Plantwise Evaluation:

Bolivia, Peru and Nicaragua

FINAL REPORT

September 2016

This report has been produced on behalf of Evidence on Demand, upon request by CABI to objectively evaluate its Plantwise programme in Central and South America for its Plantwise donors (UK Department for International Development (DFID), Swiss agency for Development Cooperation (SDC), European Commission – DG Development and Cooperation (DG DEVCO), Netherlands Ministry of Foreign Affairs (DGIS), Irish Aid, International Fund for Agricultural Development (IFAD), Australian Centre for International Agricultural Research (ACIAR), Chinese Ministry of Agriculture).

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List of acronyms

CIAT	Centre for Tropical Agricultural Research
COSUDE	Agencia Suiza para el Desarrollo y la Cooperación
DGPSA	Dirección General de Protección y Sanidad Agropecuaria
DRASAM	Dirección Regional de Agricultura de San Martín
DSIA	Department of Agricultural and Food Safety
EDAG	National Service for Agricultural and Livestock Health
EEA	Estación Experimental Agraria
ECA	Escuela de Campo
FUNICA	Fundación para el Desarrollo Tecnológico Agropecuario y Forestal de Nicaragua
GPC	Clínica Global de Planta
GDP	Gross Domestic Product
HDI	Human Development Index
IMF	International Monetary Fund
INATEC	Instituto Nacional Tecnológico
INTA	Instituto Nicaragüense de Tecnología Agropecuaria
INIA	Instituto Nacional de Innovación Agraria
MDPC	Monitoreo del Desempeño de Clínicas de Plantas
MAGFOR	Ministerio Agropecuario y Forestal MIP Manejo Integrado de Plagas
MAT	Módulos de Asistencia Técnica
OPD	Organismos Públicos Descentralizados
PROMIPAC	Programa de Manejo Integrado de Plagas en América Central
POMS	Sistema Administrativo en-línea de Plantwise
PROINPA	Foundation for the promotion and investigation of Andean products
SENASA	Servicio Nacional de Sanidad Agraria
REDAF	Red Académica Fitosanitaria
UCATSE	Universidad Católica Agropecuario del Trópico Seco
UNA	Universidad Nacional Agraria
UNAN	Universidad Nacional Autónoma de Nicaragua – León
UNDP	United Nations Development Programme's 2015 Human Development Index

Executive Summary

1. The Evaluation

An Evaluation of the Plantwise programme in the Latin American countries was conducted by a team of two independent consultants during the period June to September 2016. The consultants were Eduardo Quiroga and Bruce Kernan. The countries evaluated were Peru, Bolivia and Nicaragua.

The purpose of the evaluation was to assess the performance of the Plantwise programme, with a focus on Latin America, in terms of its relevance, effectiveness, efficiency, sustainability, impact, coherence and value added, including risks and potential for the future. The evaluation also sought to identify key lessons learned and to assess programme responsiveness to challenges in implementation. Lastly, the evaluation aimed to propose practical recommendations for the improvement of country-specific interventions to strengthen the outputs, outcomes and impact of the program in the region.

The consultants worked together for a week in Peru. Eduardo Quiroga then went to Bolivia for a week and Bruce Kernan to Nicaragua, where they interviewed government officials and farmers at select sites where Plantwise has assisted in establishing and operating plant clinics. The methods employed by the team involved collecting field data through interviews, observations and studying crop budgets. Annex D and E provide maps of the sites visited as well as a list of the people consulted in each country; Annex F outlines the mission's itinerary.

2. Country summaries

In Peru, the National Institute for Agriculture Innovation (Instituto Nacional de Innovación Agraria) (INIA) is the national responsible organisation (NRO), and has adopted Plantwise's methodology in eight of its seventeen experiment stations. In 2018, INIA may adopt the Plantwise model in the rest of its experiment stations. The plant clinics that the eight INIA stations have established are serving as models for the agricultural extension programs of the Agrarian Agencies of regional governments and the environmental staff of municipal governments. The collapse of oil, gas and mineral prices since 2014 has impacted the agricultural sector budget, leading to retrenchment of technical personnel. In addition, a new government has been democratically elected, causing uncertainty in the short term among government agencies. This fluctuating setting could affect the Plantwise programme as it could cause a turnover in Plant Doctors. To establish a national plant health system the NRO anticipates involving agrochemical companies in establishing plant clinics and large-scale, agro export operations that dominate coastal farming.

In Bolivia, the Department of Agriculture and Food Safety (DSIA) of the Santa Cruz governorate is the NRO. Plant clinics are becoming a standard procedure to enhance the technical capacity of extension officers and farmers. There is early evidence of increased crop yields and quality resulting from Plantwise actions. Firm support from the Santa Cruz governorate continues; it has adopted the plant clinic model as part of its institutional activities and has included it in their Yearly Operational Plan. In the Cochabamba governorate, Plantwise has just begun to flourish, and the Valley's Foundation and the Tarata Technical Institute are conducting the Programme's activities. The differences between the Santa Cruz and Cochabamba governorates are accounted for by: 1) their specific evolution in the decentralisation process, and 2) their relative progress in

agricultural development planning. The Santa Cruz governorate, in addition to having achieved its Statutes of Autonomy which was endorsed by the Bolivian Political Constitution, has been implementing a buoyant agricultural development plan. In contrast, the Cochabamba governorate does not have an agricultural development plan nor has it achieved its statutes of autonomy. National revenue from international oil sales has shrunk since 2014 and there is little relief in sight to what has become the worst market slump in the oil market in a generation. This financial stress has been inevitably transmitted to the agricultural budgets of all the governorates, including Santa Cruz. This has led to a turnover in the public sector's personnel, creating a challenge in moving towards a national plant health system.

In Nicaragua, the Academic Network for Plant Health (REDAF) is the NRO. It has become an established, credible regional network of universities, regional government institutions, agricultural cooperatives, and NGOs. Plantwise's goals and objectives are consistent with the current situation of agricultural extension amongst Nicaraguan smallholder farmers. Plant clinics, currently run by cooperatives, universities and NGOs, are proving to be an effective and efficient procedure for increasing the technical capacity of smallholding farmers, and thereby increasing their crop yields and quality. Plant Doctors are teaching smallholder farmers to rely on observation and data, rather than agrochemical dealers, to resolve crop health problems. Because wholesalers and intermediaries control market places, plant clinics have been moved to alternative venues.

Nicaragua's centralised government has partially stymied the expansion of the Plantwise model within the western region. The members of REDAF, Plantwise staff and the NRO are planning how to best incorporate the Plantwise methodology into the agricultural extension strategy of the new Ministry of Family, Community, Cooperative and Association Economy (MEFCCA), with the goal of expanding the use of plant clinics and Plant Doctors to a larger scale and creating an effective national system of plant health. However, the NRO has not yet involved agro-chemical or agro- industrial companies working in export crops. Growth is decelerated owing to the impact of adverse weather conditions for the main agricultural export crops.

3. Performance

3.1 Relevance

Plantwise remains consistent with the CABI mission, its donors' objectives, and more widely with the region's Sustainable Development Goals. It also complements national agricultural extension strategies in the three countries.

The Plantwise programme is as relevant as ever in Peru, Bolivia and Nicaragua. The establishment of plant clinics, supported by trained Plant Doctors near busy market places, has been useful. In Cajamarca, Peru, Plant Doctors often deliver services to farmers located in isolated villages. In the three countries, the smallholder farmers interviewed stated that through the advice received from Plant Doctors, they were able to reduce crop losses and focus more resources on other social needs such as education and health. If they suffered loses it was because of bad market conditions or unpredictable rains.

Female farmers who are members of smallholding families are simultaneously managers, mothers, caretakers and wives. They need support from their communities for their vital roles in agricultural production and resource management.

In brief, the combined evidence demonstrates that the three countries reflect clear ownership of Plantwise methodologies. The specific differences in global governance that each country commands reflects their own sovereign evolution. The fact that Plantwise has launched and

operates programmes in each of these countries without conflict testifies to Plantwise's versatility and competence.

3.2 Effectiveness

The nature of the relationships developed with government partners and the degree of buy-in shown by them is consistently productive in the three countries. Peru's institutional structure for a plant health system has been established based on eight of INIA's seventeen agricultural experiment stations, two in the coastal region and six in the Andean region. Of the twelve plant clinics operating in Nicaragua, eight are located in the north eastern provinces of Esteli, Nueva Segovia, Jinotega, Somoto, and Matagalpa and four in the south eastern provinces of Leon and Chinandega. Of Bolivia's thirty-two plant clinics, twenty-eight are located in the Santa Cruz Department and four in the Cochabamba Department (Annex D contains the maps of these sites).

Perhaps due to the new reality of lower oil/gas and agricultural commodity prices, plant clinics may not be receiving sufficient funding to sustain them in terms of long-term expansion at a significant geographic scale.

Beneficiaries interviewed (both men and women) at each of the sites visited expressed considerable satisfaction with the service provided through plant clinics. Unstructured observations and analytical inferences support the fact that Plantwise efforts are inducing increases in productivity, and in turn enhanced farm income.

The challenge is to strengthen the evidence base for this by implementing a standard (results-based management) performance framework, with a focus on agricultural outcomes. This should allow the assessment of the relative progress of outputs delivered and outcome fruition, i.e. gathering data on uptake of plant clinic advice and its application to smallholders' farm plots, which in turn should be translated into enhanced farm income. To this end, an opportunity observed during the evaluation to further enhance the effectiveness of the plant clinics was to incorporate information on value chains. Put differently, markets and alternative marketing channels appear to decisively influence the economic results from plant health uptake.

The Plantwise programme has a flexible approach that is adept at finding pragmatic and incremental solutions to local needs and requirements. It has identified relevant and effective stakeholders in the three countries, However frequent changes in staff, and in some cases rapid turnover of Plant Doctors, can restrict the effectiveness of Plantwise's support.

3.3 Efficiency

Evidence from the review suggests that the Plantwise model is a cost–effective means to provide technical advice to smallholder farmers in the three countries.

The Plantwise budget has been sufficient to finance the assessment and pilot phases in the three countries, and the programme has coordinated well with local authorities and agencies through training programmes. In-country cooperating organisations, such as INIA in Peru, universities and agricultural cooperatives in Nicaragua, and regional governorates in Bolivia, have provided in-kind support in the form of personnel to deliver the plant clinic services.

Though assessment information is unavailable, Plantwise procedures have been found to enhance traditional models of agricultural extension. A Plant Doctor can provide advice at a plant clinic in about 30 minutes, while travelling to a farm might require several hours. The NROs interviewed are satisfied with the quality of the services. They acknowledge, however, the absence of metrics to measure: 1) the benefits generated and corresponding costs, and 2) the effects of the Plantwise intervention on food security and poverty alleviation in any given setting.

Through frank discussions with NROs, it became evident that if we do not measure results, we cannot tell success from failure; if we are unable to recognise failure, we cannot correct it; if we cannot see success, we cannot reward it or learn from it, and we are likely rewarding failure instead of success. Perhaps the most critical fact is that if we demonstrate results, we can win public support.

3.4 Impact

With the exception of a CABI study conducted in Bolivia in 2010, no other analysis is available to show the potential impact of Plantwise on beneficiaries in the three countries. However, early results in Bolivia showed that improved yields and lower plant protection and production costs following the adoption of plant clinic advice can lead to profitable farm income. Anecdotal evidence and analytical inference have led to the conclusion that PW has the potential to impact the environment, gender equality and poverty alleviation.

3.4.1 Environment

Plantwise is promoting a form of IPM that offers a controlled use of agro-chemicals. Plant doctors are able to advise farmers on the most appropriate chemical for their plant health problem and how to apply it effectively. In Nicaragua, it was noted that prior to the existence of plant clinics, farmers would often rely on agro-chemical suppliers for agricultural advice, who may not have always encouraged the safe use of chemicals.

It was also reported that in Santa Cruz, plagues such as fruit flies and aphids are now controlled without agro-chemical products as a result of advice from Plantwise. Similar results have been achieved in Nicaragua and Peru. This is beneficial to the environment as it can contribute to improved food security. Biological controls are typically less costly than agro-chemicals.

3.4.2 Gender

Anecdotal evidence indicates that when women handle plant health problems, the social capital of their community can increase, especially in terms of gender equality. Plantwise does not control who is trained as Extension Officers and Plant Doctors, but could target training programmes to target more women participants. This has the potential to empower not only women but also their communities.

3.4.3 Poverty Reduction

In the three countries, reducing poverty would require resolving many problems beyond plant health. Helping farmers lose fewer crops to infestations and feed more people is, however, a fundamental step towards poverty reduction.

The consultants gathered agro-economic information from farmers that attended CABI's plant health rallies. The data provided a glimpse of the economic results of the technological innovation process which the plant clinic services support. With few exceptions, the crop budgets show profitability once farmers reduce the high costs of agro-chemicals through biological pest control.

The key conclusions from the analysis of crop budgets (Annex H) are reflected in the following lessons.

3.4.4 Lessons Learned

- If CABI is to realise its mission of helping farmers to "…lose less food and feed more people" then it needs to widen its scope to take into consideration complementary factors to plant health.
- The catalytic role that Plantwise plays in using plant health services to increase resilient productivity among smallholding farmers is currently latent. Although clearly successful in sustaining crop health, Plantwise's role could be fully enabled by including complementary facilities such as access to high-value markets and other site-specific requirements. This will permit smallholders to take full economic advantage of the plant health technologies, resulting in the loss of fewer crops and an increase in food production in the short-term, and reducing poverty in the long-term.
- To enhance the uptake of plant health, smallholders require access to timely and current information on best methods to counter crop infestations, but this advice must be framed in the context of societal norms and be supported by an infrastructure of complementing facilities leading to crop profitability.
- As agricultural production is situation-specific these complementing facilities vary from site to site, but could include physical access to high-value markets, use of new marketing channels and timely and competitive credit lines.

3.5 Sustainability

The political and institutional differences in the three countries reviewed create varying factors of sustainability in the programme. In Peru, INIA has adopted the Plantwise methodology for the agricultural extension activities of eight of its seventeen experiment stations and municipal governments have occasionally contributed to the operation of plant clinics by providing space and paying part of the costs of transportation. In Bolivia, two autonomous governorates (Santa Cruz and Cochabamba) have adopted Plantwise's methodologies. The Santa Cruz governorate commands an agricultural development plan. It appears to absorb plant health technology effectively. However, Nicaragua has evolved a centralised government, so the departmental offices need the authorisation of national government authorities to adopt the Plantwise methodology.

The impacts of the strengths and challenges of each situation on Plantwise's sustainability are partially intensified by the financial stress created by the three countries' sluggish growth stemming from depressed oil/gas and agricultural commodity world prices.

Although the current depressed prices of primary commodities do not appear to affect the core technology transfer process, including plant health technology, they could affect enabling or catalytic forces such as national or regional governments, who are facing retrenchment of public service personnel and reduced budget allocations.

Another external factor to monitor is the abrupt results stemming from climate variability and warming. Farmers are now highly vulnerable to climate's sudden shifts. However this is not included in CABI's logframe. Several farmers interviewed expressed anxiety about the extreme shifts in the rainy season and rising temperatures that bring new and different insects. This is modifying the concerns farmers come to the clinics with. It has been observed that farmers on their own initiative are empirically searching for alternative crops with fewer water requirements and that are heat- and drought-resistant. It may be necessary to identify new crops for ecosystems in transformation, and the Knowledge Bank is a potential source to address this challenge of unparalleled consequences. In Bolivia, the lake Poopo's water has receded, leaving the Uru-Murato people, who had lived off the lake's water for generations, refugees of climate change.

3.6 Value Added

There is no evidence that Plantwise duplicates any development action occurring in the three countries. However, complementary programmes financed by key donors do exist in the region, i.e. FAO-led Farmer Field Schools, a USAID/CAM programme in Costa Rica, among others. Despite the fact that coordination efforts between NROs and local implementing organisations (LIOs) appear sound, there is little evidence of coordination with key donors in the region. Common areas of interest must be established so that synergies with donors can be achieved.

4. Recommendations

4.1 Monitoring and Evaluation Aspects

Plantwise should launch monitoring actions to track and register the global benefits (economic, social and environmental) of the programme and should deepen programmatic monitoring. The monitoring information collected will be useful in persuading decision-makers and stakeholders to adopt, participate in, or continue funding Plantwise's extension model.

4.1.2 Programmatic monitoring

There is circumstantial evidence from the three countries showing discrepancies in the known number of Plant Doctors. It also appears that some Plant Doctors temporarily stop their services for administrative reasons. In some cases it seems that there is a large number of Plant Doctors trained, compared with plant clinics operating. Questions also arise in terms of their technical and administrative curriculum, supervision, work flow, data flow, and other management questions.[1]

- CABI could consider conducting an internal management audit with each NRO on the administration and operation of Plant Doctors and plant clinics. The end result must be a results-based management process with clear reporting mechanisms and performance indicators.
- Also consider officially documenting all outputs achieved that contribute to the Plantwise outcome. This information should be available in the public domain for stakeholders and future evaluations.

4.1.3 Monitoring of global benefits

To start measuring social, economic and environmental benefits, the use of rapid agro-economic techniques should be considered, i.e. the crop budget and the farming system approaches. These techniques are simple and can be conducted with the participation of students of agricultural training centres in the three countries. A possible sequencing of tracking down agricultural outputs from one key agricultural input follows.

1. Conduct a baseline study
In light of resource restrictions, the first database study could be conducted in Mairana (Bolivia) as a test-case focusing on measuring the role of plant health services (PHS) in crop profitability. This should be based on on-farm production data with and without PHS (Annex I outlines a preliminary framework for a pilot baseline study). The end result would be a

[1] All these issues are legitimate and must be answered. However, the consultants were unable to review these key management issues because of its limited mandate and timeline which resulted in a limited exposure to the problem in each of the countries.

benchmark to determine: 1) the economic benefits to PHS, and 2) a preliminary set of baseline indicators to measure economic returns per crop and food security.

2. Follow-up with surveys
Subsequent on-farm surveys should include client feedback mechanisms on the technical and economic results of the advice smallholders have received from Plant Doctors.

3. Conduct a cost-benefit analysis
Conduct a benefit/cost analysis of the Plantwise approach with respect to standard technical extension procedures on site. These results can confirm the proposition that the Plantwise model for agricultural extension produces greater social, economic and environmental benefits per unit of cost than do traditional models of agricultural extension that have been used in Peru, Bolivia and Nicaragua. A benefit/cost analysis would provide different ratios under different conditions, in terms of driving variables to be determined in the field. In turn, this set of ratios would provide Plantwise with credible information for reviewing financing options with national partners and donors. Lastly, some of the benefit/cost ratios may validate figures from above the baseline study.

4. Explore the option of charging for advice
The analysis of the cost of providing plant health advice to smallholders as well as the benefits derived from the advice suggests a willingness to pay—partly influenced by the economic profitability of crops grown using the advice. Based on this apparent "willingness to pay" a preliminary "just price" could be identified. To test the equity and inclusiveness of the proposed "just price" in a transparent manner, using the participatory approach, jointly with the participation of farmers' representatives, LIOs and other stakeholders, open discussions should be conducted. The expected result is to reach a preliminary agreement on cost sharing prices and modalities for an in-depth study by NROs, Plantwise and other key stakeholders. It is noteworthy that self-financing operations would provide financial stability to PDs services.

4.2. Technical Aspects

National partners should consider that societal norms have strong influence on the uptake of technological inputs like plant health. The role of women in agriculture has traditionally been a critical element in development efforts in the three countries. It should be noted that needy farmers maybe living under conditions affected by climate variability and warming.

- Consider providing special support, based on needs analysis, to women who run farms, or households based around farms. To this end, design pictographic materials to facilitate Plant Doctors who work with women.
- Consider including adaptation/mitigation to climate variability and warming as a core activity contributing to the Plantwise mission in the three countries.
- In sites where, apparently, climate and precipitation have shifted significantly, consider conducting a preliminary diagnostic analysis jointly with NROs to review if alternatives crops should be introduced.

4.3 CABI Programme

Despite the world's depressed prices of oil, gas, minerals and agricultural commodities, all available evidence indicates that the agricultural sectors in the three countries are evolving. Nearly all smallholders are now focusing their production efforts on the market. Fomenting their entrepreneurship to enable profitable farms is the keystone to coping with each country's financial quandaries.

CABI should consider a strategy and skill-set to meet this evolving context. Besides CABI's standard crop research skills, a demand for knowledge of sustainable agricultural growth, including the analysis of value-chains and the governance of resources, is emerging.

SECTION 1

Introduction

1.1 Background of Plantwise

1.1.1 CABI's Mission

CABI's mission is to improve people's lives worldwide by providing information and applying scientific expertise to solve agricultural and environmental problems. A principal problem facing agricultural production in many countries is the loss of a high proportion of staple food crops to pre- and post-harvest pest and diseases. Two principal environmental problems that agricultural production faces are the negative effects on biological diversity and ecosystems caused by controlling crop pests with agrochemicals and the negative effects on agricultural production of changes in climate.

1.1.2 CABI Plantwise Programme

To address these problems CABI drew on its experience with its Global Plant Clinic (GPC) project and with its Crop Protection Compendium to begin the Plantwise programme. According to Plantwise's Logframe, its goal is to "contribute to enabling male and female farmers around the world to lose less and feed more" and its purpose is to "strengthen the capacity of agricultural institutions and organisations to establish sustainable plant health systems within their country, using the Plantwise approach as the framework for action establish effective national systems for providing crop health advice and support to smallholder farmers in target countries."

Plantwise currently operates in 33 countries in Africa, Asia and Latin America and the Caribbean.

According to its Strategic Plan 2015 to 2020, Plantwise intends to:

- Consolidate networks of national plant clinics by strengthening diagnostic services and improving linkages to agro-input manufacturers and agro-input dealers;
- Implement rigorous impact assessments in 2-3 selected countries;
- Underpin activities with monitoring and evaluation;
- Develop tools that use Information and Communication Technology (ICT) to achieve more efficient collection and analysis of data and wider dissemination of high quality agricultural information;
- Develop both open access and fee services so as to produce income that contribute to the maintenance of the Knowledge Bank.

1.1.3 The Plantwise Methodology

Plantwise's overall aim is to:

- Foster diverse partnerships that underpin and sustain global efforts to remove constraints to agricultural production;

- Increase crop productivity through provision of technical advice and training to small holder farmers through national networks of plant clinics;
- Establish a global knowledge bank of current data and information about plant health that will support the national crop health systems and global vigilance of crop health problems by national plant health systems, international institutions and private sector organisations.

1.2 Purpose and Methodology of the Evaluation

This evaluation concerns the Plantwise programme in the Latin American countries. In this region, Plantwise operates in Barbados, Bolivia, Brazil, Costa Rica, Grenada, Honduras, Jamaica, Nicaragua, Peru, and Trinidad & Tobago.[2] The evaluation, however, reviewed Plantwise's programmes in three of these countries: Peru, Bolivia and Nicaragua. CABI selected these countries for evaluation because they are the largest and/or oldest programmes in the region. The evaluation was conducted between June and September 2016.

The evaluation's objectives were to:

- Asses the performance of the global programme, with a focus on Latin America participating countries, in terms of its relevance, effectiveness, efficiency, sustainability, impact, coherence and value added including risks and potentials for the mid-term future;
- Identify key lessons learned to date and assess programme responsiveness to challenges in implementation;
- Propose practical recommendations for the improvement of country-specific interventions to strengthen the outputs, outcomes and impact of the programme in the region.

This evaluation was not required to assess any programme finances or use of funds, since the Plantwise programme is financially evaluated on a yearly basis by external auditors, and also upon request by donors.

During the Inception Phase of this evaluation, the consultant team reviewed relevant documents and interviewed (via video conference) Plantwise staff. The team then prepared an Inception Report that included a description of Plantwise's development co-operation context; an analysis of the logical framework, an indicative methodology for the evaluation including tools, and the evaluation's study questions.

During the Field Phase, the team collected field data through interviews, observations and crop budgets in Peru, Bolivia and Nicaragua. The members worked together for a week in Peru. Then Quiroga went to Bolivia and Kernan went to Nicaragua, both for a week. In these countries, the team interviewed government officials and farmers at selected sites where Plantwise has assisted in establishing and operating plant clinics. Annex D and Annex E provide maps to locate the sites visited and the list of people consulted in each country. Annex F outlines the itinerary of the total mission.

