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# Synthesis report

## Evaluation of Plantwise and Action on Invasives

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# Evaluation of Plantwise and Action on Invasives; synthesis report

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## Cover photo

[Plant clinic in Kenya © Jacqueline Sluijs 2017](#)

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# Acronyms

ABAS	Agribusiness-based Advisory Services
Aoi	Action on Invasives
CABI	CAB International
FAW	Fall armyworm
FFS	Farmer Field Schools
GBP	British pound sterling
ICT	Information & Communication Technology
IPM	Integrated Pest Management
ISC	Invasive Species Compendium
KEPHIS	Kenya Plant Health Inspectorate Service
KES	Kenyan Shilling
KII	Key Informant Interview
KIT	Koninklijk Instituut voor de Tropen (Royal Tropical Institute)
LIO	Local Implementation Organization
LQAS	Lot Quality Assessment Survey
MAG	Modernizing Agriculture in Ghana (Canada funded support to MoFA)
M&E	Monitoring & Evaluation
MoALFI	Ministry of Agriculture, Livestock, Fisheries and Irrigation (Kenya)
MoFA	Ministry of Food and Agriculture (Ghana)
MSC	Most significant change
NSC	National Steering Committee
PC	plant clinics
PD	plant doctor
PHS	Plant Health System
POMS	Plantwise Online Management System
PMDG	Pest Management Decision Guides
SMS	Subject Matter Specialist
USD	United States Dollar

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# Executive summary

## Introduction

This report presents the findings of a formative evaluation of the Plantwise and Action on Invasives programmes commissioned by CABI, on behalf of the Dutch Ministry of Foreign Affairs. Plantwise is a multi-country and multi-donor programme (launched in 2011) that aims to strengthen national plant health systems through improved stakeholder linkages in developing countries. The Action on Invasives programme (launched in 2017) aims to strengthen national and regional resilience to the threat of invasive organisms. The ultimate goal of both programmes is to increase agricultural production and farmer incomes as they lose less crop yields to pests and diseases and produce more.

The evaluation looks at the performance (relevance, effectiveness, efficiency, program management and risks and potentials), the innovativeness, the benefits and good practices of the two programmes. In addition, recommendations have been made - in light of the Dutch Foreign Trade and Development Cooperation policy - for the next phase, called Plantwise+. The data collection evaluation was conducted from July to August 2020. Information was obtained on the achievements at global level through programme reports and key informant interviews. In addition, three country case studies (Ghana, Kenya and Pakistan) were conducted to obtain insights on the outcomes and impacts at national and local level. The evaluation is qualitative in nature, but multiple methods were applied for data collection and analysis including: document review, semi-structured key informant interviews (51 respondents in total), structured interviews with plant doctors (30 respondents), a Lot Quality Assessment Survey among farmers (95 beneficiary farmers), and an online survey to collect most significant change stories from 53 respondents). All data collection was done remotely by international and national consultants, due to the short timeframe of the evaluation and the travel restrictions in light of the COVID-19 pandemic.

## Programme results

In the period 2017-2019, Plantwise has trained 11,500 plant doctors, established 4,500 plant clinics and reached an estimated 44 million farmers in more than 30 countries. In addition, a wide range of fact sheets and pest management decision guides have been developed, field-level data on crop pests and diseases were collected through the POMS system, plant clinic services have been largely digitalized with the introduction of tablets for plant doctors, and national multi-stakeholder collaborations have been strengthened resulting in considerable additional funding from (inter)national governmental and nongovernmental partners for the Plantwise programme.

The Action on Invasives programme has built on the infrastructure created by Plantwise. Its activities resulted in: stakeholder engagement to inform policies and strategies on invasive species and guidelines for the registration of biopesticides and microbials, identification of best practice solutions for invasive species, community and mass media campaigns (reaching 6.6 million people in five countries) area-wide management of Fall armyworm in Kenya, the redevelopment of Invasive Species Compendium and development of the Horizon Scanning Tool and Pest Risk Analysis Tool.

## Farmers' appreciation of plant clinics

Overall, farmers reported positive experiences with plant clinics. The majority of farmers reported that the plant clinics are the best source of information for plant health problems, and they encourage farmers to visit the plant clinics. The advice of the plant doctor included both recommendations on agronomic practices and chemical inputs and was generally provided immediately when the farmer visited the plant clinic. The majority of the farmers (at least 65%) stated that the advice solved the problem, meaning it was perceived effective in treating the crop for a pest or disease. Though farmers in Ghana confirmed that the advice also resulted in decreased use of chemical pesticides, this was not always the case for farmers in Kenya and Pakistan. It could not be confirmed with certainty either that



the advice resulted in lower costs for female farmers in Kenya. However, it is noted that the implications of the plant doctor's advice for the farmer's use of chemical pesticides, as well as the type of pesticide and subsequent costs are very crop and case specific. This evaluation does not provide details at that level and the overall effect of the plant clinics on chemical pesticide use remains inconclusive from this quick survey with a small number of farmers.

### **Plant doctors' appreciation of Plantwise**

The plant doctors reported predominantly positive experiences with the Plantwise programme and thought it highly relevant. The capacity strengthening (through training and access to quality information sources) has made the plant doctors more confident in their skills. The plant doctors reported the demand-driven approach, quality diagnostics and information, and actionable recommendations as particular strengths of the approach. Challenges remain in terms of resources for transport and allowances, low farmer attendance, high workloads, difficult working conditions and lack or poor quality of equipment.

The plant doctors also reported that the majority of farmers implement the recommendations and obtain benefits from that. In Ghana and Kenya, about 40% of the farmers that visit plant clinics are female according to the plant doctors. In Pakistan, however, the cultural norms prevent women from attending plant clinics when these are held by male plant doctors in public market places; only 14% of farmer attendants are female. Plant doctors thought that the majority (about two-third) of farmers shared their knowledge with other farmers. This was indeed confirmed by the male and female farmers in Ghana and male farmers in Kenya, but not by the female farmers in Kenya and (male) farmers in Pakistan.

The COVID-19 pandemic negatively affected the functioning and performance of the plant clinics in all countries as plant doctors had to cancel the plant clinics for several months due to government restrictions on mobility and gatherings. However, many activities had resumed at the time of the survey, taking into account the necessary safety precautions to avoid infection and spread of the corona virus.

### **Stakeholders' appreciation of Plantwise and Action on Invasives**

CABI staff, government staff, local implementing organizations and plant doctors shared their views on the most significant change that they experienced in relation to Plantwise and/or Action on Invasives. The most appreciated component was the capacity building (technical expertise), followed by the ability to detect and respond to pests and diseases, and the subsequent benefits for farmers. Changes such as demand-driven advisory services, development of a knowledge base, strengthening of extension services and collaboration with partners were less frequently mentioned. The reported changes were all considered positive, and in most cases it was also expected that the change will last. Nearly all respondents also confirmed that the changes would not have happened without the programmes.

### **Performance of Plantwise and Action on Invasives**

**Relevance for stakeholders.** Key informants confirmed the relevance of both programmes. Both programmes respond to needs of the plant health system actors at national but also local level. The capacity strengthening, data collection, information dissemination and service delivery to farmers address major weaknesses in plant health systems. The strengthened plant health systems have also helped to early detect Fall armyworm in the Plantwise countries. Improvements can be made to make the programmes more relevant, for example by engaging with local private sector actors, adoption gender-sensitive strategies, or bundle services for farmers.

