operations, students trained on farming systems research</p> <p><b>Bolivia:</b> students trained on data control and data analysis</p>
	2. 6 MSc/BSc students (3 females, 3 males) completed and 6 PhD students (3 females, 3 males) initiated or completed				<p><b>Kenya:</b> 3 PhD studies (1 female, 2 male) and 4 MSc (2 female- 1 completed and 1 on-going)</p> <p><b>India:</b> 1 Master student and 1 PhD student (both male) completed research work; 1 female PhD student and 1 male master student currently working</p> <p><b>Bolivia:</b> 2 PhD studies (1m/1f) ongoing, 3 MSc accepted, 1 MSc data collected, 4 BSc data collected</p>

Outcome 2	Indicators	Kenya	India	Bolivia	Means of verification
The adoption of newly developed, locally-adapted technology innovations addressing organic farmers' needs leads to improved yields and rural livelihoods in the mid- and long-term perspective	1. Two technologies per country developed and tested by 2018 and documented for farmers and extension officers				<p><b>Kenya:</b> soil nematode control and soil fertility management</p> <p><b>India:</b> Rock phosphate and pest control for organic</p> <p><b>Bolivia:</b> Cacao cultivars tested, control of mirids and frosty pod rot, manuals about the experiences in elaboration</p>
	2. About 70 % of the farmers (20 % females, 80 % males) collaborating in the technology adaptation trials continue using the improved technologies after trial conclusion				<p><b>Bolivia:</b> farmers lost research plots with cultivar tests due to natural hazards</p>
	3. Yields increase up to 30 %				<p><b>Kenya:</b> Higher yields in Kangari (carrots), but lower yield in Chuka and Kianjugug-Thika (maize/beans)</p> <p><b>India:</b> Organic to conventional yield gap closed in 2016</p> <p><b>Bolivia:</b> not assessed</p>

	4. The total livelihood assets is increased by 10 % to 30 %				
<b>Outputs</b>	<b>Indicators</b>	<b>Kenya</b>	<b>India</b>	<b>Bolivia</b>	<b>Means of verification</b>
2.1. Site-specific participatory on-farm trials addressing bottlenecks of organic farming and/or farm surveys assessing the livelihood of organic and conventional farmers and/or the adoption of the new locally-adapted technology innovations are carried out	1. Two stakeholder workshops are conducted by 2018 in each country, in order to assess research process				<b>Kenya:</b> Stakeholder Workshop in June 2016 <b>Bolivia:</b> Workshop in July 2016
	2. Data from on-farm field trials is updated annually in each country				
	3. A socio-economic farm survey is conducted in each country by 2017				<b>Kenya:</b> Survey was conducted and report is being prepared <b>India:</b> Report already submitted in 2016

2.2. Results of on-farm trials and farm surveys are analysed and presented in technical leaflets, scientific meetings, mass and social media	1. Leaflets and/or other dissemination materials for two technologies are developed in each country by 2018				<b>Kenya:</b> <b>India:</b> <b>Bolivia:</b> about frosty pod rot and mirids in preparation, manuscript about cocoa cultivar evaluation submitted
	2. One contribution to local conferences, seminars or workshops per country per year				<b>Kenya:</b> Contribution to local conference on nematode control by organic farming <b>India:</b> IFD 2016 at Akola University India <b>Bolivia:</b> Two conferences in Bolivia
	3. At least two local mass-media releases (e.g. print, video, radio) per country by 2018				<b>Kenya:</b> Article in “The Organic Farmer” about POR results <b>India:</b> Interview of Dr. Bhullar in local newspaper in Maharashtra <b>Bolivia:</b> TV telecast Sapecho and national channel

	4. One news article published on the FiBL Facebook and Twitter accounts per country per year	Red	Green	Red	<b>Kenya:</b> <b>India:</b> Article on Fibl.org, reporting survey results <b>Bolivia:</b>
2.3. On-farm trials are used for the dissemination of developed technologies to farmers, extension officers and other stakeholders	1. Trials are visited by between 150 to 300 farmers and/or other stakeholders per year in each country	Yellow	Green	Yellow	<b>Kenya:</b> Only 12 visitors were visiting the mother and baby trials due to the constraints after losing one of our field staff in previous years and delay in replacing him. <b>India:</b> 650 visitors - 295 male and 205 female farmers, 1 scientist, 95 (32 male and 63 female) students and 54 extension officers <b>Bolivia:</b> see visitors at LTE and Sara Ana
	2. One meeting and/or field day is held with extension officers and/or other stakeholders per country per year	Red	Green	Yellow	<b>Kenya:</b> No field day was done due to the constraints experienced after losing one of our staff in previous year and delay in replacing him. <b>Bolivia:</b> together with LTE event at Sara Ana
	3. Same as in 1.3	Green	Green	Green	<b>All:</b> 3556 people visited the website in 2016
2.4. Farmers and project staff are empowered to conduct participatory research	1. At least 600 farmers (200 females, 400 males) trained by 2018 between all the three countries, starting from 2015	Yellow	Yellow	Yellow	<b>Kenya:</b> 146 (72 males and 74 females trained until 2015 to 2016) <b>Bolivia:</b> 22 farmers in a two days event organized by El Ceibo Piaf
	2. Local staff and students in each country receive at least one training per year	Yellow	Yellow	Green	<b>Kenya:</b> Students were trained in laboratory and field trial establishment
	3. 4 MSc/BSc students (2 females, 2 males) completed	Green	Green	Green	<b>Kenya:</b> 2 MSc students (1 female, 1 male – 1 completed and 1 on-going) <b>India:</b> 2 MSc students completed <b>Bolivia:</b> 1 BSc completed,

**Source:** Bautze et al. 2017, Annex II. **Green** indicates the outcome/output has been reached. **Yellow** indicates there is some delay, but the delivery of the outcome/output is on the way. **Red** indicates that the implementation of the outcome/output has not been started or there are severe delays