During the Synthesis Phase the team members prepared a draft evaluation report. The draft provided the evaluation's findings in relation to the evaluation criteria of relevance, effectiveness, efficiency, impact, sustainability, coherence and value added. Under each theme, the draft answered the study questions for the evaluation that were agreed upon

[2] In 2015, similar external evaluation of the Plantwise programmes were conducted in Asia and Africa.

with CABI, based on the data that were obtained during the field phase from interviews with key informants and field observations.[3]

The Team Leader presented and discussed the draft with members of the Plantwise Programme Board. Based on the comments from members of Plantwise Programme Board on the draft report, the Team Leader prepared the final evaluation report. The Team Leader presented the final evaluation report and the results of the evaluation at a meeting with the Plantwise Programme Board in Europe (Switzerland, September 2016) and at a meeting at the Plantwise Donor Forum in Belgium (Brussels, October 2016).

1.3 Peru, Bolivia, Nicaragua: Selected Features on Agriculture and Poverty

1.3.1 Peru

Peru has 21.5 million ha of agricultural area, 17% is arable land of which 4% contains permanent crops. In 2011 the cropland per capita was 0.15 ha/cap.[4] In 2015, Peru's population was 30.8 million, 78.3% of which was urban and 21.7 % rural. Peru ranks 84th on the United Nations Development Programme's (UNDP) 2015 Human Development Index [HDI].[5]

The share of agriculture in GDP is 7.4%; the GDP per capita is $USD 6600; and the percentage of the population undernourished is 7.5%. During the period 2000-12, the poor spent 57% of their income on food. Approximately 23.9% of the population live below the income poverty line.

The national cropping pattern (in descending order of importance) includes: fruits and vegetables, other cash crops, maize, roots and tubers, rice, pulses, wheat and other cereals.[6]

1.3.2 Bolivia

Bolivia has 37 million ha of agricultural area, 10% is arable land of which 0.6% contains permanent crops. In 2011 the cropland per capita was 0.40 ha/cap.[7] In 2015, Bolivia's population was 10.8 million, of which 69% was urban and 31% rural. Bolivia ranks 119th on UNDP's 2015 HDI.

The share of agriculture in GDP is 13%; the GDP per capita is $ USD 3200; and the percentage of the population that is undernourished is 16%. During the period 2000-12, the poor spent 54% of their income on food. About 45% of the population live below income poverty line.

[3] As is customary in OECD-CAD evaluations, names and posts of interviewees are not provided to safeguard confidentiality. In addition, the primary purpose of an evaluation is to understand why and the extent to which intended and unintended results are achieved, and their impact on stakeholders. Evaluators must therefore take into consideration management processes, to the extent that these affect the achievement of results, either adversely or constructively (cf United Nations Evaluation Group. Norms for Evaluation. New York, 29 April 2005)
[4] FAO, Statistical Yearbook 2014, Table 4, Santiago. https//endingruralhunger.org
[5] UNDP 2015 Human Development Report, New York, 2015. Extracted on 5 July 2016 from https//
[6] Homi Kharas. Ending rural hunger. Brookings Institution. Washington, DC 2015 . Extracted on 5 July 2016 from https//endingruralhunger.org
[7] FAO, Statistical Yearbook 2014, Table 4, Santiago

The national cropping pattern (in descending order of importance) includes: oils, maize, fruits and vegetables, other cash crops, roots and tubers, rice, wheat and other cereals.[8]

1.3.3 Nicaragua

Nicaragua has 5.1 million ha of agricultural area, 36.9% of this is arable land, of which 4.5% of which contains permanent crops. In 2011, the cropland per capita was 0.36 ha/cap. In 2015 the total population of Nicaragua was 6.2 million, of which 58.2 % was urban and 41.8 % rural. It ranks 125th on the UNDP's 2015 HDI.

The share of agriculture in GDP is 21%; the GDP per capita is $USD 2000; and the percentage of the population that is undernourished is 17%. During the period 2000-12, the poor spent 63% of their income on food. About 42.5% of the population live below the income poverty line.

The national cropping pattern (in descending order of importance) includes: maize, pulses, cash crops, cereals, fruits and vegetables.[9]

[8] Homi Kharas. Ending rural hunger. Brookings Institution. Washington, DC 2015 . Extracted on 5 July 2016 from https//endingruralhunger.org
[9] Homi Kharas. Ending rural hunger. Brookings Institution. Washington, DC 2015. Extracted on 5 July 2016 from https//endingruralhunger.org

SECTION 2

Findings by evaluation criteria

This chapter presents the findings of the evaluation according to the OECD-DAC indicators - relevance, effectiveness, efficiency and impact and sustainability and related study questions.

2.1 Relevance

2.1.1 To what extent is the planned outcome of the Plantwise programme still valid and relevant to need on the ground, and consistent with the government, CABI and Plantwise donors' policy and strategy?

The planned outcome of Plantwise is to "strengthen the capacity of agricultural institutions and organisations to establish sustainable plant health systems within their country, using the Plantwise approach as the framework for action".[10] The outcome is still valid and relevant for each of the three countries.

The evaluation mission revealed a clear and ongoing need for impartial support to farmers - in particular smallholders and subsistence farmers - to identify, access and implement appropriate strategies to improve plant health. Field observations confirmed that pests and disease are sometimes causing substantial crop losses in Peru, Bolivia and Nicaragua and statistics show that a large proportion of smallholder farmers continue to lack access to extension services. Two important aspects of the need for support were identified. Firstly that, in the absence of alternatives, smallholders often rely upon the use of pesticides and the potentially biased advice of pesticide manufacturers in tackling crop pests, leading to potential overuse of chemicals and reduced yields. Overuse and incorrect use of chemicals has serious impacts on health and the environment[11] and on the economics of production, either through the cost of pesticides or due to its impact on saleability of the crop.[12] Secondly, in each country traditional extension methods applied before the arrival of Plantwise have tended to focus on one-to-one on-farm advisories. These have been expensive for governments to provide and were characterised by smallholders' limited participation. Consequently, few smallholder farmers in Peru, Bolivia and Nicaragua have received useful, applicable advice on crop production in general and pest and disease control in particular, thus limiting productivity and quality.[13] The Plantwise plant clinic system is supporting the delivery of alternative, more neutral advice, which promotes reduced reliance on chemicals and can be delivered to more people at lower cost.

In the three countries, the majority of smallholder farmers interviewed stated that through the advice received from Plant Doctors, they were able to reduce crop losses and focus more resources on other social needs such as education and health.

[10] Plantwise Logical Framework
[11] For example in Peru, there was an incident in Cuzco where 21 children were killed by poisoning by pesticide.
[12] An extreme example cited to the evaluation team was the rejection of a shipment of 300 containers of Peruvian quinoa by a U.S. buyer because of pesticide residues found in the shipment.
[13] Plant clinic data in Cochabamba, Bolivia, shows that only 4600 smallholder farmer of some 700,000 were reached with extension services in 2015. In Nicaragua around 15.9% of smallholders have received technical assistance and/or training.

Plantwise remains consistent with the CABI mission,[14] its donors' objectives, and more widely with the Sustainable Development Goals (particularly SDG 1 on eliminating poverty, 2 on eliminating hunger, 12 on responsible consumption and production and 17 on creating partnerships for the SDG goals). It also complements national agricultural extension strategies in all three countries, possibly even helping to shape those strategies especially in Nicaragua through the potential uptake of Plantwise approaches by MEFCCA as it starts out in its coordination function for extension services.

2.1.2 To what extent are the stated objectives of Plantwise relevant in addressing the identified problems and social needs?

Plantwise targets plant health problems to achieve its strategic objective which is "increased food security, alleviated poverty and improved livelihoods by enabling male and female famers around the world to lose less, produce more and improve the quality of their crops".[15] As Plantwise focuses on both agricultural extension and livelihoods, it is important that the strategy links to both the identified problem (pest diseases attributing to diminished plant health) and social needs. Through observations and interviews with beneficiaries during the field visits, smallholder farmers identified key social needs as gender equality, access to education, and access to and affordability of health services. Plantwise provides farmers with more effective and less costly ways to control crop pests, and thereby to increase their crop's productivity and quality and augment their net income. With more net income, smallholder farmers should be better able to finance their education and health needs.

With regards to ensuring gender equality, it is noted that the South America region achieves the greatest balance in access for both men and women to Plantwise services,[16] and gender issues are receiving particular attention currently, with gender outreach plans in place for all three of the countries under review. However, the evaluation team noted that POMS data suggest that in the countries surveyed, women's participation remains relatively low and could be further enhanced. Plantwise Activity Plans do not indicate that Plantwise training materials respond specifically to women's interests and needs, though interviews indicate that women farmers may require different types of training materials than men. Pictorial or local language materials may be more helpful and one woman in Cajamarca strongly agreed that she would find a video about pest problems useful. Furthermore, the evaluation missions confirmed objective benefits of increasing women's participation in relation to enhancing gender equity, for example noting that where women lead in resolving plant health problems, they gain status and respect in relation to men. Crucially too, in families where many men have migrated to urban areas, ensuring that women's participation is maximised is of even higher relative importance for pro-poor development, as families and communities may depend upon their produce. Furthermore, from reports obtained in Peru, inclusion of women may strengthen uptake of low-chemical plant health approaches proposed by Plantwise, as women may pay greater attention to health and safety issues, being close to the risks run by their families.

Field observations and interviews, however, indicate that there are sub-categories of smallholder farmers in Peru, Bolivia and Nicaragua. There are differences based on ecological niches, relative emphasis on livestock, farmers without land, or marginal lands situated near urban areas or simply agricultural labourers.[17]

[14] 'to improve 'people's lives worldwide by providing information and applying scientific expertise to solve agricultural and environmental problems'
[15] Plantwise Strategy document 2015-2020, pg. 7
[16] Anon. Embedding gender and diversity in the Plantwise Programme. Evidence on Demand, UK (2016) http://dx.doi.org/10.12774/eod_cr.june2016.surridgemetal
[17] In Cajamarca, Peru, for example, farmers at lower elevations grow vegetables farmers at middle elevations maize, and farmers at high elevations, potatoes.

As Plantwise develops further in each country, and subject to resource availability, it may be possible to target more closely some of these diverse needs with appropriate adjustments in analysis, content of support and delivery mechanisms. However, it is critical to avoid scattering resources in order to ensure impact.

The data from the three countries shows that though the siting of plant clinics and plant doctor services is carefully targeted to reach smallholder communities and be accessible to them, at the larger scale, where Plantwise is implemented may be dependent on the institutional and political background.

2.1.3 Does Plantwise correctly identify key target groups?

Plantwise aims to directly benefit smallholder farmers in developing countries. Plant Clinics have therefore been targeted in geographic areas where smallholder farmers are able to utilise the services. In Peru, the majority of the plant clinics are operating in the Andean Highlands whereas in Bolivia the Plant Clinics have been established in the valleys of Santa Cruz and Cochabamba. Specifically, Plant Clinics operate in areas where smallholder farmers are likely to gather; farmer cooperatives headquarters, markets and agricultural experiment stations. In Nicaragua, most markets are controlled by wholesalers and intermediaries so alternative venues are used to interact with smallholders.

As noted above, there is a lack of evidence of Plantwise specifically identifying and responding to the needs of women and other vulnerable groups. Smallholder farmers are generally not the 'poorest of the poor'; it was observed that Plantwise could aim to target landless farmers who are renting small plots, to enable them to deal with plant health problems so as to increase their yields.[18]

2.1.4 Does Plantwise correctly identify and engage relevant stakeholders and evaluate institutional capacity issues?

Plantwise has in general identified relevant and effective stakeholders in Peru, Bolivia and Nicaragua. Plantwise's key stakeholders are government institutions (Ministries of agriculture; agricultural research stations; regional and municipal governments), public and private agricultural universities and technical institutes, development NGOs and farmer-owned agricultural cooperatives. The National Responsible Organisation (NRO) plays the key institutional role, because it stimulates the formation of the national plant health system. In Peru the NRO is the Institute for Agricultural Innovation (INIA), a public institution. In Bolivia's Santa Cruz governorate the NRO is the Department of Agriculture and Food Safety (DSIA). The NRO in Nicaragua is the Academic Network for Plant Health (REDAF), a consortium of public and private universities.

[18] It is conceptually difficult to provide economically viable options to enhance the livelihoods of vulnerable societies. One case is the Uru-Murato people, Bolivia's oldest indigenous group. They adapted over generations to the conquests of the Inca and the Spanish. Now they seem unable to adjust to the abrupt climate change that has caused the vanishing of the Lake Poopo. The water receded and the fish died. The birds that had fed on the fish abandoned Lake Poopó, once Bolivia's second-largest but now just a dry, salty expanse. Many of the Uru-Murato people, who had lived off its waters for generations, left as well, joining a new global march of refugees fleeing not war or persecution, but climate change. Source: N Y T: Climate Change Claims a Lake, and an Identity. Text by Nicholas Casey July 7, 2016

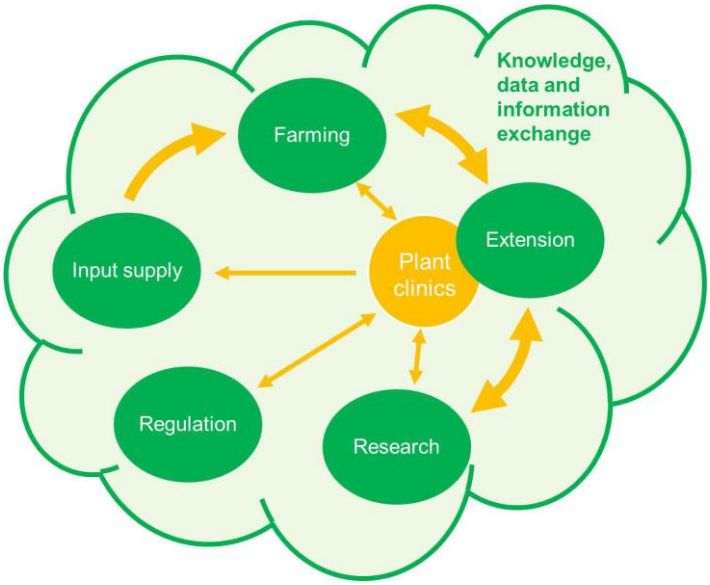

Figure1. Plantwise support to plant health systems (Source: CABI Plantwise Background Information. External Evaluation. 2016)

Plantwise, however, has not fully engaged three relevant categories of stakeholders.

- **Agrochemical merchants**. Figure 1, which illustrates Plantwise's strategy for using plant clinics to create a national plant health system, does indicate "input suppliers" as a stakeholder. This category is mostly agrochemical dealers.[19] The Plantwise Strategy 2015 to 2020 states that "Agro-input dealers are in direct contact with farmers for the sale of agro-inputs and often provide advice on the use of the inputs" and this is true in Peru, Bolivia and Nicaragua. As noted above, however, agrochemical dealers may have incentives which conflict with Plantwise aims. However, they are not a homogenous category. In Peru, for example, agrochemical dealers include international, national, and local agrochemical companies, distributors and dealers. Some agrochemical dealers make and market purely chemical pesticides, while others deal with organic or "alternative" pesticides. Engaging these organic companies more fully may enhance plant health system outcomes.
- **University agricultural students.** The potential for students from agricultural training centres to engage as stakeholders is large. In fact, several agricultural training centres in Bolivia, Nicaragua and Peru have been training their students using Plantwise materials and methodologies.[20] These students could provide the technical backbone of future plant health services and are an important constituency to consider in building national systems. This has been corroborated in the field visit to Mairana (Bolivia) where the mission had the opportunity to share the principles and application of crop budgets with students of the local agricultural training institute.
- **Large agricultural enterprises.** The other stakeholder group not mentioned in Table 1 is large agri-business. Peru, Bolivia and Nicaragua all have large-scale agricultural enterprises. These enterprises grow export crops, i.e. sugar cane, soybeans, and African palm and are connected with international financial markets and banks. The evaluation team had no reason to interview these enterprises as food security and poverty alleviation is not their main concern. Nonetheless, these enterprises may have a strong interest in promoting their corporate image through environmentally friendly

[19] The evaluation team was informed that Plantwise has prepared a written strategy for its relationship with agrochemical dealers though this has not been provided for review.

[20] For example UNAN-Leon and UCATSE in Nicaragua, University of Vallecito and Tarata Technological Institute in Bolivia, and the University of La Molina and the International Potato Centre in Peru

policies. They could offer influence and possible financial support, to a national plant health system. This was discussed in Peru in a working session convened and led by the NRO with representatives of municipalities and major agri-business corporations involved either in export crops or agro-chemical merchandising. Similarly in Bolivia (Santa Cruz) the NRO convened large agro-enterprises (ASOFRUT) and representatives of German and Japanese aid to review forthcoming cooperation with the participation of plant clinics to ensure adequate plant health standards.

For Plantwise, understanding and responding intelligently to institutional capacity issues is extremely important. The issues of institutional capacity encompass: leadership, policies, finances, staff stability, and organisation. Leadership emerged as a critical institutional capacity issue for successfully establishing plant clinics. In Cajamarca, Peru, for example, plant clinics have been established where the municipal mayor has demonstrated interest by donating space. In Nicaragua, the leadership of specific individuals has kept REDAF functional regionally despite political upheavals nationally. National policies have substantially affected Plantwise's operations. The current Nicaraguan government's policy of centralising all decisions, for example, has complicated cooperation between the regional offices of national institutions and regional institutions. In Peru, by contrast, decision-making power has been devolved to regional governments, creating possibilities for creative alliances between their Agrarian Agencies, farmer associations, municipal governments and regional agricultural research stations. Similarly, in Bolivia the Statutes of Autonomy has given departmental governorates considerable autonomy in planning and implementing their own agricultural development plans. The Santa Cruz governorate, for example, has worked with the Plantwise programme very effectively as well as with GPC.

Financial resources are an important issue. Plant clinic costs are in principle not covered by Plantwise budgets and partners at the national level need to draw staff and other in-kind resources from their own budgets to enable the system to function. In Bolivia, Plantwise operates almost entirely in the Santa Cruz Department, because the governorate is committed to provide funding, including office space, to operate plant clinics. In Cajamarca, Peru, plant clinics have opened where a municipal mayor has decided to donate office space. Staff instability affects institutional capacity. On the one hand, some decision-makers at the national, regional and municipal levels are political appointees. They rotate frequently and may lack technical expertise and experience.[21] On the other hand, as current commodity prices remain weak, especially in oil markets and for agricultural commodities, the three countries are expected to grow at a lower rate than the historical trend. All NROs (especially in the oil exporting countries of Peru and Bolivia) have unofficially commented on technical personnel retrenchment in their respective ministries, with undetermined consequences to Plantwise operations.[22] In Nicaragua, only a few of the trained plant doctors still work in plant clinics.

Evolving organisational mutations have affected Plantwise's programs. In Peru, INIA, the NRO, no longer has an official agricultural extension function. The Agrarian Agencies of regional governments have been assigned this function. In Nicaragua, likewise, INTA's function is research while MEFCCA's is extension.

While the capacity of partner institutions is critical, as Plantwise supports them in providing improved plant health services, inevitably Plantwise may not be able to directly control or

[21] Although the mission did not review personnel performance in the public offices concerned, a good number of decision-makers appear to be political appointees.

[22] IMF. Regional Economic Outlook: Western Hemisphere: Latin America and the Caribbean: Managing Transitions. Chapter 2, April 2016. Indeed, the largest oil traders are anticipating little relief to what has become the worse market slump in a generation. Oil and natural gas companies have cut more than 350,000 jobs since crude prices started to fall in 2014. Oil exporting countries in the region are vulnerable to this significant decline in prices since 2014. (Globe & Mail, "Oil traders see another year of pain as glut endures.", Sep 9, 2016, Toronto)

influence many challenges or difficulties in this area. Many observed problems or gaps lie outside of the scope of the programme or framework to change directly. Nevertheless, as an influential partner, Plantwise may have opportunities to highlight or influence opinion on such challenges, and this evaluation aims to identify where problems can be directly addressed by Plantwise, and where Plantwise may seek to influence others to achieve improvements. In brief, the combined evidence points that the three countries reflect clear ownership of Plantwise methodologies. The specific differences in global governance that each country commands reflect their own historical evolution. The fact that Plantwise has launched and operates programmes with each of these countries without conflict testifies Plantwise's versatility and competence

2.2 Effectiveness

2.2.1 To what extent has Plantwise delivered its planned benefits in Peru, Bolivia and Nicaragua?

The ***effectiveness*** criterion concerns how far the programme's planned benefits have been attained, and are contributing to its intended outcome. It is linked with ***impact*** (the degree to which the programme's specific objectives are achieved, or are expected to be achieved). One core focus of assessment under this criterion will be a review of progress against the five outputs set out in the Plantwise Logframe, and against the planned outcome, taking into account the context and stage of implementation of Plantwise in each country. However, the evaluation team has also defined "planned benefits" as the socioeconomic benefits that were planned to be achieved: higher net income and more food security; in turn, these benefits reverberate on better health and education including increased gender equity.

In fact, the Plantwise Logframe mentions only the benefit of "increased household income", as an indicator of the Logframe's goal. The Logframe does not set a quantitative target for this benefit. Plantwise's Annual Activity Plans for Peru, Bolivia and Nicaragua also do not establish quantitative targets for benefits. Nor does the Plantwise M&E system monitor or record global benefits (economic, social and environmental). However, observations from the review and from initial attempts by the evaluation team to assess the economic benefits,[23] suggest that results against this indicator and across a broader spectrum of social benefits are being achieved but often remain unidentified and unreported. Therefore opportunities are likely to be missed to target better outcomes and increased impact as Plantwise (or rather the extension systems within which it works) moves forward. The first part of this section therefore looks at results in terms of Logframe outputs, whilst the remainder also seeks to draw out lessons and opportunities across a broader horizon.

Some key data against the Logframe Outputs is given in Table 1, while the section below provides an analysis of observed progress against outcome indicators.

2.2.2 Has the Plantwise programme in each country established the institutional structures required for a national plant health system?

The outcome stated in the Plantwise Logframe is "strengthen the capacity of agricultural institutions and organisations to establish sustainable plant health systems within their country, using the Plantwise approach as the framework for action". The Logframe states seven indicators for this outcome.

[23] The evaluation team has collected crop budget data in the field (see Annex H) . The results suggest that Plantwise's plant-health advise is reducing the cost of production which in turn could be enhancing farm income in most cases. .

The first indicator looks for evidence that "Plant clinics are incorporated into national agricultural extension strategies with budgets to sustain them". In the three countries plant clinics have been partially incorporated into regional agricultural extension strategies. In Peru an institutional structure for a plant health system has been established based on eight of INIA's seventeen agricultural experiment stations, two in the coastal region and six in the Andean region. Of the twelve plant clinics operating in Nicaragua, eight are located in the north eastern provinces of Esteli, Nueva Segovia, Jinotega, Somoto, and Matagalpa and four in the south eastern provinces of Leon and Chinandega. These provinces contain approximately a fifth of Nicaragua's land area. Of Bolivia's thirty-two plant clinics, twenty-eight are located in the Santa Cruz Department and four in Cochabamba Department (Annex D contains the maps of these sites).

The evaluation team was not expected to review budgetary information about the operations of the existing plant clinics as per the Terms of Reference. In Peru and Nicaragua plant clinics are included in government annual operating plans to receive public funding. In Peru, plant clinics operate in only two of Cajamarca's municipalities. Their services have reached only about 4,000 of Cajamarca's 700,000 smallholder farmers. In Nicaragua, likewise, plant clinics' technical advice reaches only a small percentage of smallholder farmers. In Bolivia, plant clinics are receiving financial support in the Santa Cruz governorate whereas the Cochabamba governorate has limited funds. In sum, perhaps due to the new reality of lower oil/gas and agricultural commodity prices, plant clinics are not receiving sufficient funding to sustain them in the long term at a significant geographic scale.

The second indicator is "Plant health system stakeholders continue to interact in new ways established under the Plantwise approach". Such interactions are taking place in all three countries. For example, in Peru INIA is interacting with municipal and regional governments. In Nicaragua, the regional offices of national plant health institutions are interacting with regional universities and local agricultural cooperatives. The plans under development by the Humboldt Institute to establish further plant clinics starting with three this year (that is, 2016), are evidence of the programme successfully bringing in and benefitting from the support of new partners to increase outreach.

Indicator three is "Plant clinics operating in the Plantwise programme countries according to standards of good practice". There are thirty-seven plant clinics operating in Peru, thirteen in Nicaragua and thirty-two in Bolivia. Evaluation team observations of two plant clinics in Peru, one in Nicaragua and several in Bolivia indicated that they are providing advice to farmers on how to control plant pests. The most legitimate measure of the quality of the plant clinics' operational practices would be the extent to which they have resulted in a reduction of crop losses to pests. So far as could be determined, Plantwise teams have not yet introduced systematic collection of data and analysis on the effectiveness of the recommendations that plant doctors have made, though an individual study was carried out in Bolivia in 2010 on the impact of Plantwise on beneficiaries in Peru, Bolivia and Nicaragua, which showed improved harvests and lower plant protection costs. Crop budget data collected by the mission during the assignment further support this finding (Annex H).