**Effectiveness.** Although Plantwise reports its achievements on its key output indicators, no targets have been set at country level, which makes it difficult to assess the effectiveness of the programmes. Most key informants were of the opinion that the programmes were on track to meet the set

objectives. Impact studies (based on Randomized Control Trials) in Kenya and Pakistan have shown that plant clinics resulted in less misuse of chemical pesticides, and in positive effects on crop yields and incomes of farmers who sought advice from plant doctors. It is widely acknowledged that the sustainability of the programmes will largely depend on the national and local governments that are expected to fund the infrastructure and activities set up by the programmes. Although governments are currently providing (co-)funding to continue Plantwise activities, it is also reported that the available funding has been declining, putting multi-stakeholder meetings at the national and local government levels, training of extension agents and plant clinic services at risk. It is therefore recommended to diversify partnerships to complement gaps in coverage and programme delivery and implementation and make the plant health system more effective overall.

**Efficiency.** Key informants agreed that the programmes are efficient and complementary to other existing programmes and initiatives. The National Steering Committees include the major partners in national plant health systems, though private sector partners, NGOs and farmer organizations could be engaged more. Some key informants were of the opinion that similar results could have been achieved at lower costs if the programmes would have focused on fewer countries initially before scaling out to other countries. However, the costs associated to reaching farmers has gone down consistently over time as national and local governments have taken over more responsibility. The digitalization of the plant clinics has considerably improved the efficiency of the plant clinic activities. Key informants perceive plant clinics to be a more efficient extension model to advise farmers on plant health than other extension models, such as individual interactions between extension. Resource mobilization at the national and local level with government and other stakeholders is essential to ensure continued implementation and increased coverage. More diverse, in-country funding and engagement with private sector partners to explore the delivery of plant clinic services will lead to a more sustainable programme and complementary and alternative delivery channels.

**Programme management.** The programme management structure tries to accommodate the demands of multiple donors. At global level, the programmes are governed by programme boards (senior management from CABI), separately for Plantwise and Action on Invasives. At national level, the National Steering Committees are responsible for the governance and implementation both the Plantwise and the Action on Invasives programmes, with plant clinic coordination clusters in the local government areas. Challenges encountered in the governance structure include accommodating feedback from countries to global leadership, and efficient coordination between Plantwise and Action on Invasives at the global and country level. Another issue that was mentioned was that NSCs are informed on an annual basis of the budget available for the programmes, which makes it difficult to develop a longer-term vision, work plan and budget for some partners. It is planned and appears logical and necessary to merge Plantwise and Action on Invasives into one new Plantwise+ programme, with one management and operational structure and harmonized objectives and work packages. Given the new priorities for the new Plantwise+ programme (climate-smart pest management, safer food, detecting and responding to new pests, increasing availability of safer plant protection products), significant changes in the approach and a move beyond business-as-usual implementation is necessary. This requires careful assessment of in-country needs for new capacities and (new) private and public sector partnerships and co-creation of the programme with these partners.

**Risks and potentials.** Uncertainty relating to the commitment of human, financial and infrastructure resources of national and local governments, and related future funding from the Plantwise and Action on Invasives programmes, are perceived as a major risk. Other important risks mentioned were high staff attrition and turnover and the on-going COVID-19 pandemic and government imposed restrictions on travel and gatherings. At the same time, there are multiple reports that crop pests and diseases become a more pressing problem in many countries due to agricultural intensification and climate change. Nevertheless, the programmes are perceived to be resilient as they are anchored in multiple organizations and institutions through the National Steering Committee. Plantwise and Action on



Invasives have provided a foundation to further develop the plant health systems in future. We conclude that despite the risks, the programme has a high potential to contribute to food and nutrition security and is resilient to adverse effects given the approaches and tools developed in the programmes and providing a number of adaptations and changes, namely (1) diversification of partnerships, (2) adaptation and dissemination of developed tools to new partners, possibly to new countries and (3) Accelerate efforts to transition to digital services and e-extension at scale.

**Innovation.** Many elements of the Plantwise programme are considered innovative, including the demand-driven plant clinic model itself, the POMS database, the Knowledge Bank, the migration to e-extension tools, and the National Steering Committee. Social media platforms for peer-to-peer support and training have been created, which have flourished and are used frequently and, in combination with the e-extension tools, improved quality and accelerated response times of diagnostics and recommendations to farmers. The Action on Invasives is also considered innovative as it strengthens the capacity of a plant health system to improve the national response to new notifiable pest and diseases. In addition, innovative research and approaches have been initiated under this programme, which should continue. We conclude that additional areas of innovation should include institutional innovation and innovation in partnerships to enable scaling of the programme.

**Benefits.** There is general agreement that the plant clinics directly benefit farmers as they can now access quality advice on plant health. It appears that farmers are successfully applying the recommendations with respondents reporting benefits ranging from reduced use and abuse of pesticides in Pakistan and Ghana, to reduced yield and post-harvest losses, to increased yield and income. Extension agents who have been trained as plant doctors, also benefitted directly as they improved their knowledge on plant health and developed new skills to be able to diagnose problems and provide recommendations. Further benefits were mentioned for other actors, such as research staff, the extension services and plant protection services agencies. It was felt it was too early to be able to measure benefits of the Action on Invasives.

**Good practices and lessons learned.** Many lessons learned and good practices were shared by key informants, and provided in more detail in the main report. Most frequently mentioned were:

- Plant clinics have filled a gap in the linkage between stakeholders in the plant health system and the (public) extension services.
- A major shift in focus from single chemical pesticide-based solutions to a more integrated pest management approach.
- Adoption of data-driven decision making on plant health issues is appreciated as a good practice.
- ICT tools and social media platforms have considerably increased the efficiency of data collection and advisory services on plant health. In addition ICT have successfully been used to complement plant clinics with large scale dissemination of technologies.
- The Action on Invasives has complemented Plantwise well with innovative approaches and research.

### **Adaptations to the Dutch Foreign Trade and Development Cooperation policy**

The new policy of the Dutch Ministry of Foreign Affairs has two key features that have consequences for the follow-up programme Plantwise+: (1) the focus on specific regions, and (2) the focus on fragile states. This poses challenges for a programme such as Plantwise that heavily relies on functioning government structures and public services. Plantwise+ will need to adopt a more flexible, inclusive and pluralistic approach in these fragile (institutional) environments. It is suggested that Plantwise+ seeks collaboration with existing regional networks (e.g. research, producer organizations). For the implementation, it is recommended that a pluralistic approach to extension is incorporated into the programme from the beginning. Attention to diversity, inclusion and gender-sensitive approaches will also be important to make sure the programme's contribution will be effective and sustainable in supporting farmers in fragile environments. Collaboration should be sought with grass-root

organisations for the implementation on the ground. As the experience in Burkina Faso has shown, public co-funding of national governments is not guaranteed in conflict areas, and the Plantwise+ should make a careful assessment of the main weaknesses that need to be addressed, the risks involved, and how long-term funding can be ensured from multiple sources, including humanitarian organizations and the private sector (e.g. social enterprises) that focus on last-mile delivery to farmers.