Table 1 – Progress against Plantwise Logframe Outputs by country – Some selected data

	Bolivia (Plantwise initiated in 2011)	**Nicaragua** (Plantwise initiated in 2011)	**Peru** (Plantwise initiated in 2011)
Output 1 **National networks of plant clinics established to provide regular advice to farmers and facilitate the collection and use of plant health information**	32 fixed PCs established in North and West sub-regions. Some LIOs operate mobile PCs. No mobile clinics – isolated areas unlikely to access support. Data Manager in place (from Santa Cruz and Cochabamba governorates) 22 local trainers Plant Doctor turnover possibly due to personnel retrenchment limits effectiveness	13 fixed PCs established in North and West sub-regions. Some LIOs operate mobile PCs Data Manager in place (from UNAN-Leon) 15 local trainers Plant Doctor turnover/time pressure appears to limit effectiveness of support in some ways	37 PCs established Data Manager in place 33 local trainers Plant Doctor time pressures appear to obstruct rapid submission of PC and prescription data to POMS
Output 2 **Innovative linkages established between key actors involved in extension, research, regulation and input supply**	Diverse partnership established Partners include -the Santa Cruz Governorate and Cochabamba Governorate (NROs) and associated agricultural foundations and services as LIOs. - Tarata Agricultural Technological Institute - Universidad Vallecito -SENASAG Government -INIAF Government research -APIA Association of Agro-chemical companies	Diverse partnership established Partners include Strong basis of collaboration founded on REDAF network Universities using Plantwise methodology (UNAN-Leon - NRO) Diagnosis services from IPSA 16 LIOs Potential establishment of 3 new PCs by Humboldt Institute in 2016 and further PCs in 2017 Possible uptake of Plantwise approach into future extension strategy adopted by MEFCCA.	Diverse partnership established Partners include National Institute for Agricultural Innovation (INIA – NRO) National Service for Agricultural Health (SENASA) Municipalities University of La Molina Entomological Society of Peru CIP-International Potato Centre
Output 3 **Data and information management tools, content and processes developed to support national advisory and regulatory actions/ services**	44 Decision Guides and 117 factsheets (by 2015) Data manager uploads feedback data received on monthly basis from CPs into POMS. Data managers send data to KB team for inclusion in POMS Initiatives underway to increase accessibility through markets and through use of mobile technology – delivery of plant health services with services on other issues as part of a one-stop-shop approach There is a data sharing agreement	114 Decision Guides (by 2015) Data manager uploads feedback data received from CPs into POMS. Reports to the evaluation team suggest that only 10% of potential PC data is fed into POMS due to Plant Doctor time constraints There is no data sharing agreement	24 Decision Guides and 70 factsheets (by 2015) Data manager uploads feedback data received on monthly basis from CPs into POMS. Data managers send data to KB There was a data sharing agreement that expired in April 2016

	Bolivia (Plantwise initiated in 2011)	Nicaragua (Plantwise initiated in 2011)	Peru (Plantwise initiated in 2011)
Output 4 **Comprehensive KB developed according to user needs for diagnosis of plant health problems, treatment and distribution (incidence and severity), and made available to national advisory services and organisations contributing to plant health systems**	Established agreements to manage the sharing of data from the in-country data management centre to the KB	Increased collection and generation of photographic material of key pest and diseases	Continued effort to encourage data sharing Plans to work with partners to generate at least 10 technical documents on common pest and disease problems, including photo sheets and factsheets and other resource materials relevant to plant doctors and other extension workers, to be incorporated into the KB
Output 5 **Monitoring and evaluation schemes implemented for continuous learning, improving processes and quantifying outcomes and impact**	M&E plan in place Data shows that since 2000, 927 of 12,743 queries have come from females and 685 of 7,185 visits to plant clinics have been made by female farmers Evaluation team notes focus of M&E on programmatic tracking alone. Need to incorporate the economic effects of the plant health services on production results and in turn farm income. To this end, baseline study describing the situation prior to Plantwise intervention, against which progress can be assessed is a necessary first step	M&E plan in place Data shows that since 2005 122 of 1,014 queries have come from females and 90 of 748 visits to plant clinics have been made by female farmers . Mission notes that focus of M&E is on programmatic tracking alone. Need to incorporate the economic effects of the plant health services on production results and in turn farm income. To this end, baseline study data describing the situation prior to Plantwise intervention, against which progress can be assessed is a necessary step. It is possible that suitable baseline study is likely to exist within cooperatives and municipalities	M&E plan in place Data shows that since 2011 369 of 1,420 queries have come from females and 302 of 1,157 visits to plant clinics have been made by female farmers Work has been carried out recently to reflect upon monitoring of programmatic elements of delivery though a Course on Plant Clinic performance monitoring[24] Mission notes that focus of M&E is on programmatic tracking alone. Need to incorporate the economic effects of the plant health services on production results and in turn farm income. To this end, baseline study data describing the situation prior to Plantwise intervention, against which progress can be assessed is a necessary step

[24] Course culminated in a workshop on results and lessons learned on 25-29 April 2016, EEA INIA, Huaral

An opportunity observed during the evaluation to further enhance the quality and effectiveness of the plant clinics was to incorporate fuller market and commercial advice into the service. Building on the training provided to Plant Doctors in Module 2, this could include supporting understanding of market issues for high-quality crops, and improved collection and use of feedback from farmers on outcomes and financial pay-off following application of Plant clinic advice. This analysis would demonstrate to potential clients profitable returns from proposed technologies. The results from the crop budget analysis (Annex H) have shown that the application of plant health advice enhances the likelihood for profitable economic returns. This information can both motivate uptake by farmers and, in aggregate, demonstrate the impact of Plantwise technology on the farm incomes of target groups.

Indicator 4 "Data from clinic records and other Knowledge Bank information used to inform activities to influence improved plant health management strategies (data used to identify key problems, factsheets, pest management decision guides and information being used by extension and farmers etc.)" and Indicator 5 "New and emerging plant health problems are rapidly identified and assessed, prompting rapid responses" are closely related.

By using the data available in POMS, for example, it is possible to identify the location and spread of new and recurrent crop pests and then plan and implement actions to control them. In Santa Cruz, Bolivia, several infestations (fruit fly, alternaria leaf spots, aphids,leprosis) were identified through analysis of data provided through the plant clinics and the governorate was able to respond effectively. The plant clinics in Peru, Bolivia and Nicaragua have provided a way for plant health problems to be systematically noted and recorded based on first-hand information provided by farmers themselves and for Plant Doctors to deliver rapid responses to these problems to individual farmers. The information gathered in the Plant Clinics, and available on the Knowledge Bank can be used to respond to plant health problems, and strengthen capacity to deliver extension support at a regional or national level.[25] Plant Doctors are over-committed and lack the time to upload plant clinic data to POMs. As a consequence, the ability of the Knowledge Bank to support rapid interpretation of data coming from the field in identifying and tackling emerging infestations and pests is reduced.

Indicator 6 is "increased numbers of male and female farmers have access to appropriate, timely and locally relevant information and advice on plant and soil health, through plant clinics and mass extension campaigns." The evaluation team was able to observe the operations of selected plant clinics. These observations clearly indicated that Plant Clinics are providing both male and female farmers with advice about their plant health problems (see Annex D for the list of sites visited). However, time was limited to thoroughly review the increase in access achieved.

Indicator 7 is "Increased adoption of improved technologies and practices that lead to positive effect at farm level (including pest management strategies, use of inputs such as fertilisers and pesticides)". With the exception of the 2010 study in Bolivia referenced above, no systematic data were available to measure the extent to which this indicator has been accomplished in Peru, Bolivia and Nicaragua. Further anecdotal reports from the mission visits suggest that Plantwise delivers real benefits to users. Plant Doctors are taught to instruct client farmers to use Integrated Pest Management (IPM), generally an appropriate methodology for controlling crop pests at low cost and with minimised environmental impacts.[26]

[25] As indicated, Plantwise in Peru and Nicaragua has contributed importantly to building human capacities by involving agricultural universities and technical schools in its training programmes. The Catholic University of the Dry Tropics In Nicaragua, and the National University of Cajamarca in Peru for example, are using the Plantwise methodology and data to train students. Key stakeholders in Nicaragua suggest that the PW approach has induced some academic programmes to re-orient their approach in line with social demands, especially fomenting family farming.

[26] It should be noted that plant doctors cannot generally teach their client farmers to use IPM methodology with the detail and sophistication that it is applied on commercial farms in temperate countries because the climatic

Beneficiaries interviewed (both men and women) in each of the sites visited expressed considerable satisfaction with the service provided through plant clinics. The farmers interviewed felt that the quality of advice obtained was useful and reliable. One farmer in Capinota, Bolivia, was so impressed by the Plantwise approach that he made a concoction of herbs that he brought to the evaluation team's attention, indicating that it destroyed certain insects.[27] A female farmer in Cajamarca, Peru, expressed high hopes that more women would join her to learn how to improve potato farming. And in a rapid survey in Santa Cruz (Bolivia) conducted by the NROs, 94% of the farmers interviewed were satisfied with the services provided by Plantwise operations.

From these observations it can be inferred that Plantwise support is resulting in a general increase in productivity, and in turn enhanced farm income. The challenge is to strengthen the evidence base for this by further gathering data on uptake of plant clinic advice and its economic impacts on smallholders' farm income, through POMS , monitoring systems, and through targeted studies carried out by Plantwise in selected countries and regions. This will help not only report results achieved against the programme's own objectives, but also provide performance information for use in discussion with government and other partners to strengthen the case for resourcing and supporting the national plant health system.

Owing partially to the worsening conditions in the decline of oil and agricultural commodity prices,[28] a potential constraint has arisen on the effectiveness of Plantwise operations. There appears to be a high turnover of plant doctors trained. For instance, in 2015 in Nicaragua five of eleven plant doctors left their employment, quite possibly to take on higherpaid work. This certainly has positive aspects in that the knowledge Plantwise provides its trainees is then disseminated widely across their new positions. The team did not notice a particular shortage of plant doctors available, but frequently training new plant doctors uses valuable time and financial resources.[29] Furthermore, the evaluation team observed in all three countries that plant doctors appear to become more effective when 1) they can accumulate experience with plant health problems, and 2) they can respond to plant health queries within the context of knowledge of the wider situation of the farmers in that region.

2.2.3 Are there any unintended effects (positive or negative) from Plantwise?

The Plantwise model allows for great flexibility in how the support is delivered, and for the variety in the specific linkages and networks to be strengthened to reinforce a national plant health system. For this reason, while there is variety in what has emerged, this would usually not be interpreted as unintentional. However, reviewing the programme's results through the lens of this question throws into relief a benefit of the programme that is not

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conditions, crops, agricultural techniques, and ability to collect and analyze information about crop pests are very different. For example, the plant doctors do not make financial calculations based on data about pest populations when they give advice to farmers. Instead, they base their advice on the demonstration-effect, i.e. prior successful experiences from neighbouring farmers specifying the content of the training they are providing.

[27] As a side remark on the use of traditional techniques to improve plant health, while it is clear that CABI and Plantwise work under international quality standards using products rigorously tested for quality results, consideration could be given to reviewing efforts arising from the grass roots to use traditional knowledge safely through special protocols and reviewing potential benefits of piloting something similar to the programme. UNDP developed one such protocol and has been able to incorporate important herbs and plants for medicinal purposes in Southern Africa [Cf. UNDP. Malawi. Final evaluation of Natural Resources Management Project. New York, 2001]

[28] Cf:, "Oil traders see another year of pain as glut endures.", Globe & Mail Toronto Sep 9, 2016,

[29] An external evaluation may not be best equipped to review the apparent high turnover of PD trained, due to its limited mandate and resulting limited exposure to the issue. Circumstantial evidence from the cluster countries suggest discrepancies in using GPC list [2005] and PW list [2011]. Also it appears that some PDs can temporarily stop their services for administrative reasons. Therefore, this task appears consistent with the programmatic M&E. PW staff could probably have access to official records and generate updates lists of PDs.

explicitly captured in the Logframe but widely evident, and that is in relation to protection of the natural environment (and other benefits that depend upon it, such as sustainable livelihoods and human and animal health). Through facilitating the adoption of alternatives to pesticide use, Plantwise is reducing the environmental burden of chemical use. Plant doctors are addressing this issue in three ways. First, unlike agrochemical dealers, whose advice to farmers is to apply one or more pesticides according to a predetermined schedule, Plantwise's plant doctors recommend control measures based on IPM principles which includes biological and cultural means and sustainable use of pesticides where necessary. (see Figure 2). Second, plant doctors recommend pesticides that are not on the Plantwise Pesticide Red List (list of internationally restricted chemicals compiled from the relevant international agreements). This list does not include the more toxic pesticides that are in Class Ia and Ib of the World Health Organization (WHO) pesticide classification. Third, plant doctors instruct client farmers in the dangers and safe use of pesticides. These benefits are significant and should be widely reported. Comprehensive data on uptake of advice may allow some quantification of the reduction on chemical use in the future.

Plantwise can support the realisation of other benefits, not specifically mentioned in the Logframe. Concretely, in the case of Peru's INIA, according to key stakeholders, Plantwise methodology has contributed to strengthening the ongoing process of technology transfer to smallholders. This is primarily because the Plantwise approach is field-oriented, i.e. it is based on an enabling environment linking diagnostics from local clinics with UK laboratory back up, including remote microscopy. In Nicaragua the Plantwise approach has induced the practice of urban agriculture through the initiative of a NGO who used plant clinics as loci to reach young men and women interested in vegetable production in backyards.

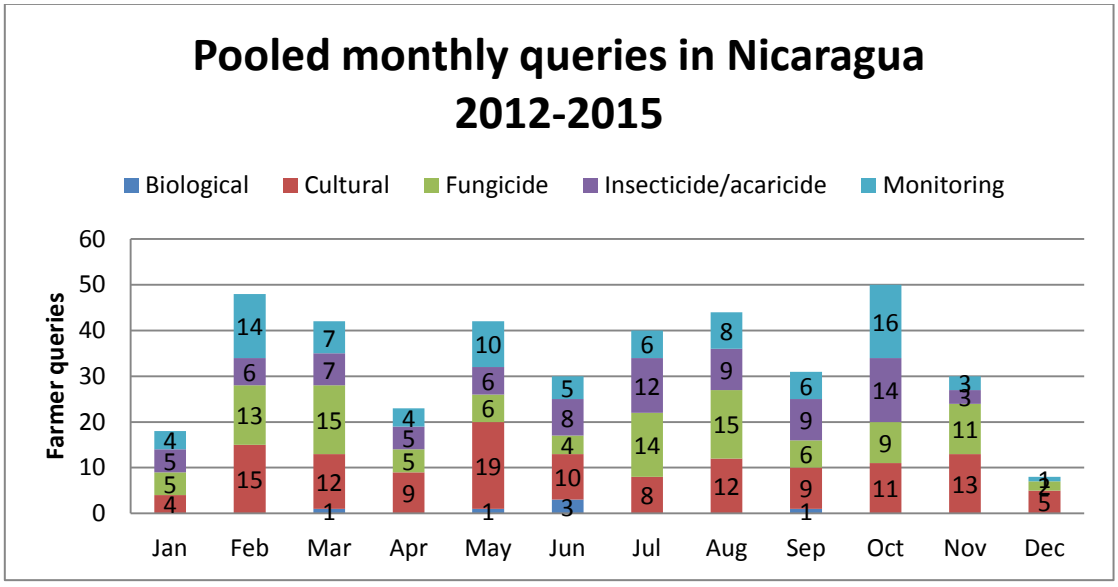

Figure 2 Pooled monthly queries in Nicaragua (Source: CABI Plantwise Background information. External evaluation. 2016)

2.2.4 Does Plantwise have the ability to adapt to changing external factors and unforeseen circumstances? Are there any limitations to Plantwise achieving its outputs and outcomes effectively?

As highlighted in the previous paragraphs, the Plantwise programme has a flexible approach that is adept at finding pragmatic and incremental solutions to local needs and requirements. However, one challenge that restricts the effectiveness of its support are the time and

resource constraints facing partners (as evidenced by the slow and inconsistent feedback of plant clinic data to POMS and the Knowledge Bank due to pressures on staff), frequent change in staff especially in governmental organisations (observed in all countries), and also in some cases rapid turnover of plant doctor personnel.

While these challenges are external in as far as they cannot be directly controlled by Plantwise, there is the potential for Plantwise to insulate itself and/or influence partners to address these problems:

- From the reports obtained through the current evaluation it appears that in Nicaragua, where the national delivery partnership is led by educational establishments rather than governmental institutions (INAN Leon, REDAF), it has been possible to avoid much of the disruption caused by changes in political appointments.
- Improved and more readily available evidence on the impact of the Plantwise approach and effective plant health systems on plant health, productivity and incomes as well as co-benefits for the environment and society may help in lobbying authorities for adoption and resourcing of the model. This underscores the need, as much as possible with available resources, for maximising data collection and analysis evidencing the benefits of the approach through the monitoring system, and through commissioned surveys, studies and joining international monitoring initiatives.[30]
- Drawing in new partners (agro-industry and agricultural training institutes[31]) and exploring self-finance models may also, in time, ease resource pressures and expand the skill base to deliver plant health services.
- There could be a silver lining in the collapse of oil and agricultural commodity prices. The province of Alberta (Canada]) one of the world's key oil producing areas, has become a food producing economy by generating consumer food products for the 21st century, i.e. organic honey, high-protein bison, unprocessed cereal products and high-value greenhouse vegetables and others.[32] In this light, the three countries command agricultural potential and may decide to expand their respective sectors to meet the 21st century demand. Concretely, by completing the implementation of the Misicuni Renewable Energy Hydroelectric Project (PHM) the Cochabamba governorate will establish a power plant (80MW) expected to generate annually 217-gigawatts/hour (GWh) of energy, whose reservoir will irrigate about 2600 ha of farm land.[33] As discussed above, to some extent, the shortage of irrigation-water for high-value crops will be mitigated in the Cochabamba valley.[34]

[30] There is one initiative led by FAO and WB to build the capacity needed for effective M&E starting with the identification and collection of the indicators. It suggests a number of approaches for determining which indicators to select given the different types of information that are most pertinent to different agricultural and rural activities, projects and programmes, and data availability. The innovative feature is that it proposes a set of " 19 priority indicators" that should be the same in all countries so as to allow for country comparisons, and to facilitate the monitoring of agriculture and rural programmes and goals at the international level. This approach was validated through in-country workshops in Cambodia, Nicaragua, Nigeria, Senegal and the United Republic of Tanzania. Source: FAO/WB. Tracking results in agriculture and rural development in less-than-ideal conditions. A sourcebook of indicators for monitoring and evaluation. Global Donor Platform for Rural Development. FAO, The World Bank, 2008. Extracted from www.fao.org on 15/08/16

[31] As noted. Plantwise in Peru and Nicaragua has contributed importantly to developing local capacities by involving agricultural universities and technical schools in its training programmes. In Nicaragua, for example, the Catholic University of the Dry Tropics is using the Plantwise methodology and data to train its students. In Peru, the National University of Cajamarca has used the Plantwise methodology to train students. The students that graduate from these programs provide the basis for technical expertise in the control of crop pests.

[32] In June (2016) in terms of dollar value food products have overtaken refined petroleum products as the largest manufacturing sector (cf. "Alberta's food sector boom" Globe and Mail, Sep 9, 2016).

[33] The PHM is financed by a consortia made up of regional banks (IDB), European Funds, national government and private sector. Cf.www.idb.org/BO-L1043 ; extracted on Sep 09, 16

[34] www.iadb.org/ BO-L1043/

2.3 Efficiency

The efficiency criterion concerns how well the available resources have been transformed in the various activities into the intended results or outputs, in terms of quantity, quality and timeliness.

2.3.1 How efficient is Plantwise in turning project costs into benefits? To what extent is Plantwise efficient in comparison to other extension models?

The evidence from the review suggests that the Plantwise model is a cost–effective means to provide technical advice to smallholder farmers in the three countries. Rather than extension agents visiting individual small farms, as was practiced under previous extension systems, the Plantwise extension model provides advice at central locations that many farmers frequent. It focuses the time of extension agents on giving technical advice rather than travelling to reach farms, often remote and difficult to access. Observations indicated that a plant doctor can provide advice to a farmer at a plant clinic in about 30 minutes, while travelling to a farm might require several hours. Thus costs per farmer are reduced and higher numbers of farmers are reached.

Though outside of the programme's focus on plant health, the utility to farmers of plant clinic contact can be increased by providing advice and services across a wider range of issues within the clinic format. This permits even greater efficiency to be achieved in supporting improved outcomes for smallholders. Such bundling of services is already in evidence in the countries evaluated (as noted in the Aide Memoires for Bolivia and Peru). Planned co-delivery of support across different topics may therefore be highly valued by beneficiaries, and provide further argument to secure organisational support and sufficient resourcing from authorities and partners.

2.3.2 Are stakeholder inputs being provided to Plantwise in order to achieve its outcomes and outputs?

The Plantwise Strategy for 2015 to 2020 lays out five phases for Plantwise interventions in a country (Assessment, Pilot, Consolidation, Scale-Up, and Sustainability). During the first two phases, Plantwise generally finances most of the costs associated with planning, establishing and operating plant clinics. Through the plant clinics Plant Doctors not only provide technical knowledge of plant pests to client farmers and learn about local plant pests, thereby becoming local experts, but the plant clinics stimulate productive links between the institutional stakeholders in the national plant health systems. Thus, during the third phase, in-country institutions take over most of these costs. It appears that in the three countries Plantwise activities have been planned and managed in accordance with these five phases. In these three countries, Plantwise has contributed only sufficient funds to plan the Plantwise operations and subsequently to establish and operate a few plant clinics. (Plantwise also pays its in-country and regional staff itself). Even during these phases, however, in-country cooperating organisations, such as INIA in Peru, universities and agricultural cooperatives in Nicaragua, and regional authorities in Bolivia, have provided in-kind support in the form of personnel to deliver the plant clinics. This shows that the Plantwise funding model is accepted and working so far in the three countries, although challenges of staff time and turnover have been noted. A challenge ahead is the task of ensuring that funding is available within each country to take the work forward during the consolidation and later phases – some issues and suggestions in relation to this financial challenge are proposed in Sections 4 and 5.

In the three countries, Plantwise's Latin American, regional and country coordinators appear to have coordinated well with the NROs and LIOs. Plantwise coordinates in various ways with each of the countries' partners in matters not necessarily linked up with plant clinics. Although the mission interacted with potential bi-lateral and private sector partners, for the moment Plantwise lacks a specific strategy to engage with these partners on development matters. The evaluation team understands that the programme has noted this as an issue to be addressed.

2.3.3 Does Plantwise generate information accurately and in a timely manner?

Plant doctors in Peru, Bolivia and Nicaragua are recording data on prescription forms that they fill out during their consultations with farmers at plant clinics. The plant doctors send these data to the country data manager, who harmonises and validates the data and then uploads them to the POMS. POMS permits these data to be analysed in order to identify major crops, crop pests, pest locations, new pests and farmers' problems, perceptions, and knowledge. These analyses aid in identifying priorities for research, extension, pest management and improving plant clinic advice. Several issues arise.

First, plant doctors may not be recording a high percentage of the data they receive from farmers. In Nicaragua, for example, the in-country data manager estimated that plant doctors record only about 10% of the data they get from farmer plant clinic clients and suggested that the reason was lack of time, given the plant doctors have other official duties. Second, observations suggested that filling out the prescription forms is time-consuming and interrupts the flow of interaction with the plant doctors' clients. Third, the prescription form may not include places to capture useful data, such as advice about livestock health. The evaluation team understands that amendments to address some of these issues are already being actioned by Plantwise. Fourth, informal discussions with some Plant Doctors revealed that access to the internet governs the access to digital information. So Plantwise's digital information is of limited use to beneficiaries, although reference materials for Plant Doctors remain available offline. Regional data (FAO 2014, Table 11) highlights low penetration rates in the three countries as compared with the region's leaders in agricultural growth. Specifically, in Argentina, Brazil, and Chile, on average, there are 10 subscribers per 100 people that have access to fixed broadband internet. This ratio plummets to 0.7, 1.4, and 4 subscribers per 100 people in Bolivia, Nicaragua and Peru, respectively.

According to documents, regional and national coordinators in Peru, Bolivia and Nicaragua make five to six monitoring visits per clinic per year. They interview a sample of client farmers in order to note their level of satisfaction with the plant clinic advice. Coordinators write a short report with recommendations for the plant doctor, noting if there are missing materials, equipment or technical references. In the three meetings plant doctors evaluate (cross check) quality of diagnostics and recommendations. Since early May 2016, Peru has been testing electronic prescription forms, using an Android application called Plantwise Data Collection App.