## Conclusions

The main goal of Plantwise and Action on Invasives is to strengthen national plant health systems which is subdivided into the following components: (1) extension, (2) research, (3) input supply, (4) regulation. Plantwise has positively contributed to the extension and research component of plant health system in the intervention countries. However, more efforts can be made to feed the knowledge back into tertiary education. The least progress has been made in terms of input supply; stronger engagement with the private sector is required to improve the advisory services of input suppliers, as well as stronger enforcement of agro-chemical input regulations (which is the task of the government). Plantwise has also contributed to the regulation component through its strong collaboration with the ministries of Agriculture. The Action on Invasives programme has further contributed to Plantwise with its systems-based approach to managing biological invasions, focusing on (1) prevention, (2) early detection and rapid response and (3) control and restoration.

This evaluation did not include a counterfactual and can thus not assess the impact of Plantwise and Action on Invasives against a control or baseline situation. Two comprehensive reviews of agricultural extension in emerging economies have been used for comparison. These reviews report the same challenges (e.g. under-resourced extension systems, high staff turnover, limited farmer-to-farmer diffusion of knowledge and spill-over effects) that were encountered during the implementation of Plantwise, constraining its impact. These weaknesses are inherent to the research and extension systems in many emerging economies and these constraints are not the result of the Plantwise programme design. Instead, both programmes have tried to respond to these challenges by strengthening the plant health system as a whole. However, there are opportunities for adaptation and integration of (components of) Plantwise and Action on Invasives in other programmes and services, and to increase collaboration and partnerships with more organizations and actors working in the agriculture and agricultural advice and services area, such as farmer organizations, local agricultural service providers and agro-input dealers, NGO's and humanitarian organizations.

## Recommendations for Plantwise+

The experiences of Plantwise and Action on Invasives form a good basis to develop the Plantwise+ programme. The three main recommendations for the Plantwise+ programme are:

- Implementation should be done in two phases. In the first phase, the focus should be on graduating successful Plantwise and Action on Invasives countries, and on piloting the new programme in a limited number of new countries, representing diverse settings, including fragile states. In the second phase, the programme can be rolled out in more countries, using the insights obtained from the pilot and successfully graduated countries.
- Private sector engagement requires more attention, as well as alternative (business) models for advisory services. Useful insights can be obtained from other market-oriented programmes, social enterprises providing inputs and extension services and studies on Agribusiness-based Advisory Services.
- ICT, mass media tools and social media platforms should be adapted and further developed to extend reach to new areas and new countries and to facilitate services by moderately skilled service providers and intermediaries between farmers and plant doctors.

# 1 Introduction and brief methodology

## 1.1 Introduction to the evaluation

The Dutch Ministry of Foreign Affairs has commissioned an external evaluation of the programmes Plantwise and Action on Invasives implemented by CAB International (CABI). This evaluation will inform decision making on CABI's new global flagship programme Plantwise Plus from 2021 onwards. In addition, the findings of the external evaluation will inform the decision making of current and potential future donors with regards to their funding. The evaluation is thus expected to provide insights into the programme approaches used by CABI, the effectiveness and efficiency of these approaches compared to other capacity building approaches, and to what extent it is aligned with Dutch policies for international trade and international cooperation. More specifically, the evaluation aims to provide a quick assessment of the performance of Plantwise and Action on Invasives as interrelated programmes and activities, the impact against main objectives, the relevance for target groups and stakeholders, effectiveness, efficiency, programme management and risks and potentials. Furthermore, the evaluation assesses to what extent the programmes have been innovative, what the benefits have been to farmers and stakeholders, and what good practices and lessons learned can be identified. Finally, some suggestions are provided on what should be done differently in the future Plantwise+ programme, in response to the BHOS policy of the Ministry of Foreign affairs of the Netherlands.

Plantwise is a large, multi-country and multi-donor programme to strengthen national plant health systems through improved stakeholder linkages in developing countries. Implemented from 2011 to date, Plantwise aims to help farmers lose less of what they grow to plant health problems, using the unique plant clinic approach at scale. The objectives are to decrease crop losses, to increase crop productivity and to improve livelihoods and food security through improving the four main components of the plant health system, namely extension, research, input supply and regulation. In the long term, Plantwise aims to increase the effectiveness of the overall plant health system in addressing crop problems through gradual systems change.

Launched in 2017 and leveraged by Plantwise, the Action on Invasives programme aims to strengthen national and regional resilience to the threat of invasive organisms to protect and improve the livelihoods of vulnerable rural families, including women and youth. The economic cost of invasive species to Sub Saharan Africa, South and Southeast Asia together is estimated at >\$183bn per annum. Many of the world's poorest farmers live in these regions. This programme aims to reverse the invasive species threat using a targeted, environmentally sustainable approach designed to prevent, detect and control key invasive species at the local, national and regional levels.

## 1.2 Evaluation questions and methodology

The Terms of Reference (ToR) states that the overall purpose of the evaluation is to assess the effectiveness of the unique approaches of Plantwise and Action on Invasives in order to inform the new global flagship programme 'Plantwise plus' as well as the funding decisions of potential future donors. More specifically, the proposed evaluation aims to provide a quick assessment of the performance of Plantwise and Action on Invasives as interrelated activities, specifically the impact against main objectives, its relevance for target groups and stakeholders, effectiveness, efficiency, programme management and risks/potentials.

The evaluation is guided by the following questions as stipulated in the ToR:

1. What is the performance of Plantwise and Action on Invasives programmes as interrelated initiatives? A number of sub-questions for a more detailed evaluation under programme performance were selected, namely:

1.1. Performance: Relevance to stakeholders:

1. To what extent do the programmes and data collected respond to the (information) needs of different stakeholder groups?
2. What are the lessons learned that have helped or are expected to help guide decision making and planning of subsequent in-country activities and/or programmes.
3. To what extent have the benefits of the programme directly and indirectly reached male and female farmers of different ages? How could this be improved in a new programme?

1.2. Performance; Effectiveness:

1. To what extent have the expected results been achieved so far (in particular change in yield and income for farmers, change in land area under sustainable practices)?
2. Which unexpected results have been achieved? How do these inform a new programme?
3. What is the likelihood that the programme objectives will be met and what are internal and external underlying factors for likely success or failure?
4. What are the strengths and weaknesses of the advice provided by CABI, compared to advice that farmers receive from other service providers?
5. Are there measures in place to monitor and improve programme delivery and decision making?

1.3. Performance; Efficiency:

1. Is the programme complementary to other projects/programmes and existing national / regional advisory services?
2. Are the most suitable partners cooperating and do roles and responsibilities of partners take into account their respective comparative expertise?
3. Do programme structures and working modes support efficient use of human and financial resources?
4. How sustainable is the programme in the light of global and in-country funding sources and what does this mean for the new programme?
5. How do the costs per farmer from the CABI approach compare the costs per farmer in other advice delivery methods?

1.4. Performance; Programme management:

1. How are the multiple demands, programme reporting and financial management structures of different donors managed to ensure a coherent programme of activities with common aims and objectives?
2. How are roles and responsibilities divided among CABI centres, project field units in relation to work in the different countries?
3. Are the priorities set appropriately across the Plantwise themes and the Action on Invasives work packages?
4. How effective and efficient are the existing structures and working processes of programme management at different levels and could these be improved, if so how?

1.5. Performance; Risks and potentials:

1. What are the risks that may negatively affect programme success in the next one to five years? How can they be addressed and minimised?
2. How has the COVID-19 pandemic affected the programmes and what has been done or should be done to mitigate its effect?
3. What is the potential of the programmes to deliver outcomes that contribute towards food and nutrition security in the medium- and long-term?
4. What is the resilience of both programmes towards adverse effects (political changes, social unrest, natural disasters, etc.) that may occur during a long-term time period of 10 years?