The Activity Tracking Tool (ATT), according to the Plantwise regional M&E specialist, is used to "monitor Plantwise implementation progress at the local (district/county, province, etc.), country and programme levels against the annual country activity plans as well as programme Logframe targets. Progress against the activities/interventions is recorded in the ATT on a quarterly basis, serving as an indicator of outputs by the programme. Activity data from various sources, including POMS, Monthly Highlight Reports (MHRs), BTORs and other relevant sources of information is captured in the ATT on a quarterly basis to present activities conducted in relation to country and logframe targets. This data is fed into the activity summary, which presents the results under the five programme logframe outputs. This is used in quarterly milestone updates, annual reports and programme updates, reports to stakeholders and donors."

Plantwise did not establish a baseline when it started operations in Peru, Bolivia and Nicaragua. Without baseline information it is difficult to measure changes in the situation that can be attributed to Plantwise actions. Nor was it able to identify numerical, multi-year targets for their programmes. Evidently numerical targets are established year-by-year at the beginning of each year. It is recognised that resources to establish comprehensive baseline data and measurement do not exist, and increasing use of baseline information (available from partners in some instances) and appropriate targets would strengthen the evidence for the efficacy of the Plantwise framework and national partnerships.

Therefore, in the three countries visited, the NROs acknowledged the absence of information measuring the economic effects of the Plantwise interventions on food security and poverty alleviation. The discussions converged on several facts. First, if we do not measure results, we cannot tell success from failure. If we cannot see success, we cannot reward it and learn from it. If we are unable to recognise failure, we cannot correct it. Perhaps the most critical fact that emerged was that if we demonstrate results, we can win public support. Several restrictions were noted with the current data management and M&E system, though these should be seen in the context of the constraints facing implementing partners.

2.4 Impact

2.4.1 What has the impact of Plantwise been on intended beneficiaries?

The impact of the Plantwise programme refers to the extent to which the objectives of the Programme have been achieved as planned.

With the exception of a CABI study conducted in Bolivia in 2010 no analysis has been located by the evaluation team to show the potential impact of Plantwise on beneficiaries in Peru, and Nicaragua.[35] However, the study in Bolivia showed how improved harvests and lower plant protection and production costs following adoption of plant clinic advice can lead to profitable farm income. This is corroborated by agro-economic information the team collected using the crop budget techniques in the sites visited (see Annex H). These crop budgets were collected from farmers who attended plant health rallies in areas where plant clinics were operating. With few exceptions, the crop budgets show profitability following the adoption of Plantwise advice, especially in cases where the farmers managed to reduce the high costs of agro-chemicals through biological pest control. Perhaps the key finding is that the farmers interviewed geared the production efforts to the market. Market-orientation supported by technological innovation (plant health advice) can be a strong driver to foment

[35] Discerning the impact of PW on the intended beneficiaries required special consideration. It seems possible to ascertain potential to impact for the following factors. (1) The PW initiative in the cluster countries has been under implementation since 2011. Although there is no formal end-of-initiative date, CABI management indicated that this assessment is a mid-term evaluation—which is not the appropriate timeframe to assess impact. (2) In contrast with standard project design, the area of influence of the initiative and the targeted beneficiaries are situated “at large” in regions broadly identified by national partners where smallholders operate. (3) Five years is a short period of time to produce impact among beneficiaries. Most agricultural projects begin yielding early results only after the fourth or fifth agricultural season as it takes approximately two or three seasons to fully mobilize and become operational. [4] PW is an agricultural initiative dealing with technology transfer among smallholders to enable them to lose less and feed more people. The historical evidence of the transfer from smallholding agriculture towards a science-based farming system suggests that it takes approximately one generation [about 30 years]. Cf. Waterston, A. Development Planning: Lessons of Experience. Baltimore: The Johns Hopkins Press. 1965. Schultz, T.W. Transforming Traditional Agriculture. New Haven: Yale University Press. 1964. Schultz, T.W. Institutions and the Rising Economic Value of Man. Amer. Jour. Agric. Econ. 50: 1113-1122. 1968. Hirschman, A.O. Development projects observed. Washington, DC: The Brookings Institute. 1967

the entrepreneurial approach among smallholders. Development experience indicates that when smallholders become entrepreneurs the poverty trap is broken much more easily.[36]

In the absence of substantial quantitative data beyond what is outlined above, the team relied on programmatic and analytical inferences to assess the potential impact of the programme on the beneficiaries. Observations and interviews with key stakeholders suggested that Plantwise has had an overwhelmingly positive effect on beneficiaries, with no unintended negative effects discerned. Many of those interviewed did however call for hard data to measure the impact of the programme . Showcasing the hard evidence of its success is pivotal in Plantwise winning greater public support.

The team recognised potential positive impacts from Plantwise across the following three cross-cutting areas which were also touched upon in the previous section. Further efforts in capturing and analysing impact in these areas are recommended, not least because they will provide even more compelling evidence to mobilise support and funds for sustaining and expanding Plantwise approaches within plant health systems in future:

Poverty reduction: In all three countries, reducing poverty would require resolving many problems beyond plant health. However, crop budget data collected from the three countries suggests that there has been an increase in profitability when farmers have received advice from Plantwise. It is widely recognised that Plantwise has improved the access of farmers in regions to clinics with technical assistance. This is both as a direct result of receiving advice from clinics and also as an indirect consequence of farmers sharing new information among themselves, such as one individual interviewed who has set up his own demonstration plot. Overall, farmers interviewed reported improved diagnosis, recommended treatment, and improved yields. One statistic from Nicaragua among the cooperative JFPS is a reported increase in production of sesame from 30% to 35% as a result of Plantwise advice. Similarly, in Santa Cruz (Bolivia) horticultural farmers in Mairana make approximately USD 3000 per hectare, according to mission estimates (see Annex H).[37] More farm data of this kind would further enable conclusions on the programme's effects on farm income. In fact, informal discussions with successful farmers in the three countries brought the message that "success breeds success". Most farmers shared that they tried the Plantwise approach because they noticed that a neighbour farmer had good experiences on his plots and it did not look complicated or costly.

Environment: Plantwise is promoting a form of IPM that offers a more controlled use of agro-chemicals, thereby contributing to a more appropriate use of them by farmers. In Nicaragua, it was noted that prior to the existence of plant clinics in the rural regions, farmers would often rely on agro-chemical suppliers for agricultural advice, who may not have always encouraged safe use of chemicals. Plant doctors are able to advise farmers on the most appropriate chemical for their plant health problem and how to apply it effectively. A farmer in Chimy, Peru, discussed how he had previously used a great deal of chemicals on his potato crops, harvesting the potatoes when the chemical was still in them. Since receiving advice from a plant doctor, he has been able to produce good crops by fumigating and planting good quality seed potatoes, rather than relying on chemicals.

It was also reported during discussions and presentations in Santa Cruz (Bolivia) that plagues, including fruit fly, alternaria leaf spots, aphids and leprosis, among others, are now controlled without agro-chemical products as a result of advice from Plantwise. Similar results have been achieved by Plantwise in Nicaragua (rust, nutrient deficiency, American

36 FAO Deep Roots: International Year of Family Farming. 2014

37 Although the crop budget analyses do not provide evidence of whether PW's intervention resulted in smallholders losing fewer crops or feeding more people, they do give information on the economic results from the technology transfer process and insight into the decision-making process and external factors that influence success. Specifically, they provide insight into the farmers' response to the plant health advice received; and information on the apparent consequences of plant health advice on both crop yields and farm income.

leaf spot, nematodes, viroses and others) and Peru (Andean potato weevil, early blight, flea beetle, potato moth, quinoa moth and others[38]). This is beneficial to the environment and could also contribute to improved food security as biological controls are typically less costly than agro-chemicals.

Gender: Plantwise has had some impact on gender equality within the communities of farmers they work with. The anecdotal evidence suggests that when women handle plant health matters they gain more respect from men. Where the prevailing cultural custom is that there is limited spontaneous interaction between men and women, such as Chitiya in Peru, national trainers should consider encouraging women to train as extension agents, with the possibility of later becoming a Plant Doctor, by tailoring training to them. Observations suggest this would encourage social empowerment in the community.

When women reach a level of financial literacy by mastering the above three skills they can use credit lines (either from standard rural banks or micro credit operations) with considerable skill. They are proven to have acumen for investment and business opportunities, as testified by development experience.

Plantwise provides smallholder farmers with more effective and less costly ways to control crop pests, thereby increasing their crop's productivity and quality and thus enhancing farm incomes. With enhanced income, smallholder farmers should be better able to finance their education and health needs. In brief, when women resolve plant health problems, the community's social capital surges upward, thereby improving gender equity and equality. This suggests that overall Plantwise has the potential to positively impact beneficiaries but further data is needed on this.

2.4.2 Have external factors and unforeseen circumstances prevented Plantwise from reaching its intended target groups?

No major external factors or unforeseen circumstances appear to have prevented Plantwise from reaching its intended target beneficiaries, though it should be noted that its reach is naturally limited by the stage of development of the programme, by resources available and by choices, often pragmatically unavoidable, about where to focus activity (for instance in Bolivia where work is focussed on two governorates with varied levels of support).

One external factor that the team suggest is closely monitored is the world's depressed prices of oil, gas, minerals and agricultural commodities, leading to slow growth in Bolivia, Peru and Nicaragua since 2014.[39] As a consequence, national governments are retrenching their personnel and other allocations to the agricultural sector. One immediate unmeasured effect is reduced support to Plantwise.

Another external factor to monitor is the negative effects of climate variability and warming. Farmers are highly vulnerable to climate change but this is not included in CABI's logframe. Several farmers interviewed were concerned by the drastic shift in the rainy season and rising temperatures which bring new and different insects. In the area of Capinota, Cochabamba, for example, smallholders can no longer grow grapes and peaches. This is altering the concerns farmers come to the clinics with, although it is noted that on their own initiative farmers are searching for other crops with lower water requirements and which are heat- and drought-resistant. Likewise, key stakeholders in Nicaragua continue advocating for the incorporation of knowledge and practices leading to mitigation/adaptation of current farming systems to climate variability and warming. Specifically, it may be necessary to

[38] Personal communication from PW regional staff Jose Gomez. Within the context of programmatic monitoring, this kind of information should highlighted as a key output contributing to the expected outcome. Otherwise, it would constitute an under-reporting of results achieved.
[39] International Monetary Fund. Regional Economic Outlook: Western Hemisphere: Latin America and the Caribbean: Managing Transitions. Chapter 2, April 201

identify new crops for ecosystems in transformation. The Knowledge Bank is a potential source to address this key challenge. As discussed earlier, however, the three countries' low penetration rates to fix broadband internet services could limit their capabilities to exploit the information available in the Knowledge Bank.

Summary:

- All evidence points to an initial spurt in uptake of plant health technologies. This had an early positive impact, with the farmers interviewed reporting a decrease in the quantity of crops lost to infestation.
- Farmers were clearly aware that technological options exist to address insect infestations. In fact, agro-chemical companies have been aggressively introducing various products in the regions studied. Regional statistics indicate that among the three countries in this study, pesticide use is highest in Bolivia (7.96 kg/ha) (FAO, 2014 Table 7).
- Nearly all farmers raised concerns about climate variability, with specific mention of lower precipitation and higher temperatures. They reported that as well as effects on crops being caused by increased variability in weather, they sense that they are witnessing new infestations. Limited time available precluded further probing into possible new types of insects, the possibility of more severe infestations, and the likely timings of these. In the face of this uncertainty the smallholders were apprehensive about their future.
- For all study sites, the plant health services, based on Plantwise implementation, were consistent with traditional agricultural modes of production and could be successfully implemented. The most important conclusion of the analysis of crop budgets (Annex H) is that with reference to plant health services, the success of the technology transfer process was location-specific and that economic results were strongly influenced by social norms and the existence of supporting infrastructure such as physical access to high-value markets.
- Although the current depressed prices of primary commodities do not appear to affect the core process of technology transfer, including plant health technology, they could severely affect the enabling or catalytic forces such as national or state governments, who are facing retrenchment of public service personnel and reduced budget allocations.
- It was apparent that not only does increasing plant health require access to timely and current information on best methods to counter crop infestations, this advice must be framed in the context of societal norms and be supported by an infrastructure of complementing facilities.
- Agricultural production is situation-specific so these complementing facilities vary from site to site, but can include access to high-value markets, marketing channels and arrangements favouring smallholders and awareness and use of cultural norms. Over time, the process can ensure a greater level of food security and reduced levels of poverty.

Lessons Learned:

- If CABI is to realise its mission of helping farmers to "…lose less food and feed more people" it needs to widen its scope to take into consideration complementary factors to plant health.
- The catalytic role that Plantwise plays in using plant health services to increase resilient productivity among smallholding farmers is currently latent. Although clearly successful in sustaining crop health, Plantwise's role could be fully enabled by including complementary facilities such as access to high-value markets and other site-specific requirements. This will permit smallholders to take full economic advantage of the offered plant health technologies, resulting in the loss of fewer crops and an increase in production of food in the short-term and reduction of poverty in the long-term.

2.5 Sustainability

2.5.1 To what extent could the benefits of the Plantwise programme continue if donor funding were to cease?

A key strength of Plantwise is the networks that it builds and its incorporation into existing institutions in the countries in which it operates. By incorporating Plantwise into the existing social and economic activities of countries its sustainability is increased, provided the institutions also remain sustainable with a strong level of support to the programme. In Nicaragua, for instance, early in the GPC years (2005) cooperatives adopted the plant clinic approach and it has been in operation for the last eleven years, although the salaries for Plant Doctors came from other financing sources.

Even so, there is a mixed reliance on donor funding for agricultural activities, not just from Plantwise, in the three countries and this brings its own challenges of dependency.

The political and institutional differences in the three countries reviewed create varying factors of sustainability in the programme. In Peru, INIA has adopted the Plantwise methodology for the agricultural extension activities of eight of its seventeen experiment stations and municipal governments have occasionally contributed to the operation of plant clinics by providing space and paying part of the costs of transportation. In Bolivia, two autonomous governorates (Santa Cruz and Cochabamba) have adopted Plantwise's methodologies. However, Nicaragua has evolved a centralised government, so the departmental offices are unable to adopt the Plantwise methodology unless given the authorisation of national government authorities. The strengths and challenges of each situation to Plantwise's sustainability are partially exacerbated by the financial stress created by the three countries' sluggish growth stemming from depressed oil/gas and agricultural commodity world prices.

In Santa Cruz (Bolivia) the financial stress since 2014 has been reflected in an unmeasured turnover of technical personnel. Each change in management brings about new personnel and sometimes new priorities. Currently there is strong leadership support from the DSIA, CIAT and SEDACRUZ of the Santa Cruz governorate. Focus is given to strengthening national partnerships in the 2015 Annual Operating Plan of Bolivia, which outlines plans to identify new partnerships and solidify these through partnership agreements. The financial support to Plantwise operations from the Santa Cruz governorate has been consistent and apparently undiminished. The Cochabamba governorate is running operations with Plantwise at a low level, as compared with Santa Cruz. It must be noted that Cochabamba lacks the agricultural development plans that have been strongly forged by the Santa Cruz governorate under the vigorous leadership of the Governor himself.

The long-term benefits of incorporating Plantwise into civil society networks as well as linking with government structures are evident in the case of Nicaragua, where Plantwise is run by educational establishments, NGOs and cooperatives. Within this framework the programme has done particularly well in riding out changes in government. Furthermore, there is also evidence of cooperation between cooperatives and universities for research beneficial to the continued improvement of the Plantwise programme.

Nicaragua's Academic Network for Plant Health (REDAF) provides a budget, including salaries, for the individual work plans dedicated to Plantwise activities. Likewise, some Plantwise resources are also dedicated to REDAF activities. The members of REDAF, Plantwise staff and the NRO are carefully planning how to use this credibility to best take advantage of the current opportunity to incorporate the Plantwise methodology into the agricultural extension strategy of the new Ministry of Family, Community, Cooperative and Association Economy (MEFCCA), which was recently set up. If MEFCCA does adopt the Plantwise methodology it would be a major step towards expanding the use of Plant Clinics

and Plant Doctors to a larger scale and creating a sustainable and effective national system of plant health in Nicaragua. However, there is some degree of financial stress in the country as world prices in agricultural commodities have not improved. This is reflected in instability of staff in governmental agencies.

Peru's INIA has adopted the Plantwise methodology in eight of its seventeen experimental stations, from which technology for crops and livestock is generated to transfer knowledge to small- and medium-sized farms. Plantwise trains some INIA personnel and. an INIA representative highlighted how Plantwise strengthens the organisation and expressed the official intention of a long-term and sustainable partnership. However, since 2014 there have been budget reductions and associated retrenchment of technical personnel. The harsh reality of INIA's reduced budget must be considered in the forthcoming operations of the seventeen regions.

Peru is divided into twenty-five regional governments, each of which has a regional directorate of agriculture from the Agencias Agrarias, the organisation in place to carry out extension work. Although INIA is the NRO, Plantwise has a working relationship with the Agencias Agrarias. The AA strengthens the regional scope of the programme.

Overall, Plantwise's comparative advantage in the provision of plant health services is unique; and it is highly complementary to existing programmes in Peru, Nicaragua and Bolivia. It has been incorporated well into existing structures in ways appropriate to each country. This is indicative that the plant health services would continue to function were donor funding to cease. Anecdotal evidence from Nicaragua highlighted how a German-funded programme to help reduce the cotton lost to insects had succeeded in reducing the insect population, but once the programme closed cotton production began to drop off. The takeaway point from this observation was that activities decline when projects (and their funds) close, so by being fully integrated into the local network of institutions the sustainability of Plantwise is ostensibly enhanced. However, two clear challenges remain: [1] the challenge of financing the operations in the long term; and [2] the challenge of ensuring support from national partners, which seems to depend on Plantwise's economic success among smallholders.

Pro-active NROs in Santa Cruz are actively reviewing the conditions and characteristics to develop cost-sharing schemes to progressively cover the technical extension support and plant health services by farmers. Information reflecting real costs and benefits from extension and plant health services to farmers could allow the calculation of the actual cost of these services. Based on these realistic cost-prices it would be possible to develop an inclusive, equitable, cost-sharing scheme.

2.5.2 What factors, if any, limit the continued sustainability of the Plantwise Programme?

As discussed above, Plantwise appears to be well incorporated into institutional structures in Peru, Nicaragua and Bolivia. Up to the point of this evaluation this has been conducive to the sustainability of the Plantwise programme. The three countries share varying degrees of politicisation across public institutions, associated with turnover of staff. This has been somewhat exacerbated by the financial pressure stemming from the declining world prices of oil/gas and agricultural commodities. However, there is no evidence so far that the financial stress pervasive in the three countries has been reflected in an unfriendly manner to Plantwise's priorities and operations.

To sustain and expand the Plantwise methodology to a national scale, and thereby improve the crop productivity of a large proportion of these countries' smallholder farmers, would require that many more LIOs provide regular and adequate financing for many more plant clinics. Interviews indicated that it is unlikely that the Plantwise programme can expand to a

large scale if it continues to offer free advice based on government financing. As discussed earlier, one option may be to explore ways of sharing cost through co-delivery of services, or through incorporating some costs into the price of sale of goods (such as agro-chemicals). Another option may be that plant clinics must be financed using part of the increased profits that their technical advice make possible. In order not to contravene the guiding objective of Plantwise to enhance the delivery of advice to poorer farmers, it would be important to consider issues such as ability to pay in designing any such scheme. In this light, NROs in Santa Cruz, Bolivia, are now considering alternative financing mechanisms to continue operating the extension services, equitably and inclusively, with the participation of the Plantwise initiative. These alternative mechanisms would be customised in terms of farmers' financial capability to progressively share the cost of extension services. Once again, as highlighted in a number of points during this assessment, the profitability of farmers' operations obtained through monitoring the economic effects of Plantwise's operations would be useful in this context.

2.5.3 To what extent does the Plantwise programme take account of socio-cultural factors and is the technology it utilises appropriate to these?

By working with LIOs to implement plant clinics at the local level, Plantwise should be able to engage better with the relevant sociocultural factors at play in different communities.

Plantwise has shown an ability to adapt to sociocultural factors as they present themselves. For instance, in the Cajamarca region (Peru) Plantwise began incorporating livestock into their programme as this proved to be a critical factor from the standpoint of farmers' needs.

Traditionally, agricultural extension takes place in markets. However, it was recognised by Plantwise that in Nicaragua smallholders do not regularly visit markets because these are run my wholesalers and intermediaries. As a result the programme bases clinics within communities via connections with organised groups, rather than simply 'showing up' and expecting farmers to engage. In some regions, mobile plant clinics have been introduced to respond to the varying availability of farmers in different communities. Further, 'Plant Health Days' – days targeted towards a particular plant health problem – are based on problems that farmers introduce, rather than imposing ideas of what should be discussed on the community.

Lastly, it is important to note for sustainability purposes in Nicaragua that the years between GPC and Plantwise where there was no funding available most of the clinics kept running regardless.

In Peru, in some instances, farmers claimed that other farmers are not willing to take new advice from plant doctors, preferring to stick to traditional technologies and methods that they know well. Although this is uncommon, one possible way to tackle this is to train farmers as extension agents as they may be able to engage on the same level. This was implemented in Camayoco, Peru.

The programme does not yet fully take account of the fact that many farmers in rural regions now migrate to the city for work, leaving behind women and children to farm; for example in Peru this is particularly the case in the rural regions of the Andes and among the Quechua people. There is therefore a need to ensure that any barriers that women may still encounter to engage in the programme are addressed, and to understand whether socio-cultural factors might limit the interaction between female farmers and male plant doctors.

The role of women in farming in the three countries has been traditionally important. For instance, in the Cajamarca region some women are illiterate and therefore the written prescription forms and data have little value to them. Given the increasing attention of all Plantwise programmes on gender issues in line with the Gender Strategy, pictographical information on different pests to be displayed in social venues would be useful.

In addition, different elevations and micro-climates in the Andes create new challenges to plant health which the team did not perceive as having been taken into account by plant clinics. Plantwise should consider undertaking research into the subgroups within farming regions and determine practical ways to engage them without diluting core efforts already programmed.

The Plantwise methodology does require consultations with local governments and farmer cooperatives about the timing and location for Plant Clinics. The consultants perceive that Plantwise consults indirectly with the target population of smallholder farmers about their problems, expectations or recommendations for Plantwise, through analysis of queries and needs encountered in the plant clinics. The Plant Doctors do interact with client farmers in detail about their problems with pests to reach adequate solutions in terms of farmers' need. The consultants' own discussions with farmers suggested that Plantwise could again consider pictographic technology that makes its advice more user-friendly. Suggestions by farmers in Cajamarca included offering video examples of their advice at clinics and utilising demonstration plots.

2.6 Coherence and Added Value

2.6.1 Does Plantwise complement existing donor interventions in the region to enhance the value of agricultural production? Has Plantwise made a concerted effort to create synergies with other donor interventions in the region?

Coherence concerns the extent to which activities undertaken (to date) allow donors to achieve their development policy objectives without internal contradiction or without contradiction with other donor country policies and the extent to which they complement partner country's policies and other donors' interventions. The evaluation team was not able to meet with relevant donors in the time available to evaluate the coherence of Plantwise's activities with their donors. Although the open discussions with the German, Swiss and Japanese Aid's field representatives showed that there is overall complementariness. The three aid agencies intend to enhance the well-being of smallholders using a sustainable approach. Plantwise methods had a sound fit in this context.

However, the team did not perceive that Plantwise has made a concerted effort to create synergies with specific donor interventions in the region. Some complementarities do appear to exist. For example, one of the evaluation team members has recently consulted for the Agency for International Development Central America and Mexico Regional office (USAID/CAM), which is financing a regional climate change program that includes considerable support for the control of the pests of coffee, such as *broca* and *roya*. The Central America Tropical Agriculture Institute (CATIE) in Costa Rica operates this program. It includes an electronic consultation system, somewhat similar to that of Plantwise, through which coffee farmers are able to consult each other and experts about how to control coffee pests. While the programme uses similar information technology to the Plantwise programme and could offer a good opportunity for cooperation, no current link between the two programmes was noted. In addition, during the visit to Nicaragua a potential point of coordination between Plantwise and the FAO-led Farmer Field Schools was noted. The Schools take place every Saturday and involve modules on crops and animals, utilising links with universities to train their technical staff. International specialists and specialists from universities also attend the days. Discussions with regional staff in Nicaragua indicated that there is currently no linkage between Plantwise and the Schools but that there is a desire to build one.

SECTION 3

Assessment summary

3.1 Assessment by Country

3.1.1 Peru

The National Institute for Agriculture Innovation (Instituto Nacional de Innovación Agraria) (INIA) is the national responsible organisation (NRO). It has adopted Plantwise's methodology in eight of its seventeen experiment stations. Six of these experiment stations are in the Andes and two are on the coast. None of the plant clinics are in the eastern lowlands. In 2018, INIA may adopt the Plantwise model in the rest of its experiment stations. To do so, it will have to include the necessary funds and activities in its 2018 Annual Operating Plan (AOP). INIA, however, no longer officially has an agricultural extension role. Its official role is confined to agricultural research. Nonetheless, to some extent, the plant clinics that the eight INIA stations have established are serving as models for the agricultural extension programs of the Agrarian Agencies of regional governments and the environmental staff of municipal governments. Within government, staff turnover occurs frequently and decisions may be made for political reasons rather than because of technical criteria. The collapse of oil, gas and mineral prices since 2014 has echoed inevitably on the budget of the agricultural sector leading to retrenchment of technical personnel. In addition, a new government has been democratically elected, causing momentary uncertainty in the short term among government agencies.

This state of affairs can affect the Plantwise programme because it can influence plant doctors to change position frequently, preventing them from gaining much experience with the crop health problems of a given region. The NRO has not involved agrochemical companies in establishing plant clinics. Nor has the large-scale, agro industry that dominates coastal farming for export crops been involved in establishing a national plant health system. The mission participated in a working session led by NRO with agri-business involved in merchandising agro-chemicals. Plantwise's IPM methods for controlling crop pests probably appeals particularly to the segment of Peruvian agriculture that intends to compete for international markets with organic, "green" products.

3.1.2 Bolivia

In Bolivia, Plant Clinics are becoming a standard procedure to enhance the technical capacity of extension officers, and farmers. There is early evidence of increased crop yields and quality resulting from Plantwise actions. The thorough support from the Santa Cruz governorate continues. It has adopted the plant clinics model as part of its institutional activities and has included it in their Yearly Operational Plan. The Santa Cruz governorate provides a respectable contribution for the implementation of the Plantwise activities, as the Plantwise budget is rather limited. In the Cochabamba governorate, Plantwise has just begun flourishing. The Valley's Foundation and the Tarata Technical Institute lead the Programme's activities. The differences in the agricultural development pathways of Santa Cruz and Cochabamba are accounted for by their specific evolution in the decentralisation process. The Santa Cruz governorate has already achieved its Statutes of Autonomy, legalised by the Bolivian Political Constitution. In contrast, the Cochabamba governorate

does not have its statutes of autonomy due to a national referendum that included other governorates. The Cochabamba governorate has the support of the political party in power; nonetheless, it has deployed limited efforts in agricultural development planning as compared to Santa Cruz. In addition, high turnover in the public sector's personnel aggravated by regional differences creates a challenge to move towards a national programme. National revenue from international oil sales has shrunk since 2014. There is little relief in sight to what has become the worst market slump in the oil market in a generation. This financial stress is inevitably transmitted to the agricultural budget of the Santa Cruz governorate and others.

3.1.3 Nicaragua

The Academic Network for Plant Health (REDAF) is the NRO in Nicaragua. It has become a fairly well-established, credible regional network of universities, regional government institutions, agricultural cooperatives, and NGOs. Its credibility derives from its members' dedication to inter-institutional collaboration and use of scientifically sound data and has enabled it to survive abrupt shifts in the national government policies for agricultural extension. The NRO has not involved agro chemical, large sugar cane, African oil palm, and soybean farms, or agro industrial companies in its activities or the establishment of a national plant health system. Agriculture in Nicaragua is concentrated in the western regions. Eastern Nicaragua has little agriculture although there are large areas of pasture. Plantwise's goals and objectives are consistent with the current situation of agricultural extension amongst Nicaraguan smallholder farmers.

Plant clinics, currently run by cooperatives, universities and NGOs, are proving to be an effective and efficient procedure for increasing the technical capacity of farmers, and thereby increasing their crop yields and quality. Because wholesalers and intermediaries control market places, plan clinics have been moved to alternative venues.

Plant Doctors are teaching smallholder farmers to rely on observation and data rather than agrochemical dealers to resolve crop health problems. Nicaragua has become a highly centralised government over the past ten years, so the regional offices of national government institutions do not have the independence and flexibility, and potential for innovation and experimentation, that they formerly had. This centralisation of decision-making power has stymied the expansion of the Plantwise model within the western region. Agricultural cooperatives have adopted the Plantwise model most enthusiastically, possibly because they recognise that controlling crop pests can increase the quantity and quality of export crops for international markets. The members of REDAF, Plantwise staff and the NRO are planning how to use this credibility to best take advantage of the current opportunity to incorporate Plantwise methodology into the agricultural extension strategy of the new Ministry of Family, Community, Cooperative and Association Economy (MEFCCA). If MEFCCA does adopt the Plantwise methodology, it would be a major step towards expanding the use of Plant Clinics and Plant Doctors to a larger scale and creating an effective national system of plant health in Nicaragua.

Despite low oil prices, growth in Nicaragua has been decelerating owing to the impact of adverse weather conditions for the main agricultural export crops

3.2 Combined Assessment

Overall, Plantwise is offering a cost-effective extension system for reaching smallholder farmers with the technical advice they require to reduce crop losses and improve crop quality. If expanded to a scale that reaches a larger percentage of smallholder farmers in

the three countries, the Plantwise programme will produce substantial social, economic and environmental benefits.

Key to ensuring sustainability and expanding the Plantwise program is finding a way to finance the plant clinic operations, one option being to introduce charges for some services, where there is willingness to pay in light of the increased profits that plant clinic technical advice supports. This may need to be a graduated system, where poorer farmers continue to access advice for free. The potential role of private sector organisations as partners has been highlighted in the above analysis and they may equally offer options for financing plant clinic services within the plant health system, as recognised in a strategy recently developed by Plantwise on increasing private sector linkages. In addition organisational and budgetary support from other partners could be mobilised more effectively with improved data on the benefits accrued across as wide a range of needs as possible, not just in plant health but related extension topics, increased incomes, environmental management and eco-system protection, health and education and equity.

A related observation is that national partners may be able to achieve efficiencies through delivering other advice and services within a single Plant Clinic format – a one-stop-shop approach which may enhance the attractiveness of clinics to farmers and allow partners to share logistical and personnel costs across different service budgets. This is not to say that Plantwise itself would alter its mission and begin to provide advice in areas other than plant health, but that it may be possible to explore co-delivery of services as a means of enhancing sustainability. The evaluation team saw evidence of this already happening in some instances on the ground, where plant doctors provide a range of advice in plant health and other topics including personal in some cases.

Within the context of this challenge, Plantwise's M&E system should become more responsive to the needs for information on results at farm, regional and national levels, especially to show decision-makers improvements of farm incomes on the ground. This could encourage expansion of the plant clinics.

As an approach dependent on local partner buy-in, Plantwise's inherent flexibility to construct partnerships that are appropriate to a local context, and which provide a place to get started, is highly valuable. This allows the programme to follow 'what works'. For example in Bolivia and Nicaragua, two different solutions have been found to address difficulties of engagement with national government as a lead partner – by working through committed autonomous government partners in Bolivia and with educational and NGO networks in Nicaragua.

A final summary observation, however, is to note the challenge encountered in all three countries created by instability in local, regional and national governments. This instability partly stems from the collapse of oil/gas and agricultural commodities inducing unmeasured financial stress that is inevitably transmitted to the agricultural budgets in the three countries. Another source of instability is the unresolved issues from rising expectations of equitable economic development. These issues have created problems in maximising the understanding and support for Plantwise approaches within the plant health system. This is an obstacle to sustaining and expanding systems based on Plantwise approaches on a significant scale. The experience in Nicaragua of successfully avoiding some of those disruptions by working extensively with non-governmental organisations is important in this regard, though the challenge lies ahead in assisting MEFCCA to incorporate the Plantwise framework into its extension activities at the national level as it takes on that mandate.

SECTION 4

Conclusions

4.1 Policy and Institutional Aspects

4.1.1 Improved crop health produces many social, economic and environmental benefits

Smallholder farmers in the three countries, as discussed in Section 1.3, produce much of their countries' food, since their large, agro-industrial farms produce mostly export crops, such as sugar cane, soya and African palm oil. Sections 2.1 and 2.2 describe how Plantwise's programmes in Peru, Bolivia and Nicaragua support CABI's policy and programme framework as well as its donor's policy and programme frameworks. Section 2.3 notes that Plantwise programmes do address the links between social needs and plant health. We therefore conclude that Plantwise's rationale applies in Peru, Bolivia and Nicaragua and that Plantwise's programmes will produce social, economic and environmental benefits. The social and economic benefits include: more abundant, and higher quality food, and increased farm income, both of which could be invested in health, education, reduced migration to large cities, more stable families and increased gender equity. The environmental benefits include conservation of biodiversity and ecosystem functions, due to reduced clearing of natural vegetation and less contamination by toxic pesticides and less risk to human health from the unsafe use of pesticides.

4.1.2 The Plantwise extension methodology is more efficient than traditional agricultural extension methodologies

Section 2.3 describes how Plantwise's methodology for agricultural extension is more cost effective for reaching a higher proportion of poor, smallholder farmers than traditional agricultural extension methodologies. Experiences with Plantwise however suggested that even greater efficiency could be achieved if countries consider broadening the scope of application of the approach to address overall agricultural extension beyond plant health, to increase the utility of plant clinics to farmers, and potentially to achieve cost savings through co-delivery of advice and services.

4.1.3 Public institutions provide an unstable institutional basis for agricultural extension – the flexibility that exists in the Plantwise approach to establishing local effective partnerships, rather than prescribe a fixed structure, is a key advantage for implementation

Plantwise does not attempt to establish new institutions for agricultural extension. Rather it attempts to embed its methodology in existing national, regional and local institutions. So far Plantwise has not created a national plant health system in any of the three countries. This may be occasioned by government policies and governance of agricultural extension service vis a vis other plant health functions. Another reason may be that sometimes the responsibility of different government institutions for agricultural extension are not clearly

defined and implemented. Finally, changes in personnel and policy priorities mean that key interlocutors and supporters of the approach may disappear regularly, and Plantwise partners have to re-introduce their activities to new decision makers. These challenges will not disappear soon. Consequently, public institutions may often be the weak link in a national public plant health system. Plantwise's flexible approach to establishing appropriate effective partnerships in different constellations and with diverse leadership, working with champions for the approach rather than prescribing a need to work through central government, has permitted some plant clinics to be established quickly in Peru, Bolivia and Nicaragua, and demonstrate results.

4.1.4 Plantwise has not yet sufficiently demonstrated its benefits to decision-makers

So far, however, Plantwise has not effectively demonstrated the benefits of its methodology to decision-makers. This holds both in relation to its impact on improving plant health and therefore farmer's income – its core objective – and to its indirect contribution to multiple other economic, social and environmental benefits, which may garner further support. Though individual studies and the evaluation team's own observations on the ground provide prima facie evidence of these benefits, specific data from tracking down the way agricultural outputs are derived from inputs, such as plant health services can indicate how Plantwise's programmes in the three countries, have increased the farm incomes of smallholders, by enhancing crop production and food supplies, as well as protecting biodiversity, ecosystems and human health. Decision-makers will be more likely to support the expansion of Plantwise to a national scale if they are presented with compelling evidence that its methodologies provide a cost-effective way to resolve pressing issues. This relates not just to governmental decision-makers but also to leaders of other organisations such as academic institutions who may cooperate with and help to resource the delivery of services, to private business – especially agro-dealers – and to other funding organisations. Furthermore, improved data on how Plantwise improves incomes should encourage a virtuous circle of increasing uptake by farmers themselves, and underpin any decision to charge for advice in the future (see Conclusion 14 below).

The time and resource constraints on partners, personnel and Plantwise itself to collect this data are clear, and the evaluation team also recognises the existing efforts and plans in place to ensure data is collected and analysed (for instance through detailed studies in selected countries). Further improvements are nevertheless seen as important and valuable.

4.1.5 Private sector enterprises are a key component of national plant health systems

Section 2.1 discusses agrochemical and large-scale farming enterprises as potential stakeholders in national plant health systems. Competition has so frequently proven to be effective in establishing services that respond to needs that it may do the same for providing farmers with sound IPM advice. If farmers become educated in IPM through Plantwise efforts, then they will be able to judge rather than simply accept the advice of agrochemical dealers. If some agrochemical dealers can offer farmers sound IPM advice they may out-compete dealers who cannot offer such advice. Competition would create a self-financed system for providing farmers with IPM advice. These findings support the efforts already underway within Plantwise through its Strategy to link more fully with private sector actors.

4.2 Technical Aspects

4.2.1 Plantwise could consider supporting further needs analysis and a diversification of materials and training of Plant Doctors to enhance their knowledge on specific niche needs or emerging issues that can affect smallholder income through plant health

Plantwise's efforts to support partners, particularly the LIOs, to adapt to country contexts, including addressing specific farmer needs, are important. The evaluation missions suggest that the impact of support on plant health is enhanced by tailoring training and the knowledge base to address needs of specific groups, notably women farmers and other needy farmers situated in mountain communities.

A review of how training and analysis might be enhanced to ensure that plant clinics can advise effectively on emerging and evolving issues such as climate variability is also important, and the evaluation team understand that efforts are underway at Programme level to address this. Climate variability and warming will certainly affect the type and pattern of agricultural production likely to arise.

Plantwise may also wish to consider reviewing options to increase data collection and provide further training (building on that supplied through Module 2) for Plant Doctors to acquire proficiency in value chain analysis. Put differently, addressing key market and commercial matters, so as to assist farmers in reaching out to new markets through alternative marketing channels. All farmers interviewed while collecting crop budgets were geared to take their produce to the market, especially those who happened to lose earnings. This is indicative of market-oriented farmers that need strategic support so they can reach consumption centres at the lowest cost and minimum time. This will allow them to exploit the economic benefits of plant health services and extension (Annex H).

4.2.2 Plant doctor turnover can impact performance

Plant doctors at plant clinics must prove their worth by providing target farmers with effective and feasible technical advice on controlling crop pests. To provide such advice, plant doctors must be well-trained and experienced. They must know the crop pest problems of their region and be accessible when farmers need their advice. Such knowledge comes as much from experience as from training. We conclude that plant doctors must spend sufficient time in their area if they are to provide high-quality, feasible technical advice. When a plant doctor transfers out of the location or quits their job, a plant clinic loses valuable accumulated experience. Stability in plant doctors is thus an important condition for maximising the effectiveness of national plant health system. It is recognised that plant doctors are not employed by CABI, and that Plantwise has no direct control over personnel turnover. However, the programme may be able to influence partners by highlighting the benefits of improved staff retention and/or exploring ways of sourcing additional personnel with greater stability (perhaps through the private sector or through academic networks) and financial resources to reduce pressure on existing staff.

4.2.3 Responding to the needs of women farmers

As discussed in Section 2, women have played a key role in the agriculture of the three countries. Many men migrate for non-farm work in the nearby towns sometimes to improve the household income. Those earnings are often re-invested as farm assets. Although there has traditionally been a division of labour in smallholding families, when women have to run the farm alone additional needs arise. Plant doctor's technical advice must address effectively the household division of labour as well as additional women's perceptions and

needs; this would ideally be informed by women's feedback. Suggestions that arose during the evaluation mission included creating pictorial advice materials, and possibly video material to show at plant clinics. These learning materials should remain in the special venues of communities, e.g. schools, community centres.

4.2.4 Leveraging opportunities for co-delivery of services by partners through the plant clinic format

Farmers consider a suite of factors (e.g. alternative labour opportunities; financial costs; potential financial return, etc.) when they decide how to control (or not control) pests infesting their crops. Crop health, likewise, reflects many factors (e.g. elevation; soil fertility and structure; surrounding vegetation; soil humidity; extent of shade and exposure to sunlight and wind; quality of seed, etc.) more than just the presence of a pest. National partners may be able to achieve efficiencies through delivering other advice and services within a single Plant Clinic format – a one-stop-shop approach, which may enhance the attractiveness of clinics to farmers and allow partners to share logistical and personnel costs across different service budgets. This is not to say that Plantwise itself would alter its mission and begin to provide advice in areas other than plant health, but that it may be possible to explore co-delivery of services as a means to enhancing impact and sustainability. As noted at section 3, the evaluation saw evidence of this happening on the ground, where plant doctors provide a range of advice in plant health and other topics. Thus this is not necessarily a change in practice but rather a change in focus, to recognise such practices as an opportunity to enhance sustainability of the Plantwise approach on the ground.

4.3 Monitoring and Evaluation Aspects

4.3.1 M&E should include tracking the global effects (social, economic, environmental) of plant health services on farms

Section 2.3 notes a few ways in which the M&E system could become more accurate and useful in tracking the global effects of Plantwise actions on farm incomes. This evaluation itself has demonstrated that the Plantwise M&E system effectively monitors the programmatic evolution. However, the information to assess economic, social and environmental issues should be more easily accessible if it is to be useful for Plantwise programmes in the three countries. The evaluation team found it somewhat difficult to locate and utilise data from the M&E system for the purpose of assessing programmatic results on, for example, pest control either on farm or regionally. Although, the "raw" information is available in POMs, it should be formatted for public knowledge so it becomes useful for an evaluation.

For example, in Santa Cruz (Bolivia) the pest Tutta absoluta has been controlled and the number of applications to control it reduced from twenty-two to eight. However, the mission had difficulties finding an official version besides references in presentations. Another example is that the area of influence (in hectares) of each plant clinics is available "raw" in POMs, but the official figures would be useful for evaluation purposes. This information may be difficult for farmers, Plant Doctors and other stakeholders to access; in addition there are limitations in access to the internet because of low penetration rates to fixed broadband internet services across the three countries.[40]

[40] FAO [2014] Table 11

Fuller use of baselines will enhance reporting of the achievements of Plantwise and will strengthen the case for sustaining and expanding the uptake of the approach. The resource constraints that may prevent Plantwise from establishing baselines for rigorous analysis of the impact of all activities it supports are clear. Plantwise did not prepare a baseline when it started its operations in the three countries. However, a baseline enables measurement of changes attributable to Plantwise's interventions. It could be used to strengthen arguments to decision-makers for financing and expanding the Plantwise programme to become part of national plant health systems. Baselines at regional or municipal levels, moreover, would provide arguments to convince regional and local decision-makers to support plant clinics. Based on recognition of the practical constraints to recording baselines, a proposal is made in the next section with suggestions for how to support these aims.

More farmer feedback will also further strengthen M&E and enhance reporting of Plantwise achievements. When plant clinic clients apply Plantwise's advice, they see, judge, measure and record the effects of this advice on their crops. By collecting this data the Plantwise M&E system will become more useful in revealing and evidencing the effectiveness of the plant health system. Plantwise's programmatic M&E does not yet include provision for systematic, representative (or perhaps comprehensive) feedback from clients on the results of plant clinic advice on crop productivity and quality, and therefore income. Some studies, e.g. farmer satisfaction surveys, have been carried out and have proved useful. Increased data gathering in this area will help extend the utility of the M&E system, and provide evidence to promote the approach both to more farmer clients and to national partners and potential funders. One technique that could be introduced is the analysis of Crop Budgets tested on a very limited scale during this evaluation exercise (Annex H). Amendments to the prescription forms used and gathering data on repeat usage will also help to build a fuller picture of how Plantwise advice is used and to what effect.

4.4 Financial and Economic Aspects

4.4.1 Financial considerations strongly affect uptake of technical recommendations

Farmers, like all business people, must calculate whether a course of action will provide a positive return on investment. Among the three countries, Bolivia uses the highest amount of pesticides (7.96 kg/ha[41]). It is likely that when talking to a plant doctor farmers consider how much implementing the advice will cost and whether it is worth the money. Consequently, pesticides attract farmers as their costs seem exact and the results certain. To convince a large proportion of farmers to adopt the IPM approach Plant Doctors need to demonstrate on-farm results showcasing to farmers that it is in their financial interest. Techniques such as the Crop Budgets can help capture and present this information. With few exceptions, the crop budget analysis shows profitability once farmers reduce the high cost of agro-chemicals and use biological control.

4.4.2 Financial sustainability is a key challenge facing each country as they move further into consolidation

Possible ways to increase the financial sustainability of Plantwise include enhancing evidence of impact to promote support from national organisations, harnessing cost savings by bundling the delivery of different services through the plant clinic format, increasing

[41] FAO [2014] Table 7

involvement of the private sector, and possibly charging for Plant Clinic technical and health advice by fomenting entrepreneurship.

Plantwise may be able to support efforts at the national level to identify financial solutions for expanding plant health systems through:

- Supporting enhanced monitoring reporting of the benefits and concrete results of the approach in tackling plant health and other challenges to build the case to encourage government or other relevant organisations to allocate support and resources.
- Helping to identify and follow up on opportunities to co-deliver services and share costs
- Implement actions arising from the Plantwise strategy for engaging with the private sector. Private sector partners could offer influence, financial support, entrepreneurial drive and talent, and technical expertise to a national plant health system. .
- Investigating the feasibility of charging smallholder farmers for technical advice, given that the technical advice will increase profits, perhaps on a graduated system of fees related to ability-to-pay. Investigations already underway at NRO in Santa Cruz, Boliva as highlighted above.[42] This option foments the entrepreneurial motivation of smallholders. It should be remembered that the impressive growth of neighbouring countries (Chile and Brazil) in agricultural productivity and incomes has been almost solely the result of small entrepreneurs. They have had the strategic support of state agencies and private banks in enabling competitive and timely credit, strategic information about markets, infrastructure development for competitive and easy transportation, and access to technology, among other fundamentals.[43]

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[42] In response to this quandary, there are ongoing initiatives led by NROs in Santa Cruz, Bolivia. The idea consists of developing an inclusive, equitable, cost-sharing scheme to progressively cover the technical extension support cum plant health services by farmers. One area where the social-economic viability of this scheme could be tested would be in the region of Mairana where horticultural farms show profitability. However, it is sobering to consider that in Nicaragua, a LIO (INTA) has tested one such cost sharing scheme with farmers of different income levels. Although the results obtained were not appraised, an apparent limitation of the scheme was the insufficient resources needed to carry out such an enterprise.
To this end, a critical step to take for the PW and NROs in the cluster countries is to begin measuring costs and benefits so that an equitable cost sharing scheme can be elucidated. This will require launching a socio-economic monitoring process to learn what the factors are that influence the costs and benefits of technical extension , and to determine the cost and benefits of plant health services. A consolidated, thoroughly researched cost analysis could open avenues of bankrolling from financing agencies, including banks.
43 FAO Deep Roots: International Year of Family Farming. 2014

SECTION 5

Recommendations

5.1 Policy and Institutional Aspects

5.1.1 Increase use of data to persuade decision-makers and stakeholders to adopt, participate in, or fund Plantwise's extension model to enhance sustainability and expansion

Sections 2, 3 and 4 have noted that many economic, social and environmental benefits result from improving plant health through agricultural extension. Section 2.2 concludes that Plantwise's model for agricultural extension is more effective and efficient than traditional models. Section 4, however, concludes that Plantwise has not collected sufficient evidence of these benefits to demonstrate Plantwise benefits as effectively as possible to decision-makers and stakeholders who can contribute to sustaining and expanding the approach in the future. Within the resource constraints of Plantwise and its partners, we recommend that Plantwise increases the level of analysis and documentation on the economic, social and environmental benefits of improved crop health produced by Plantwise in the three countries. This evidence can be used to persuade decision-makers to support an integrated plant health approach. Some specific suggestions are given at section 5.3 and Annex I below.

5.1.2 Emphasise non-governmental and private sector participation in Plantwise model

Sections 2 and 4 conclude that to provide effective and applicable technical advice on plant health plant, Plant Doctors must accumulate experience with the crops and growing conditions in a given region. Yet public institutions by themselves provide an unstable institutional basis for agricultural extension in Peru, Bolivia and Nicaragua, for various reasons, and staff members change frequently. Experience with UNAN-Leon and REDAF in Nicaragua has shown that where Plantwise activities are led by non-governmental organisations, some of the disruption associated with the instabilities within government can be avoided. At the same time, where public sector personnel may be unable to accumulate the experience in how to control crop pests that the provision of effective and applicable technical advice to farmers requires, or have limited time to keep abreast of all key areas of emerging knowledge, private sector actors may offer important contributions. We recommend, therefore, that Plantwise continues to seek ways to involve private sector institutions in providing technical advice in crop pest control to smallholder farmers. Agrochemical dealers, as discussed in Section 2.1, may come to be an important source of technical expertise in IPM. The students in agricultural programs may be another source of private technical advice.