2. To what extent are both programmes innovative, with a focus on country activities in Africa and Asia?;
3. What are the benefits (incl. yield and income improvements) experienced in both programmes as compared to alternative interventions/results (opportunity costs)?
4. What are the good practices and key lessons learned to date and how have the programmes responded to challenges in implementation?
5. What should be done differently if the same programmes had been initiated in response to the new BHOS policy of the Dutch Ministry of Foreign Affairs.
  1. What activities could work well in the BHOS focus areas (in particular in fragile states of West Africa/Sahel, Horn of Africa, Middle-East and North Africa), where programme activities have not yet taken place.
  2. How should CABI go about identifying the need for and relevance of those activities (identified under a) in the DGIS focus countries, to confirm which countries could be relevant for CABI's programme activities to help improve national plant health systems and/or advisory to the ultimate benefit of smallholder farmers in those countries?
  3. What should CABI do to identify the relevant stakeholders and partnerships needed in selected countries (confirmed under b) so that future programme work could be implemented in those countries?

The evaluation is based on qualitative data collected from stakeholders involved in reaching program impact, from farmers (attendants of plant clinics), to community level implementers (plant doctors) to country implementers and key partners of the programmes, as well as global and sub-regional coordination and program management. Data was collected through semi-structured key informant interviews, online surveys, structured interviews with plant doctors and farmers and document reviews. Three country case studies were included: Ghana, Kenya and Pakistan. This report presents the findings from a global assessment with a focus on three country case studies, namely Ghana, Kenya and Pakistan. More details of the methodology of the evaluation is presented in Annex 1. In the each of the following sections, we will explain which main questions have been addressed when discussing the findings.

Section 2 provides a description of achievements of Plantwise and Action on Invasives, information mostly extracted from annual reports and CABI project documents. Section 3. Presents results from interviews with plant clinic attendants using the Lot Quality Assessment Survey (LQAS) approach. This section deals mostly with evaluation questions on relevance to stakeholders (1.1), effectiveness (1.2), Risks and potentials (1.5) and Benefits (3). Section 4 presents the results of the plant doctor survey and relates to all evaluation questions, except programme management (1.4) and Plantwise+ response to the new BHOS policy of the Dutch ministry of Foreign Affairs. Section 5 presents a selection of results from the online stakeholder survey on the most significant change stories and deals with programme performance, except for Risks and potentials (1.5) and Benefits of the programmes (2). Section 6 is the information from the key informant interviews from the global, sub-regional, national and district, county, provincial and local government levels, often triangulated with literature and information sources from previous chapters. Section 6 deals with all evaluation questions, except the evaluation question related to the new BHOS policy of the ministry of foreign affairs, which is discussed in section 7. Section 8 draws conclusions on the evaluation overall and provides recommendations for adapting and improving the new Plantwise+ programme, based on the evaluation questions and different information sources, the BHOS policy of the Dutch Ministry of Foreign Affairs, and KITs experience, referring to the backdrop of the COVID-19 pandemic where relevant.



## 2 Plantwise and Action on Invasives achievements and impact

### 2.1 Plantwise outputs and results (2017-2019)

The reach of Plantwise globally has increased significantly in the last three years, with cumulatively 11,500 plant doctors trained, 4,500 plant clinics established (of which 3,000 are active) and 44.1 million farmers reached in more than 30 countries (CABI Plantwise Annual Report 2019).

The programme's recent focus has been to (1) incorporate aspects of climate resilience for smallholder farmers, (2) strengthen evidence outcomes and impact of the programme, (3) use of ICT tools and applications to enhance reach and efficiency in service delivery, (4) promoting use of plant clinic data in countries, (5) explore opportunities for engagement with private sector organizations and (6) increase gender equity of access to information.

In Ghana, Plantwise and partners have trained a total of 446 plant doctors, with over 50% trained in the last three years. Plant doctors, with support from Plantwise and partners have initiated over 248 plant clinics. In addition, the programme has developed 104 Pest Management Decision Guides (PMDG) and six factsheets, although these had all been drafted by 2016 (CABI Plantwise Annual Report 2016, 2019). In 2019, the programme in Ghana was able to respond to 9,601 farmer queries, of which 2,854 (43.2%) were women (CABI Plantwise in Ghana. 2019 Annual country report). The program has also engaged with partners to gradually transfer responsibilities to the national government institutions and their partners. To encourage national ownership and sustainability of funding, the Plantwise programme no longer provides transport and lunch allowances for plant doctors to hold plant clinics, or provide data bundles for plant doctors to submit their queries in the Plantwise Online Management System (POMS) from 2020 onwards (CABI Plantwise in Ghana. 2019 Annual country report).

In Kenya, Plantwise and partners have trained a total of 689 plant doctors, with over 40% trained in the last three years. Plant doctors, with support from Plantwise and partners, have initiated 284 plant clinics with over 162 in the last three years. In addition, the programme has developed 266 PMDGs, of which 112 in the last three years and seven factsheets, all drafted before 2017 (CABI Plantwise Annual Report 2016, 2019). Furthermore, 11,557 plant clinic queries had been entered into the POMS system and 6,192 queries were validated through a new sampling method in 2019 (CABI Plantwise Annual Report 2019). It appears that Plantwise Kenya, in an effort to pass responsibility of funding to the county and national governments, reduced lunch and transport allowance for plant doctors in 2018, and stopped funding allowances altogether since the start of 2020 (CABI, 2020. Plantwise in Kenya 2019 Annual Report).

In Pakistan, Plantwise and partners have trained a total of 1,965 plant doctor with over 40% trained in the last three years. Plant doctors, with support from Plantwise and partners have initiated 964 plant clinics with over 434 in the last three years. In addition, the programme has developed 70 PMDGs, of which 28 in the last three years, and 86 factsheets, with 27 drafted in the last three years (CABI Plantwise Annual Report 2016, 2019). Furthermore, 91,750 plant clinic queries had been entered into the POMS system and local partners using the administrative information on POMS in 2019 (CABI Plantwise Annual Report 2019).

Some highlights and successes from 2019, with a focus on Ghana, Kenya and Pakistan, were:



- Continued and new partnerships in Ghana with significant co-investment from the Modernizing Agriculture in Ghana (MAG) program, the Market-Oriented Agriculture Program (MOAP), Kuapa Kokoo (cocoa sector) and NGO Solidaridad, of a total of GBP 50,648 representing government, donor and private sector funding in 2019.
- Reinforced partnerships in Kenya with funds (GBP 115,720) allocated to Plantwise activities by local governments, Self Help Africa (SHA), Kenya Plant Health Inspectorate Service (KEPHIS) and Kenya Agricultural & Livestock Research Organization (KALRO).
- Engagement and funds (GBP 141,406) allocated by national partners in Pakistan to support Plantwise activities.
- Use of an economic model to estimate the cost of different control regimes, showing that the current control regime in Ghana saves an estimated USD 10 Million per year through reduced damage by Fall armyworm (FAW) (Williams et. al., 2019)
- Training in running e-Plant clinics, use of ICT tools and data management and use by local implementation organization (LIOs) and partners, resulting in high numbers of queries submitted in the POMS system and use by district, regional and national Ministry of Food and Agriculture (MoFA) staff and researchers in Ghana.
- In Pakistan, as a result of advocacy meetings and scientific data provided by Plantwise, a decision was made by the government to phase out highly hazardous pesticides.
- Continued migration from paper to tablet-based submission of queries into POMS and use of the Knowledge Bank by plant doctors (for instance the conversion of 103 paper-based plant clinics to e-plant clinics in Pakistan in 2019).