5.2 Technical Aspects

5.2.1 Identify and respond to circumstances of women farmers and needy farmers

Section 4 (Conclusion 6) notes the benefits of analysing the requirements of needy farmers with a focus on women's requirements. Obtaining good baseline information or conducting a situational analysis will enhance the effectiveness and feasibility of the technical advice plant doctors can offer plant clinic clients, and is likely to increase Plantwise's reach to marginalised groups. We recommend, therefore, that the Plantwise programmes in the three countries respond systematically to the requirements of needy farmers. Having established a differentiated understanding of need, choices can be made as to how to maximise support through designing training materials that respond to these specific needs. In line with Plantwise' Gender Strategy, special attention should continue to be paid to the needs of women farmers, which should then be incorporated into the gender outreach plans that are in place, if appropriate. This evaluation has highlighted indicative examples of steps that could be taken, such as creating pictorial or local language materials.

5.2.2 Stabilise Plant Doctors' service

Section IV-B-1 concludes that the stability of Plant Doctors in their positions is a necessary condition for establishing a national plant health system. We speculate that their stability may be achieved if they are not considered to be political appointees, perceive Plant Doctor work as a regular part of their official activities, to receive financial compensation equivalent to alternative employment, find their work satisfying and rewarding, work in conditions they find satisfactory and receive regular training to update their skills. The evaluation team understand that these issues are outside of Plantwise's jurisdiction. We recommend, however, that Plantwise explores ways of highlighting the benefits of improved staff retention with partners and/or exploring with them ways of sourcing additional personnel with greater stability (perhaps through the private sector or through academic networks) and financial resources to reduce pressure on existing staff.

5.2.3 Incorporate resilience to climate change into technical recommendations

Smallholder farmers' resilience to climate variability and warming and their ability to control crop pests are closely related. Plantwise should explicitly include resilience to climate change as an output or outcome of its activities in the three countries, in line with CABI's process currently underway to address climate change issues at programme level.

CABI should consider a strategy and skill-set to meet this evolving context. Besides CABI's standard crop research skills, a demand for knowledge of sustainable agricultural growth, including the analysis of value-chains and the governance of resources, is emerging.

5.3 Monitoring and Evaluation Aspects

5.3.1 Establish baselines where possible

Section 2.2 concludes that Plantwise's technical advice would be more pertinent and effective if it responded to the specific situation of appropriate groups of plant clinic clients. Section 2 (Conclusion 12) concludes that decision-makers in both governmental and non-

governmental organisations and the private sector would be more likely to support the expansion of the Plantwise methodology if its efficacy in responding to pressing issues could be demonstrated. Plantwise has not established baselines for its operations in any of the three countries and the lack of a baseline makes it difficult to attribute improvements in crop production to Plantwise's methodology. Recognising the limits of what is feasible within programme resources, we recommend that Plantwise establish some baseline data on parameters relevant to its activities (e.g. number of smallholder farmers; crops grown; crop productivity; crop losses due to pests; different categories of smallholder farmers, etc.) to demonstrate its impact. In view of resource restrictions, this could be undertaken progressively within the three countries using a pilot in Bolivia in the first instance. Some specific suggestions are provided in Annex I.

5.3.2 Incorporate feedback from farmers into the M&E system

Section 4 concludes that feedback from farmers would greatly strengthen the Plantwise system in the three countries. We recommend, therefore, that Plantwise systematically incorporate client feedback on the efficacy of the advice they have received from plant doctors into its M&E system. Crop budgets are one approach that could be adopted.

5.3.3 Incorporate vulnerability and resilience to climate change into M&E

As discussed above, vulnerability and resilience to climate change are closely tied to smallholder farmers' ability to control plant pests. We recommend, therefore, that Plantwise's M&E system incorporate variables related to the vulnerability and resilience of tis client farmers to the negative effects of climate change.

5.4 Financial and Economic Aspects

5.4.1 Take appropriate steps to explore options that could help to resolve problems of lack of finance to sustain and expand the Plantwise approach in the three countries

Plantwise may be able to support efforts at the national level to identify financial solutions for expanding plant health systems through:

- Supporting enhanced monitoring reporting of the benefits and concrete results of the approach in tackling plant health and other challenges in building the case to encourage government or other relevant organisations to allocate support and resources.
- Helping to identify and follow up on opportunities to co-deliver services and share costs.
- Implement actions arising from the Plantwise Strategy for engaging with the private sector.
- Also by investigating the feasibility of sharing costs with smallholders for technical advice including plant health services (see separate recommendation below).

5.4.2 Enable plant clinics to become self-financing

Related to Recommendation 9 above, Section 4.4 concludes that charging (some or all) plant clinics' clients for advice could contribute to financing the expansion of the Plantwise model. We recommend that Plantwise review existing analyses, and finance further studies if needed, to determine how much the target farmers in the three countries are willing to pay, and how much they should be willing to pay for plant clinic technical assistance, building on the analysis that may take place in Bolivia. This would need to recognise the aim of reaching the poorest farmers and may require a graduated system of charging. Data on

costs of establishing and operating a plant clinic under different circumstances, in the three countries, would provide a basis for analysing how plant clinic charges might be incorporated into the Plantwise methodology.

5.4.3 Compare the cost/benefit ratio of the Plantwise and traditional agricultural extension models

Section 4 concludes that the Plantwise model for agricultural extension probably produces greater social, economic and environmental benefits per unit of cost than do traditional models of agricultural extension that have been used in Peru, Bolivia and Nicaragua. It concludes, however, that a reliable study of the two procedures' cost/benefit ratio would provide Plantwise with a credible tool for convincing decision-makers in the three countries to enhance the implementation of the Plantwise modality. We recommend, therefore, that Plantwise undertake such a study if the appropriate resources are available.

ANNEX A TERMS OF REFERENCE

External evaluation of the on-going donor-funded programme “Plantwise: integrated plant health systems in South America”

Region South America, with three target countries: Peru, Bolivia, Nicaragua
Coordinating agency CAB

International Donors UK Department for International Development (DFID), Swiss Agency for Development Cooperation (SDC), European Commission DG Development Cooperation (AIDCO/DEVCO), Netherlands Department of International Cooperation (DGIS), Irish Aid, International Fund for Agricultural Development (IFAD), Australian Centre for International Agricultural Research (ACIAR), Chinese Ministry of Agriculture (MoA)

Evaluation management Evidence on Demand

BACKGROUND

Currently, up to 40% of the food grown worldwide is lost to plant pests (including diseases and weeds) before it can be consumed (Oerke, 2006). This is often due to low awareness as well as poor management of plant health problems for which solutions are already known. Globalization, international trade, quick means of travel and climate change are exacerbating the problem by altering and accelerating the spread of plant pests. At the same time, an estimated 0.9 billion people are going hungry every day. Over half of these are smallholder farmers in poor countries as crop health problems persist in negatively impacting food security, income generation and world trade.

CABI’s mission is to improve people’s lives worldwide by providing information and applying scientific expertise to solve problems in agriculture and the environment. CABI has 48 member countries, of which 36 are developing countries. At the CABI Review Conference in 2009, all CABI Member Countries gave CABI a mandate to begin investing in development of the Plantwise programme building upon the existing expertise within CABI and its Global Plant Clinic project and electronic databases, in particular the Crop Protection Compendium. This decision to develop Plantwise as CABI’s flagship global programme was endorsed at the 2011 Review Conference, recognising that the organisation’s focus on pests of plants, together with its expertise in managing agricultural knowledge and in training farmers, meant that CABI was well-placed to address these needs, with the capability to make a major impact on food security on a sustainable basis. Plantwise offers an innovative approach to extension that aims to help smallholder farmers to lose less of their crops to plant health problems and improve their productivity, enabling them to feed more people from the same resources. Rather than focusing on a specific plant health problem or problems, Plantwise strengthens links between plant health stakeholders and improves access to information at all levels, building the capacity of existing systems to effectively detect and manage problems as they arise. In doing so, Plantwise is well-aligned with its donors’ objectives of improving food security in favour of the poorest and most vulnerable, and contributing to the achievement of Sustainable Development Goal (SDG) 1 and 2 (no poverty, zero hunger). By providing knowledge and tools required to enhance agricultural productivity through sustainable practices, Plantwise will also contribute in achieving SDG 12 (responsible consumption and production). By building partnerships and sharing knowledge, Plantwise contributes to SDG 17 (partnerships for the goals).

External evaluation of the on-going donor-funded programme “Plantwise: integrated plant health systems in South America”

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Evaluation management
The overall objective of Plantwise is to increase food security, alleviate poverty and improve livelihoods by enabling farmers around the world to lose less, grow more and improve the quality of what they grow.

The overall purpose is to deliver an effective system for providing plant health advice and support to smallholder farmers in target countries backed up by a global knowledge bank, through:

- fostering diverse partnerships that underpin and sustain global efforts to remove constraints to agricultural productivity through increased access to information and effective delivery of national advisory services
- implementing national networks of plant clinics and strengthen national plant health systems to improve agricultural services for farmers
- developing a global knowledge bank, bringing together existing and new information on plant health to support and inform stakeholders in national plant health systems, international bodies and the commercial sector, with long term potential for effective global vigilance.

The region to be evaluated forms an integral part of the global Plantwise programme.

By 2016 the Plantwise programme has been piloted in 34 countries around the world, of which 11 countries in Central, South America and the Caribbean (Barbados, Bolivia, Brazil, Costa Rica, Grenada, Honduras, Jamaica, Nicaragua, Peru, Suriname, Trinidad & Tobago). The evaluation team of two consultants will collectively visit 3 of the Latin American countries (Bolivia, Nicaragua, Peru) to evaluate the programme in the Americas. The consultants will both start in the UK with an introduction to the CABI Plantwise programme including Knowledge Bank and proceed with a joint assessment of Plantwise in Peru, after which each consultant will visit one further country (Bolivia and Nicaragua).

In-country collaboration of key stakeholders contributing to extension, research, regulation and input supply will be among the partners to be met by the evaluators. Two key partnership areas in Plantwise implementation in each country are with the ‘local implementing organisations – LIOs -’ (the partners who actually run the clinics on the ground) and with the ‘national responsible organisation – NROs-’ (the country-specific body responsible for national coordination of plant clinic services and having the authority to decide on pest reporting issues).

In most countries the Ministry of Agriculture is NRO, since it generally has overall responsibility for agricultural research, public extension and regulation with the Directorates of Extension as the LIOs. Research organisations, universities and colleges need to be involved in the plant health system so as to provide technical back-stopping and diagnostic

support for the clinics. Agro-input suppliers and the other organisations that are involved in the input supply chain can also become partners through the provision of advice and resources.

The Plantwise knowledge bank partners with other repositories for the provision of complementary datasets, services or technologies according to the priority to deliver to specific end-user requirements. Partners who have already been identified to support the plant clinic network and in-country needs for information on diagnosis and advice may include national, regional and international organisations as well as nongovernmental organizations (NGOs).

EVALUATION OBJECTIVES

The external evaluation, which has been agreed with Plantwise donors, will provide sufficient information to: a. Make an overall independent assessment about the performance of the global programme, paying particular attention to the impact against objectives, its relevance for stakeholders, effectiveness, efficiency and risks/potentials for the mid-term future. The evaluation should consider the programme as a whole, including all aspects of coordination and implementation, with a focus on in-country activities in South America; b. Identify key lessons learned to date and assess programme responsiveness to challenges in implementation; c. Propose practical recommendations for the improvement of country-specific interventions to strengthen the outputs, outcomes and impact of the programme in the region.

ISSUES TO BE STUDIED

The consultants shall verify, analyse and assess according to the five evaluation criteria endorsed by the OECD-DAC (relevance, effectiveness, efficiency, sustainability and impact) plus to additional evaluation criteria (added value and coherence). A focus on the expected impact of the action in the selected countries, coherence of the action at continental level and visibility strategy implementation is also required.

Specific questions to be addressed by the consultants will be agreed with CABI before the start of the field phase. Lessons learned and experiences from different countries should be identified in order to evaluate the implementation of the programme through a comparative approach.

The Plantwise programme is being financially evaluated on an annual basis by external auditors and also upon request by donors. Therefore, this external evaluation will not assess any programme finances or use of funds.

METHODOLOGY

The evaluation is managed and quality assured by Evidence on Demand. Once the external evaluation team has been contractually engaged, the evaluation process will be carried out through three phases: Inception Phase, Field Phase and Synthesis Phase, as described below:

1. Inception phase
   In the inception phase, relevant programming documents (Annex 1) should be reviewed, as well as documents shaping the wider strategy/policy framework. On the basis of the information collected the evaluation team should:

   - Describe the development co-operation context
   - Analyse and comment on the logical framework
   - Interview the programme management (coordination)

- Interview the management team of Plantwise Knowledge Bank management as well as that of Monitoring and Evaluation (M&E)
- Develop an indicative methodology for the overall assessment of the programme (note: written questionnaires should not be used)
- Develop the evaluation questions identifying provisional indicators and their means of verification, and describe the analysis strategy. Being a technical evaluation, it is important that the team should not request financial information from implementation partners, but rather assess efficiency and value in technical/operational terms
- Present each evaluation question stating the information already gathered and their limitations and where necessary provide a first partial answer to the question, identify the issues still to be covered, the assumptions still to be tested and describe a full method to answer the question.
- Develop the work plan including time schedule
- Submit to CABI the proposed detailed work plan with an indicative list of people to be interviewed and tentative visit itinerary. This plan has to be flexible enough to accommodate for any last-minute difficulties in the field

An Inception report shall be prepared and submitted to Evidence on Demand and CABI for feedback and corrections as relevant before the start of the field phase.

2. Field phase
The evaluation team should:

- Ensure adequate contact and consultation with, and involvement of, the different stakeholders; working closely with the relevant government authorities and agencies during their entire assignment.
- Use the most reliable and appropriate sources of information and harmonise data from different sources to allow ready interpretation
- Immediately discuss with Evidence on Demand if any significant deviation from the agreed work plan or schedule is perceived as creating a risk for the quality of the evaluation
- Summarise its field works at the end of each country visit, discuss the reliability and coverage of data collection, and present its preliminary findings in a meeting with Plantwise staff on the last day of each country visit. In-country Plantwise donor representatives will be invited to each of these country debriefing sessions. Feedback to these debriefs should be considered when preparing country debrief reports

The outputs of the field phase are country debrief reports (Aide Memoires), which will be submitted to Evidence on Demand and CABI.

3. Synthesis phase
This phase is mainly devoted to the preparation of the draft final and final report. The consultants will make sure that their assessments are objective and balanced, affirmations accurate and verifiable, and recommendations realistic. They will acknowledge clearly where changes in the desired direction are known to be already taking place, in order to avoid misleading readers and causing unnecessary misrepresentation of facts.

The evaluation team should not repeat the work already covered by available documents (Annex 1) but use them and go beyond them. The draft final report will be submitted to Evidence on Demand, who will quality control the draft final report. Once deemed to be of sufficient quality, Evidence on Demand will share the draft

final report with CABI for comments. To discuss the draft final report, a meeting will be organised for the Evaluation Team Leader with the Plantwise Programme Board (one or two days during its meeting 31 Aug – 2 September, 2016) in the proximity of London, UK or a suitable venue in Europe.

On the basis of comments expressed by the Plantwise Programme Board, and shared with Evidence on Demand, the evaluation team shall amend and revise the draft report to become the final report. Comments requesting methodological quality improvements should be taken into account, except where there is a demonstrated impossibility, in which case full justification should be provided by the evaluation team. Comments on the substance of the report may be either accepted or rejected. In the latter instance, the evaluation team is to explain the reasons in writing.

The main conclusions of the final report should be presented by the Evaluation Team Leader using a 30minute PowerPoint presentation to the Annual Plantwise Donor Forum meeting (6-7 October 2016) in Brussels, Belgium. This PowerPoint must provide a fair and overall reflection on the evaluation process and findings and be submitted to CABI at least 1 week before the event.

REPORTING REQUIREMENTS

The reports must match quality standards. The text of the report should be illustrated, as appropriate, with relevant maps, graphs and tables. The consultants will submit the following reports in English:

a. Inception report of maximum 12 pages to be submitted at the end of the inception phase. In the report the consultants shall describe the first finding of the study, the foreseen degree of difficulties in collecting data, other encountered and/or foreseen difficulties in addition to the programme of work and staff mobilization. The inception report will be submitted to Evidence on Demand and CABI for comments to be provided within 5 working days after the submission of the draft report. Comments shall be integrated in the report and the final inception report shall be provided by the consultants within 2 working days.

b. Mission Aide-Memoires of maximum 5 pages for each mission (i.e. each visited country). The aide memoire should specify, in a standardised manner, the attendance, main issues discussed, relevant meetings held, and findings/results. The aide memoire should be submitted to Evidence on Demand and CABI after maximum 3 working days from the end of each country visit.

c. Draft final report (of maximum 30 pages main text) using the structure set out in Annex 2. Besides answering the evaluation questions, the draft final report should also synthesise all findings and conclusions into an overall assessment of the Plantwise programme. The first draft of the report should be presented to Evidence on Demand and CABI within 1 week after the end of the field phase. Written comments will be provided by Evidence on Demand and CABI within 5 working days. Based on the draft report, a powerpoint needs to be prepared and presented to CABI at the Plantwise Programme Board Meeting in the week of 29 August.

d. Final report Incorporating any additional comment received from Evidence on Demand and CABI on the draft report after the Plantwise Programme Board meeting, to be presented within 1 week after the receipt of these comments. The final report should be submitted to Evidence on Demand for final quality control and to CABI. Based on the final report, a powerpoint presentation needs to be prepared and presented to the Plantwise donor forum meeting in the second week of October. All reports that are submitted to the Evidence on Demand, will be formally approved by Evidence on Demand after quality control to ensure objectivity and transparency of the evaluation process. All reports shall be distributed in electronic version only.

THE EVALUATION TEAM

The evaluation team will be composed of 1 senior consultant / team leader (24 working days) and 1 consultant (21 working days).

The team leader will coordinate the work of the evaluation team during the whole contracting period and will supervise the drafting of all the documents that have to be submitted to Evidence on Demand and CABI by the indicated deadlines as in below.

The consultant will cooperate with and under the team leader supervision in the evaluation process and in drafting the required documents. He/she will not take part in the meetings organized for the purpose of discussing the draft final report or presenting the evaluation conclusions.

Field missions will be done by both consultants. Initially, both consultants will conduct a joint visit to the first targeted country (Peru) to establish a standardised approach for in-country work. Subsequently, the two consultants divide the remaining 2 countries between them to lead evaluation studies separately.

The team should have the following profiles and qualifications:

Senior consultant (Team leader)

- A solid and diversified experience in the specific field of expertise needed (minimum 10 year experience in extension services, integrated pest management, agricultural research for development, SPS). He/she will have at least 10 years' experience in development cooperation
- In-depth knowledge of programme evaluation methods and techniques (minimum 10 year experience)
- Professional experience of agricultural research and extension systems in developing countries
- Proven excellent report writing
- Fully conversant with the principles and working methods of project cycle management and donor aid delivery methods
- Experience in working on South American cooperation regional/country projects (at least 10 years)
- Full working knowledge of English (knowledge of Spanish will be an asset but not required)
- Understanding of donor development policies and practices

Consultant

- Some experience in the specific field of expertise needed (extension services, integrated pest management, agricultural research for development, M&E). He/she will have at least 5 years' experience in development cooperation
- Knowledge of programme evaluation methods and techniques
- Proven excellent report writing
- Fully conversant with the principles and working methods of project cycle management and donor aid delivery methods
- Experience in working on Asian cooperation regional/country projects
- Full working knowledge of English (knowledge of Spanish will be an asset but not required)
- Understanding of donor development policies and practices

WORK PLAN AND TIMETABLE

The assignment should start early June 2016 and be carried out over a period of 3 months. It should be noted that this period corresponds to the total duration of the assignment, which

includes several periods for the provision of comments by Evidence on Demand / CABI to draft reports.

The place of implementation for the inception phase will be the place of residence of the evaluators. The field phase will entail missions in Peru, Bolivia and Nicaragua. The synthesis phase will include for the Team leader two meetings, one meeting to be held with the Plantwise Programme Board in Europe (Switzerland or United Kingdom) (late August / early September, date tbc), plus one meeting to present at the Plantwise Donor Forum in Belgium (Brussels, 6 or 7 October 2016).

The dates mentioned in the table below may be changed with the agreement of all parties concerned. Travel days to and from locations in below table are not considered working days.

ANNEX B EVALUATION CONSULTANTS

Eduardo Quiroga, Independent Consultant

Dr Eduardo Quiroga brings over 30 years of experience in evaluating agricultural and natural resource programmes. He has field experience in more than 67 countries, covering both managerial and advisory capacity, financed by a multitude of bilateral and multilateral organisations.

Selected Professional Experience

Team Leader and Irrigation Economics Expert, UNDP, 2010

- Irrigation, Climate Resilience and Private Sector Awareness Building project. Cambodia.

Team Leader and Natural Resources Management Expert, UNDP, 2009

- Mid-term review. Community Development Project for the Rehabilitation of Salt Affected and Waterlogged Lands – Bio Saline II.

Team Leader and Environmental Policy Expert, UNDP, 2006

- Programme Formulation Mission. Sustainable Environmental Governance (Bangladesh).

Team Leader and Rural Development Expert, UNDP, 2005

- Mid Term Review of Poverty Outcome Evaluation and Rural Enterprise Development in the Kingdom of Bhutan.

Team Leader and Natural Resources Management Expert, UNDP, 2005

- Final Independent Evaluation. GEF/UNDP Project for the Biodiversity conservation of the Titicaca Lake Basin.

Principal Researcher and Coordinator, IDRC, 2004

- Lessons from the Formalisation of Artisanal and Small-Scale Mining. Joint MPRI-CASM Project.

Selected Education

Ph.D, Economics, Université de Paris VIII à Saint-Denis, 1996

Graduate studies and research on natural resource management and environmental studies,

Westwater Research Institute, The University of British Columbia, 1973

MA Department of Sociology and Anthropology, The University of British Columbia, 1970

BA Liberal Arts (Social Sciences), St Mary's University of Minnesota, USA, 1967

Languages

English (Fluent); Spanish (Fluent); French (Fluent); Portuguese (working knowledge); Italian (working knowledge); Quechua (working knowledge)

Bruce Kernan, Independent Consultant

Bruce Kernan has 32 years of professional experience in the design, management, assessment, monitoring, and evaluation of environmental, climate change, biodiversity, and forestry aspects of international development projects. He has served as a team leader or participant for over 50 short-term consulting assignments in 26 countries. He has extensive experience in designing and implementing short-term training courses and public consultations.

Selected Professional Experience

Team Leader, ECODIT, January – March 2016

- Led a six person team in preparing USAID Central America and Dominican Republic analyses on vulnerability and adaptation to climate change and conservation of biodiversity and tropical forests.

Senior Program Monitoring and Evaluation Advisor, Crown Agents, June 2014 – Present

- Provides technical advice in project monitoring and evaluation, including gender issues, to USAID/Climate Economic Analysis for Development, Investment and Resilience (CEADIR) program for 85 days of LOE.

Team Leader, USAID Central American and Mexico, IBTCI, June 2014 – Sept 2014

- Led a four-person team in preparing a final performance evaluation of the effectiveness in conserving marine biodiversity of the USAID Management of Aquatic Resources and Economic Alternatives Project (MAREA).

Team Leader, PCI Global, Malawi, June 2014

- Prepared a draft environmental safeguards and compliance section for a Title II project Proposal for Malawi.

Team Leader, National Rural Electrification Cooperative (NREC), Ghana, Apr 2014

- Prepared and environmental evaluation of electricity distribution project in Northern Ghana.

Team Leader, USAID, Sun Mountain, Eastern Caribbean and Guyana, May 2013 – Sept 2013

- Led an eight-person team in formulating recommendations to USAID for supporting conservation of biodiversity and adaptation to climate change in the Eastern Caribbean countries, Guyana, and Surinam.

Selected Education

Master of Professional Studies (Natural Resources), Cornell University, 1998-1999

Master of Forest Science (Silviculture), Yale University, 1989-1991

BA Geology, Hamilton College, USA, 1973-1977

Certificate of Forestry Technology, New York State College of Forestry, USA, 1972

Languages

English (Native); Spanish (Fluent); French (Basic)

ANNEX C EVALUATION METHODOLOGY

Conceptual framework of an outcome assessment
The focus of the present evaluation is on outcomes, because this level of results can reveal more than other levels about how effective the Programme's actions have been in achieving expected development changes. A focus on outcomes also promises a shorter timeframe and more credible linkages between an executing agency's (LIOs and NROs) actions and the farmers. These linkages are pivotal in ascertaining the effect of Plantwise actions on the level of food security and poverty alleviation by reduction of crop losses.