However, the programme also encountered some challenges, such as:

- Some funding committed to from the program and/or national government partners was not released, leading to reduction of activities planned.
- Challenges with the data collection application (updates) leading to loss of data.
- Terminating of transportation and lunch allowance by the Plantwise programme in Ghana and Kenya, leading to demotivation of extension staff. Some commitments have since been made to fund these costs by counties, districts and partner LIOs.
- Challenges with timely analysis of plant clinic data and sharing with clusters to improve use and continued capacity building of coordinators and plant doctors.

## 2.2 Action on Invasives outputs and results (2017-2019)

The Action on Invasives programme has built on the infrastructure created by Plantwise, complementing efforts, adding new key partners – also to the National Steering Committee (NSC) – and focusing on a number of key interventions under the different work packages, namely (1) Stakeholder engagement, (2) Best practice solutions, (3) Community action and (4) Knowledge and data. From the recent annual reports (CABI Action on Invasives Annual Reports 2017-2019) the following can be mentioned:

### Stakeholder engagement work package:

- Producing evidence on the economic impacts on fall armyworm to inform policy decisions (Rwomushana et al. 2018).
- Complementing the mandate and agenda of the Plantwise NSC by Action on Invasives and addition of key stakeholders as members in 2018.
- Implementation of an Invasive species system assessment in Kenya that will lead to establishment of a Technical Working Group for invasive species in the country.
- Support to the development of the East Africa Community harmonized guidelines for the registration of biopesticides and microbials, that are in the process of adoption by Kenya.

- Completion of the Ghana National Invasive Species Strategy and Action Plan by a consortium of stakeholders.
- Initiation of a Ghana FAW action plan by MoFA, that focused on (1) collaboration, (2) awareness, (3) surveillance and (4) management and establishment of a Fall armyworm task force in 2018.

#### Best practice solutions work package:

- Prioritization of potentially invasive species in Ghana and Kenya using the Horizon scanning exercise.
- Trials of non-chemical approaches to FAW that appear cost-effective and surveys for natural enemies of Tomato leaf miner.
- Papaya mealybug surveys in Kenya revealed high pest incidence and low populations of parasitoids, providing a strong basis for classical biological control
- Several trials of non-chemical approaches tested in Ghana, Kenya and Zambia show some cost-effective results, suggesting that fall armyworm can be controlled without chemical insecticides.
- Import and host specificity testing of classical biocontrol agent for *Parthenium hysterophorus*, a toxic and dangerous invasive weed in Pakistan.
- Identification and collection of a natural enemy of Fall armyworm in Latin America, which is being tested in Switzerland, and shipped to Pakistan for further research.

#### Community action work package:

- Communication campaigns conducted through a variety of gender-responsive media and communication channels – 6.6 million people reached (Pakistan, Kenya, Ghana, Zambia and Bangladesh)
- Fall armyworm technical brief for Kenya approved by the Ministry of Agriculture, Livestock, Fisheries and Irrigation (MoALFI), and widely disseminated across traditional and social media
- An assessment of why farmers in Kenya do not use bio-pesticides.
- Area-wide management of fall armyworm piloted in eight communities in Kenya using various lower-risk control products.
- Practicality of Tomato leaf miner integrated pest management (IPM) products being assessed with farmers in Kenya.
- Household surveys in Ghana and Zambia on the impact of FAW, indicating 26% yield loss due to FAW in Ghana.
- Household surveys in Kenya on the impact of Tomato leaf miner.

#### Knowledge and data work package:

- Redevelopment of the Invasive Species Compendium (ISC) knowledge platform and addition of features, which by the end of 2018, had received over 2 million visits from 239 countries (60% women, 56% under 35 years of age).
- Development and release of the Horizon Scanning Tool and the Pest Risk Analysis Tool.

However, several challenges and needs for improvement have also been indicated in the documentation, the most important being:

- Limited engagement with input dealers on recommended insecticides and / or unavailability of biological control products in Ghana and Kenya.
- Fall armyworm has been such a big issue it has to some extent distracted from some of the system-strengthening activities that would help better address the next invader.
- Need for increased engagement with media by training and press briefings/releases for improved quality of communication.

- Slow regulatory systems for registration of new (biological control) products (e.g. Kenya).
- Limited two-way communication between national and local stakeholders.
- Need for identification, coordination and harmonization of activities and efforts of new collaborators.

### 3 Farmers' appreciation and perceptions of plant clinics

In order to assess the key objectives related to the evaluation of programme performance (relevance to stakeholders, effectiveness) and benefits at farmer level, we constructed and employed a Lot Quality Assessment Survey (LQAS)<sup>1</sup>. We randomly sampled 19 female and 19 male cohorts of farmers in each case study country for phone interviews from a list of plant clinic queries submitted by farmers who had given their phone number in 2020. If farmers could not be contacted, they were replaced with a set of randomly selected backup farmer contacts. The survey was a simple checklist of 12 yes/no or numerical response questions related to coverage, the plant clinic query submitted and the sharing of information with other farmers. We were not able to contact female farmers in Pakistan and after several failed attempts to contact women farmers, we were obliged to abandon this effort, reason for the absence of a female farmer cohort for Pakistan. LQAS is an increasingly popular tool for rapid evaluations in the development sector, as it identifies priority areas based on statistically sound techniques requiring small sample sizes. The LQAS survey results constitute estimation boundaries (between which the real coverage in the population is) with close to statistical certainty. The real coverage is likely lower than the higher threshold, and almost certainly higher than the lower threshold. Because we are looking for 'early warning signals' we report the lower threshold, meaning that we can't say with statistical certainty that the true coverage is above the reported percentage. This chapter aims to provide partial answers to the evaluation questions related to,

#### 3.1 LQAS results, areas that need attention

Table 1 shows the results of the LQAS survey for Ghana and Kenya for the male and female cohorts, and for Pakistan, only for a male cohort. The columns identify the different cohorts disaggregated by country and the rows represent the various indicators scored by the LQAS survey. Each cell thus represents the score for the specific cohort on said indicator. The colouring of the cell is coded by scoring: cohorts that have a lower threshold of fifty percent or more for the indicator (and thus made the target) are green-shaded; cohorts that have a lower threshold value of below fifty percent for the specific indicator (and thus require additional attention) are yellow-shaded.

For the male cohort from **Ghana**, a maximum score is achieved for each indicator, signalling that we do not find evidence that any evaluation criteria requires additional attention. For women beneficiaries in Ghana, we can say with certainty that at least 70% received advice that would imply a reduced use of chemical pesticides. As this is still far higher than the 50% lower threshold, we conclude that Ghana is on track for all LQAS indicators.

For **Kenya**, despite scoring high across most evaluation criteria, some priority areas were identified. Firstly, we note that the indicator for advice that would imply the use of less chemical pesticides scores low for both the male (lower threshold of 40%) and female (lower threshold of 30%) cohorts, indicating that the advice often does not achieve this goal. Secondly and correspondingly, following the advice would often not lead to lower costs, as is specifically often indicated within the female cohort. Thirdly, the advice is often not shared with other farmers, which is specifically true for the female cohort (lower threshold of 45%). Looking at the number of farmers that shared the advice with at least four other farmers, the lower threshold for female farmers decreases to 25%.

**Pakistan** scored high and acceptable across all evaluation criteria except for the indicator that implies reduced use of chemicals from the advice, which has a lower threshold of 45%. Furthermore, we note that the program's intention to have the beneficiaries share the advice with at least four people is

<sup>1</sup> See Annex 1 for more detail on the methodology.

acceptable but low, as the lower threshold only just exceeds the minimum acceptable value. This observation is supported by the distribution of the number of farmers that the advice is shared with which is skewed and peaks at zero, indicating that there is a relatively high number of farmers not sharing the acquired advice with anyone.

Table 1. Indicators of farmers' perceptions of plant clinic services in Ghana, Kenya and Pakistan and their lower limit threshold of coverage percentages.

Indicator, The farmer has,	Ghana		Kenya		Pakistan
	Men (%)	Women (%)	Men (%)	Women (%)	Men (%)
<b>A positive impression of the plant clinics</b>	85	85	80	60	70
<b>Received advice on agronomic practices</b>	85	85	70	70	80
<b>Received advice on chemical inputs</b>	85	85	70	80	80
<b>Received advice on the same day the plant clinic was held</b>	85	80	90	80	65
<b>Received advice in time to respond to the problem</b>	85	80	55	70	65
<b>Stated that the advice implied use of less chemical pesticides</b>	85	70	40	30	45
<b>Stated that the advice implied lower costs</b>	85	80	60	40	55
<b>Stated that he/she implemented the advice</b>	85	80	85	70	70
<b>Stated that the advice solved the problem</b>	85	80	65	65	65
<b>Shared the advice with others</b>	85	85	85	45	55
<b>Shared the advice with at least four others</b>	85	55	55	25	50
<b>Stated that plant clinics are the best source of information on plant health issues <sup>1</sup></b>	85	65	65	65	65
<b>Encouraged others to visit plant clinics</b>	85	80	80	70	70

<sup>1</sup> Plant clinics were considered the best source of information on plant health issues, compared to other sources, such as radio, FFS, and other extension activities.

In **Ghana**, all men and all but three women learned first about the plant clinic via the extension agent, with three women learning about the plant clinic via other farmers. In **Kenya**, 13 out of 19 men and women respondents learned about the plant clinics via the extension agents, whereas the others (six out of 19) first learned about the plant clinics via a community event. In **Pakistan**, 14 men first learned about the plant clinics via the extension agent, two via a community events and three via another channel.

The average number of times that the respondents contacted the plant doctor in the last three years was about 14, 6 and 95 times in Ghana, Kenya and Pakistan, respectively. In Ghana and Kenya, men attended more frequently than women. In Pakistan, it was reported that it was difficult for women to attend plant clinics as they are often held in public market spaces where women are not allowed to come. The high frequency of contact moments in Pakistan is explained by the good rapport between male farmers and plant doctors. Farmers do not only attend plant clinics for specific plant health problems, but contact them regularly for various agriculture related reasons (also by phone), such as to seek advice on seed types, fertilizers, varieties, weather fluctuations, market problems, sowing, harvesting, weeding, etc.

The median of number of persons the respondents shared their advice and knowledge from the plant clinic with, was 15, 5, and 7 in Ghana, Kenya and Pakistan, respectively. In general in Ghana and Kenya, men shared knowledge with a larger number of persons than women. Less women in Kenya share advice, and often with less than four other persons, which is the assumed/desired spill-over multiplication used by Plantwise to estimate total reach. A considerable higher number of men in Ghana reported sharing information with at least four persons than in Kenya and Pakistan

### 3.2 Discussion and limitations

As mentioned above, the results for **Ghana** do not indicate that any of the beneficiary level evaluation criteria require additional attention. Based on the analyses for **Kenya**, two evaluation criteria are marked as attention areas. The first observation is that advice of the plant doctors often does not imply a reduction in the use of chemical pesticides for both men and women, which corresponds to the second observation that following the advice would often not result in lower costs for women. As third observation, we note that many female farmers do not share the acquired advice with at least four (or any) other farmers. High scores were obtained for the other criteria of this evaluation, thus no special attention is needed for these indicators. For **Pakistan**, two evaluation criteria are marked as attention areas. Firstly, similar to Kenya, the advice of the plant doctors often does not imply a reduction in the use of chemical pesticides. Secondly, similar to the case of women in Kenya many farmers do not share the acquired advice with at least four (or any) other farmers.

On the subject of advice implying a reduction in the use of chemical pesticides, it is useful to bring some nuance to the interpretation. Plantwise training and reference materials apply an IPM approach to management. When direct chemical control is deemed necessary, selection of the least toxic chemicals is promoted over those that are acutely toxic to humans. These are the so-called 'red list' pesticides. Selection of less toxic alternatives reduces the exposure of humans and the environment to these damaging chemicals. Often, when a farmer presents a pest problem, it has already advanced to a stage that biological control or other non-pesticide measures are no longer feasible and/or effective. Therefore, sometimes the only immediate option that is left is a chemical pesticide, while alternative measures can be suggested for future emergence of the pest problem. Second, the advice is based on a proper diagnosis and the pesticides recommended should be the most appropriate and least toxic one, therefore avoiding use of hazardous pesticides and experimentation with multiple types of inappropriate pesticides by the farmer. In the LQAS survey, there was no question related to whether the advice of the plant doctor implied a change in type of pesticide to be used for the problem or other non-pesticide measures. Therefore, we conclude that while there may be a problem related to the advice implying the reduced use of pesticides in Kenya and Pakistan, the survey did not allow us to provide detail on the nature of the advice or the type of pesticides recommended.

The programme has not set specific targets for coverage or response rate, rate of implementation by farmers and peer-to-peer sharing of advice and knowledge. Therefore, we can only generically indicate areas that may need attention. We subjectively chose 50% as a lower threshold value, at and under which, the indicator needs attention. It can be argued that there should be specific targets per indicator, based on what is required or realistic. For example, there can be good reasons why plant doctors do not give advice to use less chemical pesticides if that is the only solution to treat an advanced pest problem, or if a new pest emerges in a crop where little pesticide was used before (e.g. FAW pest in maize). Furthermore, the indicator that advice implied a reduction of the use of pesticides, will not explain whether the advice implied use of a less hazardous, safer type of pesticide. Unfortunately, this specific question was not part of the LQAS indicator questions and thus, this analysis does not take such nuances into account.

Several noteworthy issues were raised during the sampling and survey stage. Firstly, during data collection, it became clear that the beneficiary lists for sampling in **Ghana, Kenya and Pakistan** were not the full lists of farmers that had consulted a plant clinic in the last two years, but a sub-sample. In Kenya, it was only the queries from 2020, whereas in Ghana, the sub-sample was queries from 2020



and only for a selection of farmers of whom it could be guaranteed that they could be reached by phone. Both of these processes could lead to a sampling bias – potentially affecting results – and are methodologically not ideal. Further for **Ghana**, our consultant was not able to reach a sufficient number of female respondents in each of the initial geographical sub-samples. As such, six beneficiaries were included whose province was unknown when they were sampled. However, these decisions were made in the light of the limited time available for contacting and interviewing farmers. Therefore preference was given to sample respondents from recent queries, to ensure that the farmer in question could be contacted and could provide useful feedback related to their recent query.