Outcome evaluations work backwards from the outcome. They take the outcome as their starting point and then assess a number of outputs contributing to the outcome. However, experience indicates that it is essential to reach an agreement on the evaluation themes, the collection of evidence, the criteria of success, and field procedures used during the evaluation exercise. To this end, the participatory approach facilitates the process among the key stakeholders because everyone has a chance to share their views.

The evaluation themes include the following:

(a) whether an outcome has been achieved or progress has been made towards it;
(b) how, why, and under what circumstances the outcome has changed;
(c) executing agencies' contribution to the progress towards or achievement of the outcome; and
(d) executing agencies' partnership strategy in pursuing the outcome.

From an operational standpoint, a specific outcome is the point of departure of an outcome assessment. This is followed by a sequence of four evaluation components.

First evaluation component:	ascertaining the status of the outcome
Second evaluation component:	examining the factors affecting the outcome
Third evaluation component:	assessing the contribution of the executing agencies [LIOs and NROs] to the outcome
Fourth evaluation component:	assessing partnerships for changing the outcome

Criteria and Evaluation Questions Matrix
The TOR stipulates that the present evaluation should verify, analyse and assess according to the five evaluation criteria endorsed by the OECD-DAC (relevance, effectiveness, efficiency, sustainability and impact) plus two additional evaluation criteria (added value and coherence). A focus on the expected impact of the action in the selected countries, coherence of the action at the continental level, and visibility strategy implementation is also required.

Last but not least, two instruments that will be used to test evidence. The first is the Significant Change [SC] technique, which involves the collection of significant change (SC) stories emanating from the community level. The key principle is to "search" for project results or tangible changes reflected in stories. Once these stories reflecting change have

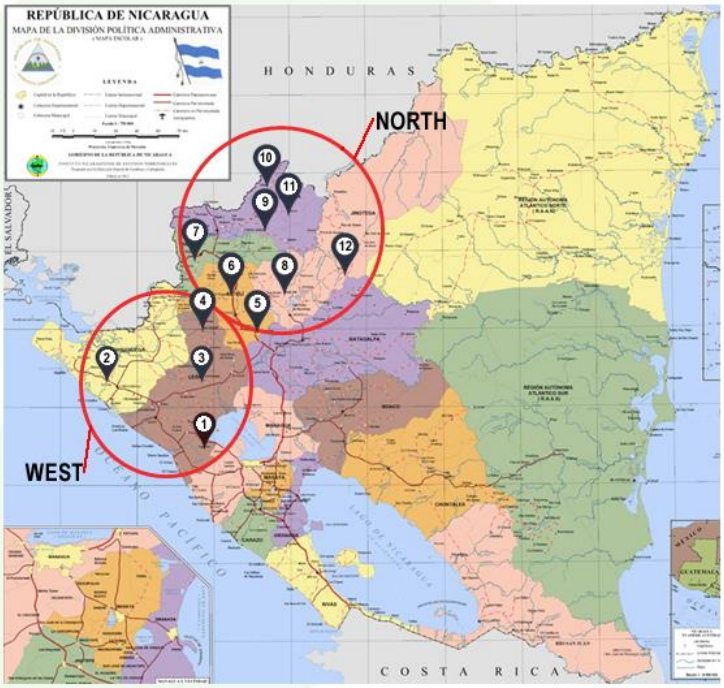
been captured, key stakeholders and evaluators can use them as the basis for an in-depth discussions about the relevance of these reported changes.

The second technique is the crop budget, which is widely used in agro-economic analyses. Through partial budgeting, it is possible to determine the benefit of adopting new techniques that increase productivity or decrease costs of production.

ANNEX D MAPS OF PROGRAMME AREAS

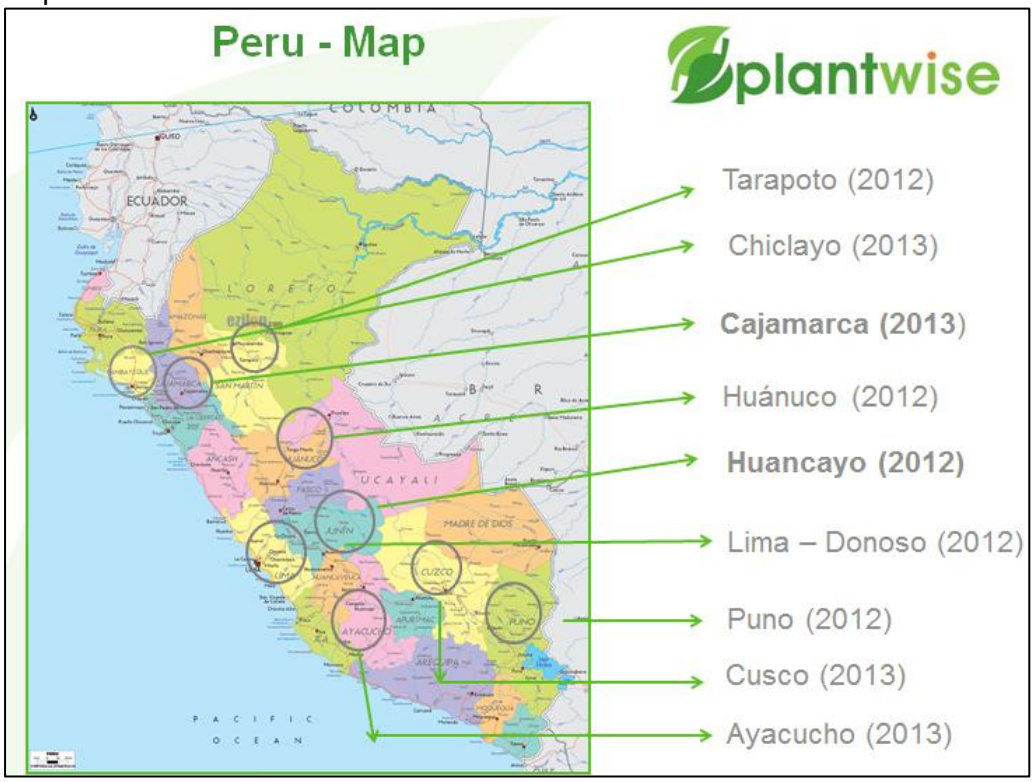
Map of Location of Plant Clinics in Bolivia

Map of Location of Plant Clinics in Nicaragua



1. Nagarote
2. El Viejo
3. León
4. Achuapa
5. Foro Miraflor
6. UCATSE
7. INPRHU
8. La Concordia
9. El Jícaro
10. Jalapa
11. Murra
12. Jinotega

Map of Location of Plant Clinics in Peru



ANNEX E PERSONS CONSULTED

Bolivia: List of People Met

Name	Designation	Relationship to Plantwise
June 13th - 17th 2016		
Yelitza Colmenarez	CABI Brazil Centre Director	Plantwise Regional Coordinator – Latin America and Caribbean
Javier Franco	Senior Advisor	CABI Associate
Rafael Bonatto	CABI Country Coordinator	CABI Country Coordinator Bolivia & Peru
Jose Gomez	ICM Coordinator	Data Management/M&E
Luis Benjamin Bowles Casal	Director Sedacruz	Director Sedacruz - NRO
Luis Alberto Alpire Sanchez	General secretary of agricultural production development	General secretary of agricultural production development – NRO
Juan Ascarrunz	Director DSIA	Director DSIA- NRO
Denise Delgadillo	DSIA	PW Data Manager – Santa Cruz
Juan José Lagrava	DSIA	PW National Coordinator
Ricardo Rodriguez	SEDACRUZ- Extension & Technology Transfer	PW National Coordinator - Assistance
Gabriela Rivadeneira	CIAT specialist	PW National Coordinator – Assistance – Diagnostic Laboratory
Olivia Antezana	CIAT	Plant Doctor – Diagnostic Laboratory
Telemaco Orquera	DSIA	Plant Doctor
José Perez Justiniano	DSIA	Plant Doctor
Emanuel Durán	DSIA- President of Fruit producers Santa Cruz	Plant Doctor
Maria Delia Justiniano	GIS- Proagro	GIS- Proagro
Carlos Fernandez	Head of GIS Proagro in Santa Cruz	Head of GIS Proagro in Santa Cruz
Noeh Morón Carrasco	Head of Asrofrut	Collaborators- LIO
Oscar Diaz	Fundación Valle- Proinpa	Plant doctor- PW data manager - Cochabamba
Claudia Saenz	Fundación Valle	Pw Coord. Fundación Valle- Cochabamba

Nicaragua: List of People met

Name	Designation	Relationship to Plantwise
I. Meeting with CABI Staff and Introduction, UNAN-León		
Eduardo Neves	CABI Regional Coordination representative for the mission	
Eduardo Hidalgo	CABI CCC-Nicaragua/Costa rica/Honduras	
Luis Medina	National Technical Supervisor for Plant Clinics	UNAN-León PW Local coord
Bruce Kernan	External Consultant	
1.1. Meeting with National Coordinators and Review of Data Management Process.		
Eduardo Neves	CABI Regional Coordination representative for the mission	

Name	Designation	Relationship to Plantwise
Eduardo Hidalgo	CABI CCC-Nicaragua/Costa rica/Honduras	
Luis Medina	National Technical Supervisor for Plant Clinics	UNAN-León PW Local coord
Bruce Kernan	External Consultant	
Erlin Torres	director of Agroecology Department	UNAN-Leon
Patricia Castillo	National Coordinator Plantwise Nicaragua	UNAN-León PW Local coord
1.2. Visit to Plant Clinic at UNAN-Leon		
Evaluation Team		
II. Visit to IPSA-Leon/INTA-Leon		
Evaluation Team		
At IPSA:		
Yanet Flores	Responsable for Diagnostic Lab at IPSA	IPSA
Marcio Perez	Delegate IPSA-Leon	
At INTA:		
Oscar Sampson	INTA Technician	INTA
Andres Gonzales	INTA Technician	INTA
III. Meeting with the Steering Committee and National Partners at UNA-Managua (REDAF, Coop SOPROCOM, INPRHU, UNA, UNAN-Leon, IPSA)		
Evaluation Team		
Patricia	National Plantwise Coordinator, UNAN-Leon	UNAN-León PW Local coord
Ivania Zeledon	REDAF Coordination	UNA Managua
Luiz Alvares	INPRHU representative	INPRHU Somoto
Juan Menezes	UCATSE	UCATSE
Josue Urutia	UNA-Managua	FAREM Esteli
Berklim Martinez	INPRHU - Somoto	INPRHU Somoto
Gregorio Varela	UNA and REDAF National Coordination	UNA Managua
Wilber Salazar	UNAN-Leon	UNAN-Leon
Amparo Maria Arauz Galeano	director for research and extension, UCATSE	UCATSE
IV. Meeting with Plant Doctors and Local Coordinators at UCATSE		
Evaluation Team		
Sandra Lopes	Rector UCATSE for Academic Purposes	UCATSE
Juan Octavio	Extension Coordinator, UCATSE	UCATSE
Amparo Maria Arauz Galeano	director for research and extension, UCATSE	UCATSE
V. Field visit to Plant Clinic Coop. Santiago[1] and to Comunidad la Libertad[2]		
Evaluation Team		
Pedro Antonio	Secretary of the Coop	Secretary- Coop Santiago
Ramon Mendes	Coop Manager	Manager- Coop Santiago
Roger Armando	Coop Technician	Technician- Coop Santiago
Mauricio Blandon	Student/Intern	Student/Intern- Coop Santiago
Freddy Arras	Municipality Secretary of Agriculture	Coop Santiago
Elmer Sarantes[1]	Plant Doctor	PD- Coop Santiago
Alexis Peralta[2]		
VI. Field visit to Plant Clinic Coop. Multisectorial 'Juan Francisco Paz Silva'[1] and to NGO Norwelk[2]		
Evaluation Team		
Eddar Castillo	Coop Coordinator	Coop JFPS
Vernon Berrios	Plant Doctor	Norwalk-Nagarote
VII. Meeting with Swiss Development Cooperation		
Evaluation Team		
Patricia Castillo	National Coordinator Plantwise	UNAN-León PW national coord

Name	Designation	Relationship to Plantwise
	Nicaragua	
Maylaure Crettaz Corredor	Rural and Economic Development, SDC	SDC

Peru: List of People

Name	Designation	Relationship to Plantwise
June 6th - 10th 2016		
Yelitza Colmenarez	CABI Brazil Centre Director	Plantwise Regional Coordinator – Latin America and Caribbean
Javier Franco	Senior Advisor	CABI Associate
Eduardo Neves	CABI Country Coordinator	CABI Country Coordinator Brazil & Colombia
Rafael Bonatto	CABI Country Coordinator	CABI Country Coordinator Bolivia & Peru
Jose Gomez	ICM Coordinator	Data Management/M&E
Luis Navarrete Guzmán	Head of the Extension and technology trasnfer - Institututo National de Innovacion Agricola (INIA) – Min Agricultura & Riego	NRO National Coordinator
Claudia Marcela Alarcón De La Torre Ugarte	Specialist – Technical Cooperation office INIA	Specialist – Technical Cooperation office INIA
Luis (Lucho) Torres	INIA Specialists – Seed – Technology transfer- Institututo National de Innovacion Agricola (INIA) – Min Agricultura & Riego	NRO National Coordinator Assistant
Benjamin Rey Tordoya	General Manager of SERFI – Agro company	Collaborator – Private sector engagement
Armando Valencia Legua	Technician at INIA	Plant Doctor - Huaral
Fortunato Fausto Santiago Munayco	Director Agencia Agraria Huacho	Director Agencia Agraria Huacho - LIO
Anibal Degollar	Técnico de la Oficina Agraria Sayan Huacho	Técnico de la Oficina Agraria Sayan Huacho
Juan Alberto Palomino	Consultant -	Collaborator – Technical documents
Maria Elvira Luna de Cacho	INIA Cajamarca	INIA Cajamarca- Representing the director of INIA Cajamarca
Carlos Mondragon	UNC (University) - Cajamarca	Collaborator – technical documents - Training
César Augusto Gálvez Oliva	Agencia Agraria Cajamarca	Agencia Agraria Cajamarca - LIO
Marieta Cervantes Peralta	INIA Cajamarca	Coordinator PW Cajamarca -Plant Doctor
Fernando Escobal Valencia	INIA Cajamarca	Coordinator PW Cajamarca -Plant Doctor
Marcial Ruiz Pérez	MPC – Local Municipality - Cajamarca	MPC – Local Municipality – Cajamarca - LIO
Paulino Ramos Castejón	Represent of Local Municipalities – Local government in Chamis - Cajamarca	Represent of Local Municipalities – Local government in Chamis - Cajamarca
Faustino Garcia	Represent of Local government in Chamis - Cajamarca	Represent of Local government in Chamis - Cajamarca
Wilfredo Cavero Altamirano	Director EE Santa Ana - Huancayo	Director EE Santa Ana - Huancayo
Flavia Félix Huanca	INIA Huancayo	Coordinator PW Huancayo -Plant

Name	Designation	Relationship to Plantwise
		Doctor
Miguel Ángel Mayco Toykin	INIA Huancayo	Coordinator PW Huancayo -Plant Doctor
Federico Serapio Ollero Delgado	Director de la Dirección Regional de Agricultura	Director de la Dirección Regional de Agricultura - LIO
Jorge Dextre	Agencia Agraria – Concepción	Agencia Agraria – Concepción – Plant Doctor - LIO

ANNEX F MISSION ITINERARY

Peru: Mission Itinerary

Date	Time	Activity	Location
06.06.16, Monday	09.00 to 12:30	Contextualization and Planning Meeting among CABI staff and consultants	Hotel Habitat, Lima
	13:00	Lunch	
	14:00 to 16:00	Meeting with National coordinators – Data Management process	INIA - La Molina, Lima
	16:10 to 18:00	Meeting with National Plant Health Network	INIA - La Molina, Lima
	18:30 to 20:00	Evaluation Team: Synthesis of the Day	Hotel Habitat, Lima
07.06.16, Tuesday	06.00	Travel by air from Lima to Cajamarca	
	14:00 to 18:00	Meeting with Collaborators and Local Key actors in Cajamarca	E.E. Banos del Inca
	18:30 to 20:00	Evaluation Team: Synthesis of the Day	Hotel Cajamarca
08.06.16 Wednesday	08:00	Transportation to Plant Clinic	
	9:00 to 13:00	Field visit to Plant Clinic at the community 'Chamis' (Participant observation, crop budget survey, interview with farmers and Plant doctors).	Chamis, Cajamarca
	13:30	Lunch at the farm	Chamis, Cajamarca
	14:00	Travel back to Cajamarca Center	
	15:00 to 18:30	Evaluation Team: Synthesis of the Day and Return to Lima	Hotel Cajamarca / Airpoort
09.06.16 Thursday	05:55	Flight From Lima to Jauja and Transfer from Jauja to Huancayo	
	08:45	Transfer from Huancayo to Concepcion	
	09:30 to 13:00	Field visit to Plant Clinic at Concepcion (Participant observation, crop budget survey, interview with farmers and Plant Doctors).	Concepcion, Huancayo
		Meeting with LIO representatives	
	14:00	Lunch with local collaborators	
	16:30 to 18:00	Meeting with DRA (*Direccion Regional de Agricultura*)	DRA Regional HQ, Huancayo
	18:30-19:00	Evaluation Team: Synthesis of the Day	Hotel Huancayo
10.06.16 Friday	05:00	Travel from Huancayo to Jauja and Flight From Jauja to Lima. Arrival to Lima 09:30	
	11:00- 13:00	Preparation for debriefing	HoteL Habitat
	14:30 to 18:00	Debrief Session	INIA - La Molina, Lima
11.06.16 Saturday		CABI Staff split in two groups to continue the evaluation in Nicaragua and Bolivia simultaneously	

Bolivia: Mission Itinerary

BOLIVIA			
Day	Time	Activity	Logistic
11-12.06.2016		Arrival of the team	Hotel Caparuch
	14:00-16:00	Visit to La Guardia Plant Clinic	La Guardia
	19:00	Dinner with CABI Staff	Hotel Caparuch
13.06.2016	08:00 - 10:00	Meeting with CABI Staff	Hotel Caparuch
	10:30 - 11:00	Meeting with the Secretary of Agriculture and directors of the Governorate of Santa Cruz	Gobernación Santa Cruz
	11:00 - 12:00	Meeting with the National Coordinators – Presentation of results of the implementation of PW in the country.	
	12:00 - 13:30	Lunch	
	13:30 - 15:30	Review of the Data Management in the country.	Gobernación Santa Cruz
	15:00 - 17:00	Meeting with Plant Doctors – Presentation of experience and results of implementing PW in Bolivia	Gobernación Santa Cruz
14.06.2016	08:30 - 10:30 am	Meeting with the national plant health system members (ASOFRUT, DSIA, SEDACRUZ)	Gobernación Santa Cruz
	10:30 - 11:30 am	Meeting with GIS	Gobernación Santa Cruz
	11:30 - 13:30	Lunch	
	13:30 - 17:00	Visit to the diagnostic laboratory in Saavedra	Saavedra
15.06.2016	Todo el dia	Travel to Mairana and visit to Plant Clinic	Mairana y Los Negros - valles de Santa Cruz
		Visit to farmers in Mairana and Infiernillo	6:30 am - Salida del Hotel Caparuch - Regreso a Santa Cruz a las 20:00
16.06.2016	05.30	Fligh to Cochabamba	Salida del hotel Caparuch a las 05.30
	9:30 AM	Visit to Plant clinic in Capinota	Capinota
	12:00 PM	Lunch	Capinota
	13:00 - 14:00	Meeting with Oscar Diaz and Review of Data Management in Cochabamba	Fundación Valles
	14:00 - 16:00 20:30 Arrival to hotel 23:00	Meeting with Claudia Saenz - Coordinadora Fundación Valles Return to Santa Cruz	Fundación Valles
17.06.2016	08:30 - 10:00 am	Debrief CABI Staff	Hotel Caparuch
	12:30	Lunch with coordinators	
	15:00-17:00	Debrief parters and collaborators	Gobernación Santa Cruz
18.06.2016		Travel Back	

Nicaragua: Mission Itinerary

Time	Activity	Location
12/05/2016		
	Arrival of the team	
	Dinner with CABI Staff	travel to León
13/06/2016		
9:00-10:30	I. Meeting with CABI Staff and Introduction	UNAN-Leon
10:30-12:30	1.1. Meeting with National coordinators and review of Data Management process	UNAN-Leon
12:30 - 13:30	Lunch	
13:30 -14:30	1.2. Visit to Plant Clinic UNAN Leon	UNAN-Leon
15:00 - 18:00	II. Visit to Collaborator Yanet Flores / IPSA lab. Visit to INTA-Leon	Leon
14/06/2016		
06:45	Travel to Managua	
09:00-11:30	III. Meeting with the steering committee and other partners (REDAF - Coop SOPROCOM, INPRHU, UNA, UNAN-Leon, IPSA)	Managua
11:30-12:30	Travel to Estelí	
15:00-18:00	IV. Meeting with plant doctors and local coordinators at UCATSE	
15/06/2016		
06:00 - 8:30	Travel to El Jícaro	
09:00-12:00	V. Visit to plant clinic Coop. Santiago	
12:00-14:30	Travel back to Estelí	
14:30 - 18:00	V. Visit to local farmers	Visit nearby community "La Libertad"
16/06/2016		
07:30	VI. Field visit to Plant Clinic Coop. Multisectorial 'Juan Francisco Paz Silva'	
09:00-11:00	Visit to plant clinic JFPS	
11:00	Travel to Nagarote	
15:00	VI. Visit to plant clinic Norwalk –Nagarote	
17:00	Travel to Managua	
17/06/2016		
10:00	VII. Meeting with SDC representative	SDC – Managua
14:00	De-brief CABI staff and Collaborators	UNA – Managua

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ANNEX H ANALYISIS OF CROP BUDGETS

LESSONS LEARNED FROM CROP BUDGETS COLLECTED FROM SITES IN PERU (Cajamarca, Huancayo) BOLIVIA (Capinota, Infiernillo) AND NICARAGUA (La Libertad)

Aim of the Crop Budget Economic Framework (CBEF)

·

- It provides a semi-quantitative evaluation of the agro-economic benefits of an intervention designed to increase agricultural production or reduce agricultural losses.
- The goal of this analysis is to situate results in the context of current economic processes and hence to provide a perspective on project success that is firmly based on economic reality.
- Method
- Data input to the Crop Budget Tool include yield and economic data. These generate an estimate of the overall profit or loss on an individual farm basis.
- In the current study, the results of this analysis were then interpreted in the context of field observations and unstructured interviews with both farmers and intervention staff (CABI PW staff) at each field site.44
- Concepts behind the Crop Budget Economic Framework45
- The unitary economic returns on crops grown can be considered representative of the current trends in income conditions.
- Crop budgets for the previous season can provide a realistic estimate of revenue at the farm level.
- Technological uptake is intrinsically linked to, and must be considered with respect to, commercialization and the crop value chain.
- Increase in and security of revenue leads to an increase in a food security as well as reducing the poverty level of the family unit.
- Farm income indicates how much farm-families have to live on, either from participating in an initiative or from other sources of livelihood.

[44] The Crop Budget Tool provides an overview of input and labour requirements, crop production costs and crop profitability, whereas a farm budget is concerned with organizing resources on a farm to maximize profits or - more frequently, family satisfaction (FAO User manual crop budget. Rome 2014). Extracted from <www. fao.org> on 20-08-16

[45] The actual crop budget format used in the exercise is found as Appendix 2

- Family income includes food grown which is consumed directly by the household. A household's absolute income may be so low that virtually all food produced is used for direct consumption.
- Labour remuneration, particularly that from the family, is a key farm income. Its cost is estimated on a per hectare basis for each for each crop using the going wage rate in each particular area.
- Family- farm managers identify and assess risks associated with their crops, and then decide whether to take these risks. They may decide to adopt practices that mitigate perceived risks even though these may result in increased costs.
- The 'management fee' is a percentage amount that includes cost of the farmer's time and any risk mitigation strategies. It is estimated for each project and based on field experience rather than objective criteria. For the current calculations the management fee was set at 20 %.
- In terms of measuring the economic effects of plant health services in the context of each site, the simplifying technique of measuring farm incomes "with" and "without" the contribution of the plant health technology can be applied.
- The analysis assumes that the intervention itself is too small in relation to the whole economy to have a significant effect on prices. Consequently, constant domestic prices and exchange rates have been used in calculations.
- For comparative purpose, all costs are converted to a common currency, in the current study USD, using the exchange rate at the time when the data was collected.
- Importance of the holistic framework in successful implementation of new approaches
- The core issue for most for most agricultural interventions is the uptake of the new technologies. Research demonstrates that the likelihood of adaptation to the new technology, which will strongly influence economic results, must be understood in the context of individual settings. Aspects that need to be considered include:
- The role of agro-ecology in the specific setting;
- The option and appropriateness of grafting agricultural innovations onto traditional modes of agricultural production;
- Local dynamics, including social structure norms;
- The potential influence of the prevailing process of globalization on the specific sites.
- The latter three aspects are referred to as institutional factors.
- In addressing issues pertaining to reducing food loss and increasing the number of people fed, it is important to understand to what extent institutional factors impede or accelerate the technology transfer process and associated economic results in the smallholder context.
- Setting and Participants
- The presented CBEFs resulted from interviews with a non-random sample of farmers, both men and women, who participated in plant health rallies held on community market-

days.46 The attached images show the sites visited by the mission in each of the three countries.

- Most of the interviewed farmers worked farms of approximately one hectare in size. The exception was the Santa Cruz governorate in Bolivia where the farms average approximately 5 ha.
- Review of the initial findings.
- This section reiterates the main findings discussed in the main report. Appendix 1 contains the crop budgets collected in the field.
- Although the crop budget analyses do not provide evidence of whether PW's intervention resulted in smallholders losing fewer crops or feeding more people, they do give information on the economic results from the technology transfer process and insight into the decision-making process and external factors that influence success. Specifically, they provide:
- Insight into the farmers' response to the plant health advice received;
- Information on the apparent consequences of plant health advice on both crop yields and farm income.
- All evidence points to an initial spurt in uptake in plant health technologies. This had an early positive impact, with the farmers interviewed reporting a decrease in the quantity of crops lost to infestation.
- Farmers were clearly aware that technological options exist to address insect infestations. In fact, agro-chemical companies have been aggressively introducing various products in the regions studied. Regional statistics indicate that among the three countries in this study, pesticide use is highest in Bolivia (7.96 kg/ha) (FAO, 2014 Table 7).
- Nearly all farmers raised concerns about climate variability, with specific mention of lower precipitation and higher temperatures. They reported that as well as effects on crops being caused by increased variability in weather, they sense that they are witnessing new infestations. Limited time available precluded further probing as to possible new types of insects, more severe infestations, at different times, and the like. In the face of this uncertainty the smallholders were apprehensive about their future.
- For all study sites, the plant health services, based on PW implementation, were consistent with traditional agricultural modes of production and could be successfully implemented. The most important conclusion of the Economic Framework study, however, is that with reference to plant health services, the success of the technology transfer process was location-specific and that economic results were strongly influenced by social norms and the existence of supporting infrastructure such as physical access to high-value markets.
- Although the current depressed prices of primary commodities do not appear to affect the core process of technology transfer, including plant health technology, they could severely affect the enabling or catalytic forces such as national or state governments, who are facing retrenchment of public service personnel and reduced budget allocations.

[46] See types of random and non-random sampling. In: Michael del Balso & Alan D. Lewis A guide to social research. International Thomson Publishing, Ontario, 1997 pp 118-122

- It was apparent that not only does increasing plant health require access to timely and current information on best methods to counter crop infestations, this advice must be framed in the context of societal norms and be supported by an infrastructure of complementing facilities.
- Agricultural production is situation-specific so these complementing facilities vary from site to site, but can include access to high-value markets, marketing channels and arrangements favouring smallholders and awareness and use of cultural norms. Over time, the process can ensure a greater level of food security and reduced levels of poverty.
- Lesson Learned
- If CABI is to realize its mission of helping farmers to '…lose less food and feed more people' then it needs to widen its scope to take into consideration complementary factors to plant health.
- The catalytic role that PlantWise plays in using plant health services to increase resilient productivity among smallholding farmers is currently latent. Although clearly successful in sustaining crop health, PlantWise's role could be fully enabled by including complementary facilities such as access to high-value markets and other site-specific requirements. This will permit smallholders to take full economic advantage of the offered plant health technologies, resulting in the loss of fewer crops and an increase in production of food in the short-term—and reduction of poverty in the long-term.

APPENDIX 1

Table 1. Bolivia: PW Programme
Site: Mairana (Santa Cruz) Mission estimates June 2016

Item	Unit	Fructoso Lazarte - {*Peach (early)*}	Marcial Rosales -{*Tomato (Huichal)*}
Yield	Kg/ha	11700	20000
Farm-gate price	USD/kg	0.56	0.29
value of output	USD	6552	5800
Fertilizer	USD	743	943
pesticide	USD	714	2857
seed + other	USD	664	1714
labour + mgmt	USD	771	2642
Gross revenue	USD	4431	286
Net revenue	USD	3660	(2356)

Table 2 Bolivia: PW Programme
Site: El Infiernillo, (Santa Cruz) Mission estimates, 15 June 2016

Item	Unit	Primitivo Lopez Tomato (Baranja)	Matias Yale Tomato (Omereque)
Yield	Kg/ha	24000	18400
Farm-gate price	USD/kg	0.25	0.22
value of output	USD	6000	4048
Fertilizer	USD	343	1486
pesticide	USD	3142	160
seed + other	USD	2000	1090
labour + mgmt	USD	1080	946
Gross revenue	USD	515	1312
Net revenue	USD	(565)	366

Table 3. Bolivia: PW Programme
Site: Yata Mico, Capinota (Cochabamba) Mission estimates, June 2016

Item	Unit	Mariano Gutierrez {Garlic (Peruano)}	Mariano Gutierrez {Carrot (Criollo)}
Yield	Kg/ha	4140	23000
Farm-gate price	USD/kg	1.00	0.12
value of output	USD	4140	2760
Fertilizer	USD	137	519
pesticide	USD	94	5
seed + other	USD	450	714
labour + mgmt	USD	1305	1002
Gross revenue	USD	3459	1522
Net revenue	USD	2154	520

Table 4. Bolivia: Santa Cruz Governorate
Dirección de Transferencia y Extension Agricola Bolivia. June 2016

Item	Unit	Maize Hybrid	Tomato* (Orquera)

Yield	Kg/ha	4900	46000
Farm-gate price	USD/kg	0.2	0.18
value of output	USD	980	8280
Fertilizer	USD	n/a	492
pesticide	USD	51	2435
seed + other	USD	226	2520
labour + mgmt	USD	345	2758
Gross revenue	USD	703	2833
Net revenue	USD	358	75

Table 5. Peru: PW Programme
Site: Mataracocha, Cajamarca (Peru) Mission estimates June 2016

Item	Unit	Paulino Ramos {Potato (Palla)}	Juan Lopez {Potato (Libertena)}	Gertrudis Ramos {Potato (Amaritas)}
Yield	Kg/ha	7350	207	7150
Farm-gate price	USD/kg	0.72	0.7	0.8
value of output	USD	5292	144.9	5720
Fertilizer	USD	1666	n/a	1700
pesticide	USD	1958	n/a	1960
seed + other	USD	1280	166	1300
labour + mgmt	USD	850	384	2833
Gross revenue	USD	388.0	-21.1	760
Net revenue	USD	(462.0)	(405.1) [1]	(2073) [2]

[1] a value of $500 USD can be subtracted as he used *minka* (labour reciprocity) to reduce labour costs so net revenue is $33 USD
[2] a value of $525 USD can be subtracted as she used minka (labour reciprocity) to reduce labour costs, so net revenue is $452 USD

Table 6. Peru: PW Programme
Site: Mata Huasi – Huancayo [Peru] Mission estimates June 2016

Item	Unit	Enrico Yupanqui Maize (Baby Corn)	Marcelo Milton Alfalfa (Aragon)
Yield	Kg/ha	9240	36500
Farm-gate	USD/kg	0.2	0.19

price			
value of output	USD	1848	6935
Fertilizer	USD	404	1389
pesticide	USD	52	966
seed + other	USD	268	873
labour + mgmt	USD	256	160
Gross revenue	USD	1124	3707
Net revenue	USD	868	3547

Table 7. Nicaragua: PW Programme
Site: La Libertad, Esteli [Nicaragua] PW Team, June 2016

Item	Unit	Bean	Maize
Yield	Kg/ha	2363	3545
Farm-gate price	USD/kg	0.79	0.38
value of output	USD	1866.77	1347.1
Fertilizer	USD	9	161
pesticide	USD	212	120
seed + other	USD	73	32
labour + mgmt	USD	240	317
Gross revenue	USD	1572.77	1034.1
Net revenue	USD	1332.77	717.1

APPENDIX 2

CROP BUDGET FORMAT

Item	**Pilot Site:** **Group:** **Sex:** **Name of Farmer:**	
	Crop	**Variety**
A	Area (ha)	
B	Yield (kg/ha)	
	Consumed [kg]	
	Sold [kg]	
	Farm gate price (K/kg)	
C	**Gross Revenue = Total Value Sold ( )**	
D	**Sub-total Inputs**	
	Seeds (K/kg)	

	Irrigation (K/ha)		
	Fertilizer: (K/kg)		
	Pesticide/herbicide (K/kg)		
	Traction (K/ha)		
	Storage (K/kg)		
	Other		
	Labor (days) @ (/day)	Male	Female
	Land Preparation in days		
	Seeding/transplanting		
	Weeding		
	Spraying pesticides/herbicides		
	Irrigation		
	Watching		
	Harvesting		
E	**Sub total labor**		
F	**Management cost** (est. 20% of total labor)		
G	**Total Cost** [labor + management + inputs]		
I	**Net Revenue** [C-G]		

ANNEX I PRELIMINARY FRAMEWORK FOR PILOT BASELINE STUDY

A Introduction
This annex will first discuss issues reviewed during the the Weggis seminar concerning the need for baseline studies, and will then outline a pilot baseline study.

B Baseline Framework
Evaluations and baseline studies, in general, are focused on the beneficiary, as the key notion is to determine what the effects [economic, social, behavioral, etc] on the beneficiary are from the implementation of any given initiative. Therefore, it is not common to design a baseline study when it is not known who the beneficiaries are, where the area of influence is, what the unit of analysis is, and what kind of data will be required in terms of assessing the effects on the potential beneficiary, among other things. This is why OECD-DAC[47] criteria used in this evaluation defines a baseline study simply as "an analysis describing the situation prior to a development intervention, against which progress can be assessed or comparisons made".

Reconstructing Baselines?

As discussed in Section 2 of the main report, there is an initiative led by FAO and WB to build the capacity needed for an effective M&E, starting with the identification and collection of indicators.[48] This could be considered a reconstructed baseline.
Under this framework, the key idea is to determine which indicators to select given the different types of information that are most pertinent to different agricultural and rural activities, projects and programmes, and data availability.
This initiative's innovative feature is that it proposes a set of " 19 priority indicators" that should be the same in all countries, allowing for country comparisons, and facilitating the monitoring of agriculture and rural programmes and goals at the international level. This approach was validated through in-country workshops in Cambodia, Nicaragua, Nigeria, Senegal and the United Republic of Tanzania.
At the core, however, there needs to be a central M&E unit with the authority to coordinate the different initiatives in any given country. There are two key functions for this unit
[1] to promote and encourage the demand for M&E and enable the supply of timely and useful M&E information and
[2] to help establish stronger links with data suppliers within the National Statistical System (NSS).

The NSS comprises all the institutions and agencies that contribute in some way to the bank of national statistical data, which includes line ministries, Customs and Excise and the Central Bank, among others. The apex institution for the NSS is the National Statistics

[47] OECD Glossary of Key Terms in Evaluation and Results Based Management. OECD Publications, 2 rue André Pascal, 75715 PARIS CEDEX 16
[48] FAO/WB. Tracking results in agriculture and rural development in less-than-ideal conditions. A sourcebook of indicators for monitoring and evaluation. Global Donor Platform for Rural Development. FAO, The World Bank, 2008. Extracted from www.fao.org on 15/08/16

Office. Many countries are now developing National Statistical Development Strategies (NSDS) in such a way that they are integrated into national development policy processes. This ties in closely with the ideas underpinning the development of national M&E capacity. Although the task is daunting, there is no other option in sight if one wants to establish the progress or lack of progress ensuing a development initiative in a given area.

A checklist of basic concepts is outlined below to understand what the purpose of a baseline is, as well as the possible procedures used to collect the information. However, it is critical to understand that above all, a baseline is empirical work based from the ground up and is location-specific.

What is a Baseline Study[49]

In operational terms, a baseline study simply defines the 'pre-operation exposure' condition for the set of indicators that will be used to assess outcome achievement and impact expressed in the programme's logical framework. When compared with the condition of the same indicators at some point during implementation (mid-term evaluation) and post-operation implementation (final evaluation), the baseline study forms the basis for a 'before and after' [or with / without] assessment or a 'change over time' assessment. Without baseline data to establish pre-operation conditions for outcome and impact indicators it is difficult to establish whether change at the outcome level has in fact occurred.

When to do a Baseline Study

In relation to the programme cycle, a baseline study should be conducted prior to the onset of operation activities in order to establish the pre-operation exposure conditions of the outcome and impact level indicators. However, it is not uncommon for baseline studies to be conducted after activities have already begun. In any event, the following features are critical for a baseline study.

- ⊕ Demonstrates the initial situation of the target population, its area of influence, and context.
- ⊕ The focus is on the target population: does it meet the requirements outlined in the project.
- ⊕ The overall purpose is to provide information to assess changes attributable to the project.
- ⊕ There should be methodological elements to review or redesign the Monitoring and Evaluation system.

Baseline Requirements

It is clear that a baseline study is just one component of the M&E design that outlines the planned M&E data collection and analysis. The entire evaluation strategy, including the design and budgeting of the baseline and subsequent studies (mid-term and final evaluations), must be developed during the planning or design stage of an operation by Management.

For operations under the OECD-DAC criteria, a baseline study is required for every type of operation. However, the rigour of the methods used to establish baseline conditions varies according to the type of operation being implemented. A compromise must be reached between the need for robust, precise data to establish pre-operation exposure conditions and the cost of collecting such data in terms of resources (financial, human and time).

Characteristics of Quantitative and Qualitative Data for Baseline Studies

[49] Where sources are not specified the information comes from : WFP. M&E Guidelines How to plan a Baseline Study Office of Evaluation. No date; FIDA/ PREVAL Los estudios de base. Fundamentos de una gestion por resultados. Lima, Junio 2007.

Two general types of data can be used – quantitative and qualitative – although the distinction between the two is often blurred. While quantitative data have long been cited as being more objective, and qualitative data as more subjective, more recent debates have concluded that both types of data have subjective and objective characteristics. As qualitative and quantitative data complement each other, both should be used.

What is a Unit of Study

The primary unit of study refers to the unit of interest defined in the M&E indicators listed in the operation's logical framework, as measures of whether or not design elements occur as planned. Indicators must specify the unit of study clearly in order to ensure that the same unit can be applied in baseline and follow-up studies (mid-term and final evaluations). This is important because it ensures comparability at different points in time when measuring indicators.

Commonly found primary units of study used in the M&E operations include (but are not limited to) households, farmers, students at different school levels, land, organisations, institutions (e.g. schools, hospitals), and government departments.

Why Sampling

Sampling occurs when a subset of the population (or other unit) under study is selected from the larger group (the entire population under study). By studying the findings from that sample (denoted as “n”) it is hoped that valid conclusions can be drawn about the larger population (denoted as “N”) from which the sample was taken, making it possible to analyze the impact of an operation. Sampling is commonly employed in order to avoid the expense and time associated with total enumeration of the population, as is done during a census. Whether focus group discussions are held to analyse the impact of an operation in a geographic region, or 1,500 households, in the same region, are selected at random, visited and asked questions from a questionnaire, sampling is used.

What distinguishes Probability Sampling from Non-probability Sampling

As discussed, both probability and non-probability sampling methods seek to gather data that provide a fair representation of the larger population, although the definition of “representative” varies between the two methods. Probability sampling methods rely on statistical theory as a basis for extrapolating findings from the sample population (n) to the larger study population (N). By contrast, non-probability sampling does not utilise statistical theory to support inference from a sample population (n) to the study population (N), but rather relies on a more subjective determination of the degree to which a sample “represents” the larger study population. The choice of which method to follow depends on the intended use of the information and the importance placed on objective (probability sampling) versus subjective (non-probability sampling) determinations of how representative the sample is.

C Outline of a Pilot Baseline Study

Hereunder is an illustration of a simple procedure to obtain basic information on farm income “with” and “without” the effect of PW advise on plant health provided to farmers in one area of the Santa Cruz’s temperate valleys. It must be emphasized that this is an illustration of an empirical exercise to collect farm income data, in a short period of time and with limited resources. It is miles away from randomized analysis.

It should be underlined that the mission visited the area where this exercise is outlined for approximately three hours. Therefore, the mission did not have time to gather information on land tenure, or the social profile of the area known as Mairana, in terms of social segmentation based on wealth [size of farm, assets], social status [these are historically ascribed qualities that certain social segments may have], and other factors.

There are several reasons in favour of choosing the PW programme in Bolivia, in an area known as Mairana, for launching an operation to conduct a baseline study. One key notion was to measure the cost and benefits of the programme through a scheme of tracking agricultural outputs from a key agricultural input: plant health.
First , the operations in the area began in 2000 under GPC, and in 2011 under PW, so NROs, LIOs, and other stakeholders are familiar with PW procedures.
Second, there is good support for Plantwise by the Santa Cruz governorate, as testified by the results of the present evaluation,
Third, in 2010 CABI staff conducted an exercise to determine farm income changes, following the advice received from plant health clinics.[50] Some of the procedures used to assess the data through the Plantwise system should be helpful. In addition, one of the plant clinics used for the study was situated in the Mairana region [Santa Cruz], where farms have been raising profitable crops.
Fourth, there is an agricultural technical institute in Mairana. The study could be conducted with the institute's students' participation, if such an agreement can be reached with the institute and provided a consultant has the experience to design and conduct studies with the participation of students as enumerators, data processors, and similar functions.[51]
Fifth, Mairana also provides the opportunity to study the factors that contribute to crop profitability in the context of providing plant health services. The provision of one critical input, i.e. plant health or irrigation-water, does not necessarily lead to growth in productivity and increase in income, unless certain ancillary complements are already in operation, i.e. market access and marketing channels, access to financing crop production, and many other factors to be identified on site.

For instance, in El Salvador, in order to exploit the economic potential of another critical input: irrigation water, smallholders needed access to ancillary resources to complement irrigated agriculture development such as credit, markets and marketing channels. Without these resources, smallholders sold their produce at a loss, even though they achieved anticipated yields. Ultimately, they became poorer with irrigation development, as their net farm income was higher without irrigation development. [52]
Finally, during the field visit conducted in Mairana, the mission participated in discussions with farmers and students about the pros and cons of initiating a cost sharing scheme for plant health services in the area. From previous experiences of privatizing public services [i.e. PW plant health services] among local communities, the evaluation team found the community members that participated in the discussion, including the NROs who led the discussion, highly sensitized to the importance of the issue to the community and aware of the responsibilities implicit in the decision-making process . [53]

[50] Eric Boa and Jeffery Bentley Net income change obtained by farmers following advice received from plant health clinics CABI – Global Plant Clinic, April 2010

[51] This kind of study can be viable. In Senegal, while imparting post-secondary courses on the economics of project evaluation with special reference to on-farm investment, Eduardo Quiroga conducted practicums so students could learn the practicalities of tracking project results within the context of monitoring frameworks, with special reference to food production systems. These practicums took place on sites managed by state organizations (Société nationale d'aménagement et d'exploitation des terres du delta du fleuve Sénégal et les vallées du fleuve Sénégal et de la Falémé). Students collected and analyzed the information gathered from small holders operating in the small- irrigation sites of Niandane, Ndiawara and Podor. The students' final grades were based largely on their performances in the field, as reflected in the ensuing report [Institut national du developpement rural, Thies, Senegal].

[52] See : Eduardo R. Quiroga. 1984. "Irrigation Planning to Transform Subsistence Agriculture: Lessons from El Salvador". Human Ecology 12 (2). Springer: 183–201. http://www.jstor.org/stable/4602731.

[53] In Mauritania as consultant I participated in the privatization of a revolving fund. The community in question was asked to choose one of the two following options. Option One: The revolving fund would be used without any charges; however, it would terminate when the funds either devalued or ceased to exist because of inflation or lack of repayment. Option Two: It would include charges for the sustainability of the revolving fund, i.e. administrative cost, and the opportunity cost of the value of capital so that the fund would not lose its purchase value, among other things. The whole community chose option two. UNDP/Mauritania. Country Cooperation Programme. Noakchot, 2001

Rapid Base- Line Analysis to Monitor Agricultural Outputs
As stated, a base line study is an analysis describing the situation prior to a development intervention against which progress can be assessed or comparisons made. This measure is fundamental and necessary for all analysis on income changes. One macro- indicator in this connection is the percentage of food expenditure of the poor, which in the case of Bolivia is 54% in Peru and Nicaragua are slightly higher: 57% and 63%, respectively [FAO, 2014: Table 12]

Possible process

Select approximately 20 students, one half of which are female. With the participation of the ILO the design and implementation of the base line survey will be conducted with the participation of these students through the following preliminary steps.

Step 1. Identify the farmers that have not been involved with the PW initiative in the Mairana area.
Step 2. Draw a representative number of informants using either stratified sampling or any other adequate technique to ensure representativeness
Step 3 Pres-test the crop budget format
Step 4 Design and pre-test a rapid family expenditure schedule
Step 5 Organize the data processing
Step 6 Conduct the survey using both crop budgets and a family expenditure schedule for each case.
Step 7. Tabulate the information from crop budgets and family expenditure
Step 8 Prepare a preliminary report of findings for validation with stakeholders.

Once the findings are considered representative of the conditions of the farmers who did not participate in the PW initiative, then it is possible to iterate the same procedure with farmers who are participating in the PW initiative. Both exercises will provide comparative measurements of farmers [1] who did not participate in the initiative and [2] who did participate in the PW initiative. This is the first stage in establishing the effects of the PW initiative on farmers' income in Mairana.

Farmers Systems Development Approach[54] [FSD]

In the second stage, it is useful to probe deeper into the profitability of farmers' operations to clearly understand the cost and benefit of plant health services as compared to technical extension or any other essential agricultural input. The application of FSD can be productive. The idea is to understand how the farmer uses inputs to obtain the highest return on his farm as a whole. It is therefore essential to use one crop budget for each crop the farmer grows on his farm, eventually configuring a farm model. A farm model reflects what farmers are likely to do. With the participation of the previous set of students, the following steps can be considered.

Step 1. Select a group of 6 or 12 farmer-leaders [of which one half should be women] with different skill levels. It would be useful to continue working with the same set of students as they already have experience and accuracy may increase.
Step 2. Using the crop budget technique, assess the physical and economic results of plant health advice on the set of crops grown during the last agricultural season.

[54] FAO (1994) Farming systems development. A participatory approach to helping small-scale farmers. Rome

Step3. Obtain a clear understanding of the farmers' cropping pattern. Determine if there is a strategy to maximize farm output, be it either physical or economic. What considerations are taken into account in the choice of crops?
Step 3. Once it is clear what the effects of the PW are on the cropping patterns, draw an understanding of the farm operation as a unit of production. Determine what other livelihood operations are conducted besides crop farming.
Step 4. An agro-economic understanding of the total farm as a production unit will reveal the performance in terms of productivity growth, resilience and farm income.

This would be a major benchmark to determine the costs and benefits of technical extension, specifically the role of plant health in productivity and profitability. It should be possible to discuss with more precision inclusive, transparent and equitable cost sharing mechanisms.

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Monitoring agricultural outputs

Although NROs and LIOs clearly indicated their intention to launch monitoring activities of the agricultural outputs derived from the inputs provided, such as plant health services, for the same reasons indicated earlier, it may be expeditious to wait for the results from the test-case in Bolivia. Tracking down the agricultural outputs from one key input [plant health service] comes with conceptual and operational challenges.
The country has chosen eight sites for the implementation of the PW initiative, therefore the monitoring of agricultural outputs will be more complex. consequently, it would be useful to identify the key issues to consider in the process of conducting a monitoring system for agricultural outputs. It also may be necessary to outline a strategy to determine the best course of action.
Given the agro-ecological and social structure characteristics of the eight sites, it may be feasible to narrow down a few representative sites.
Finally, depending on resource availability, especially the participation of another agricultural institute, one could consider beginning to collect systematic information on base-line information, following the procedure outlined earlier.

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NROs and LIOs clearly indicated during working sessions with the mission, the challenge of quantifying the economic cost and benefits arising from the PW initiative. As is known, tracking down the agricultural outputs from one key input [plant health service] comes with conceptual and operational challenges.
The country has two implementation poles for the PW initiative.
The agro-ecosystems and social structures of both poles should be reviewed to identify key issues.
A strategy should be outlined to determine the options available for both poles, and based on these options, the best procedure in terms of resources available should be selected.