## 4 Plant doctors' appreciation and perceptions of plant clinics

Interviews were held with 30 plant doctors, 10 each in Ghana (10 districts), Kenya (10 counties) and Pakistan (10 districts). For each country, five male and five female plant doctors were interviewed. Respondents were all extension agents (government staff) trained to become a plant doctor between three and eight years ago in Ghana and Kenya, and between one and five years ago in Pakistan. All plant doctors had run plant clinics for more than 12 months. Most plant clinics in Ghana and Kenya were reported to be organized every two weeks, whereas in Pakistan, plant clinics were mostly reported to be held every week. Communities and farmers were informed of plant clinics via announcements in public gatherings, mosques and churches, posters, flyers and banners, short mobile messages and phone calls to community contacts, social media platforms, radio announcements and making sure the plant clinics were held at the same day and time agreed (for instance the market day).

### 4.1 Programme performance according to plant doctors.

All plant doctors, except for one in Kenya and one in Pakistan, reported an overall positive experience with the plant clinics. Reasons for positive experiences were:

- The approach has enabled them to do their job and duties much better.
- The training and running of plant clinics has upgraded their technical skills in pests and diseases, but also in the use of digital tools.
- The demand-driven nature of plant clinics makes them feel satisfied that their services are valued and that the pests and diseases addressed are topics of high relevance for farmers.
- The plant clinic approach and location makes it convenient for farmers to attend.
- Use of concrete samples, followed by diagnosis and clear recommendation.
- The plant clinic approach is more effective and beneficial for farmers. More number of farmers can get benefit in less time. The alternative reference extension approach was not specified in responses.

Reasons for negative experiences include:

- Uptake of agricultural practices and biological solutions to pests and diseases has been low, as farmer clients prefer use of inorganic products that are perceived to offer immediate results.
- The regular responsibilities of agricultural extension agents are already resulting in a high workload, which leaves no time for running the plant clinic.
- Low literacy level of farmers and reticence of illiterate farmers to engage and adopt recommended practices.
- Farmers may prefer to go to the agro-dealers directly and do not come to the plant clinic for advice.
- No follow-up from CABI/Plantwise and no maintenance of provided gadgets.
- There is potential for public-private partnerships, however no efforts are made in this regard.

#### 4.1.1 Programme performance: Relevance to stakeholders

Table 2 shows that overall, plant doctors felt that the Plantwise programme responded well to their needs with the highest score for Ghana (8.7 out of 10) and the lowest score for Pakistan (6.8 out of 10). The plant doctors also felt that they were able to respond to the needs of farmers with scores around eight out of 10.

Table 2. Appreciation of plant doctors of responsiveness of Plantwise

Indicator of performance	Ghana	Kenya	Pakistan
To what extent does the Plantwise programme respond to your needs?	8.7	8	6.8
To what extent are you able to respond to farmers' needs?	7.9	8	8.1

Scoring scale: 1 very poor/not at all, 10 outstanding/very much.

As can be seen in Table 3, plant doctors were satisfied with the quality of information provided by Plantwise through training, the Knowledge Bank and the subject matter specialist (SMS), with relatively higher average scores for Ghana and lower average scores for Pakistan. Plant doctors mostly used the information provided by trainings to (1) run the plant clinics, (2) provide recommendations to farmers, but also (3) to simply increase their general knowledge and skills as an extension agent. However, the information provided by the Knowledge Bank and SMS were used more specifically to (1) respond to queries and give recommendations, (2) for reference and (3) to increase their general knowledge.

Plant doctors reported the following positive aspects of information sources:

- Knowledge Bank provides clear information to plant doctor and farmer (all countries).
- Training provided the skills for diagnosis and recommendations to farmers (Ghana, Kenya).
- Peer-to-peer support between plant doctors (Ghana, Pakistan).
- Responsive and good master trainers (Pakistan).
- Quality technical advice from the subject matter specialist is good (Pakistan).
- Useful training on Fall armyworm (Pakistan).

Plant doctors reported the following areas for improvement:

- Make quality tablets available and provide additional training for submitting data, sharing information and data and accessing information on the Knowledge Bank (all countries).
- Increase interaction and feedback between plant doctors and SMS (all countries).
- Provide updates from the Knowledge Bank of emerging and new pests and organize refresher trainings (all countries).
- Need for area specific information (Ghana, Pakistan).
- Need for the SMS to update his/her own knowledge regularly (Ghana, Pakistan).
- Provide a list of recommended pesticides that are locally available in the country should be including in the Knowledge Bank for referral (Ghana, Pakistan).
- Training appeared very general and needed more specific examples of pests and diseases (Kenya, Pakistan).
- Troubleshoot the applications so that data can be submitted and information found easily (Ghana, Kenya).
- Make the Knowledge Bank information available offline (Kenya).
- Improve the quality of the pictures on the Knowledge Bank information materials (Kenya).
- Provision of printed material with guidelines and pictures that are helpful in disease diagnoses, control and treatment (Pakistan).

Table 3. Appreciation of plant doctors of the information provided by Plantwise through training, the Knowledge Bank and subject matter specialists.

Information source	Ghana	Kenya	Pakistan
Training	8.9	9	7.1
Knowledge Bank	8.6	7.7	7.3
Subject matter specialist	8.3	7.5	7.4

Scoring scale was, 1 very poor/not at all, 10 outstanding/very much.

### 4.1.2 Effectiveness of plant clinics according to plant doctors

Table 4 shows the perceptions of plant doctors on the effectiveness of plant clinics as indicated by farmers' attendance, responses and advice, implementation of advice, benefits of implementation and information sharing by farmers. Except for women participation in Pakistan and not being able to give a satisfactory response by the time the next plant clinic is held in Ghana, the outcomes are remarkably similar between countries. Participation of women in the plant clinic was very low in Pakistan, which is confirmed by earlier responses from plant doctors, the fact that we were not able to contact enough women for the LQAS survey and a global Plantwise impact assessment showing that only 1% of all queries in Pakistan between 2012 and 2017, were from women (CABI, 2018. Plantwise Impact Report 2011-2018).

Table 4. Performance indicators for the service of plant clinics, adoption and knowledge sharing by farmers attendants

Performance indicators	Ghana	Kenya	Pakistan
Out of 10 farmer queries, how many are from women farmers?	4.1	4.2	1.4
Out of 10 farmer queries, how many times where you able to give recommendations immediately?	7.7	8.1	8.4
Out of 10 farmer queries, how many times were you not able to give a satisfactory response by the next plant clinic meeting?	2.7	0.7	0.7
Out of 10 farmers that you have given a recommendation, how many implemented that?	6.8	7.8	7.9
Out of 10 farmers that implemented the recommendation, how many had some form of benefit?	8.4	8.4	8.1
Out of 10 farmers, how many shared their knowledge with other farmers?	6.6	6.9	6.6
<i>Value is the average of a score from 0 to 10 out of 10 in total.</i>			

In Ghana, the number of times a plant doctor was not able to provide a satisfactory response to a query by the time the next plant clinic was held, was relatively high compared to Kenya and Pakistan. This could be related a lower frequency of plant clinics and high turnover of farmers attending the plant clinics every time it does happen. Immediate responses could be given in all countries in about eight out of 10 queries and out of 10 queries that received a recommendation, plant doctors estimated that about seven to eight times farmers implemented the advice. Out of 10 farmers who have implemented the advice, plant doctors estimated that about eight farmers had experienced some form of benefit.

Plant doctors estimated that out of 10 farmers, about seven shared their knowledge and advice with other farmers. The LQAS findings confirm this for male and female farmers in Ghana, and male farmers in Kenya, but not for female famers in Kenya and male farmers Pakistan. Additionally, plant doctors estimated a farmer who shares the advice, would do so with on average 5.4, 4.7 and 5.4 other farmers in Ghana, Kenya and Pakistan, respectively. These estimates deviate from the findings of the LQAS survey, which is not surprising given that the LQAS data showed that information sharing is highly skewed with a small number of farmers share the information with many peers, whereas a substantial group of farmers does not share the information with anyone or only a few peers. Many plant doctors also felt that men and women share their knowledge differently. In Ghana and Pakistan, plant doctors believed that men usually demonstrate their knowledge actively with practical examples in groups and public gatherings, whereas women tend to share their knowledge more as stories and in

smaller groups. However, in Pakistan, there were some conflicting statements from plant doctors, where a few stated that women share their knowledge more widely and that men only share part of their knowledge and may filter it while sharing. In Kenya, plant doctors thought that women share their knowledge more than men, because they socialize more, participate more in groups and participate more in plant clinics than to use social media and virtual means to get information.

Plant doctors in Ghana and Kenya mentioned mostly plant health rallies and field days as means to share their knowledge and advice more broadly outside plant clinics. Other means of sharing information were social media and magazines. Plant doctors in Pakistan mentioned social media as the main platform for sharing knowledge outside plant clinics, and to a lesser extent through farmer gatherings organized by extension, through mobile loudspeaker announcements and mosques, printed factsheets, TV channels and influential personalities (school principals and land lords).

### Strengths, weaknesses and unexpected results of plant clinics

While there is a high diversity of strengths, weaknesses and unexpected results mentioned by the plant doctors (see Table 5), some generalizations can be made. For strengths, the (1) demand-driven approach, (2) quality diagnostics and information and (3) actionable recommendations are mentioned by plant doctors from all three countries. General weaknesses of the plant clinic approach are that running a plant clinic is (1) tiring / time consuming, (2) dependent on well trained and well equipped extension agents and (3) low attendance and travel to the site by both the plant doctor and farmers.

Table 5. Strengths, weaknesses and unexpected results of the plant clinics, mentioned by plant doctors.

	Ghana	Kenya	Pakistan
<b>Strengths</b>	<ul style="list-style-type: none"> <li>* Advice provided by the PD is wholly demand driven with a system designed to provide timely feedback and solutions.</li> <li>* PC approach effective since farmers are given comprehensive advice on integrated pest management with the advice based on sound training and a pool of knowledge resources.</li> <li>* PDs appear to be the pride of the formal extension service.</li> </ul>	<ul style="list-style-type: none"> <li>* Demand driven nature of PC approach to extension</li> <li>* Focus on a specific topic, namely pests and diseases</li> <li>* PC provides actionable advice, and in timely manners and digital format (SMS)</li> <li>* Regularity of PC activities</li> <li>* Covers diverse crops, pests and diseases</li> <li>* PC approach applies digital technologies and integrates data to inform messaging and overall planning</li> <li>* Holding (mobile) plant clinics during market days has shown potential to attract women</li> </ul>	<ul style="list-style-type: none"> <li>* Need based technical solutions and unbiased advisory services for farmers.</li> <li>* PC facilitates enhanced interaction with farmers and their confidence to access advice.</li> <li>* PC and advice lead to reduced expenses for farmers.</li> <li>* PC enhances the knowledge of PDs.</li> <li>* Positive experience with women PDs, allowing for women farmers to access PCs.</li> </ul>
<b>Weaknesses</b>	<ul style="list-style-type: none"> <li>* Running a PC is tiring and time-consuming with low or limited attendance on some days and over time (market days, rainfall day).</li> <li>* Given the resources required, there is limited coverage or low use of the PC approach in some areas.</li> </ul>	<ul style="list-style-type: none"> <li>* Limitations of coverage since PCs are not mobile</li> <li>* PCs require that extension agents (PDs) are well, trained, equipped and facilitated to respond to demands from farmer clients</li> <li>* Initial costs of setting-up PCs are high</li> </ul>	<ul style="list-style-type: none"> <li>* Lack of equipment and infrastructure for running the PCs.</li> <li>* Challenges with transport to sites by PD.</li> <li>* Male farmers uncomfortable to speak to female PD.</li> <li>* Inappropriate seating arrangements (open air and markets) and equipment considering cultural and climatic environments.</li> <li>* Access to clinics by (women) farmers is a challenge.</li> </ul>
<b>Unexpected results</b>	<ul style="list-style-type: none"> <li>A new collaboration with YARA Ghana (fertilizer company) to provide plant health support to a fertilizer demonstration plot</li> </ul>	<ul style="list-style-type: none"> <li>* Spillover effect in terms of coverage via i) peer-to-peer sharing and ii) farmers from untargeted wards who end up participating in PCs, especially when PCs are held in market centers that draw farmers from far and wide.</li> <li>* Graduating the PC activities to county governments and adoption into workplans and budgets.</li> </ul>	<ul style="list-style-type: none"> <li>* Some farmers also seek advice on cropping patterns and other improved agricultural technologies.</li> <li>* Women PDs are inspiring role models for women farmers to get an education and aspire a career outside of farming.</li> </ul>

\* High expectations from farmer clients that the program will provide complementary inputs.

\* Initially, visitors were mostly small scale farmers, but now larger farmers are also seeking advice from PCs.

Pakistan seems to be more of an exception with a number of strong gender-related cultural constraints such as challenges for women to access/attend the plant clinics and men reluctant/unable to interact with women plant doctors and vice-versa.

Some unexpected results were reported, such as (1) a collaboration with a fertilizer company to provide plant clinic services at a fertilizer demonstration plot (Ghana), (2) spillover effects from peer-to-peer sharing between farmers and farmer visitors from far away communities at market day plant clinics (Kenya), (3) Graduation of plant clinic activities to county governments (Kenya) and (4) women plant doctors becoming inspiring role models for women farmers (Pakistan).

### Challenges encountered by plant doctors

Challenges encountered by plant doctors were many, most often related to funding for transport, equipment, data bundles and allowances (Table 6). Other important issues were poor equipment (Kenya and Pakistan), low farmer motivation and participation and broader farmer expectations. Another issue mentioned in all countries was the workload of plant doctors, who as agricultural extension agents also have many other obligations. Finally, extreme heat and poor working conditions during the plant clinic sessions were also important challenges, in particular in Pakistan.

Table 6. Challenges encountered by plant doctors.

Challenges encountered by plant doctors	Ghana # responses	Kenya # responses	Pakistan # responses
None	0	0	0
No means of transport	1	10	2
No fuel for transport	4	0	1
No IT equipment	0	0	3
No data bundle to connect (delays)	0	6	4
Facilitation (withdrawal of lunch allowance)	0	3	1
Poor equipment / kitting (umbrellas chairs etc.)	0	1	3
Extreme heat and poor working conditions	0	0	5
Low motivation and participation of farmers	3	0	1
Broader expectation from farmers (other technical, financial, input support)	1	1	0
Work load and broader expectation from employer to do other tasks	1	1	1
Poor road infrastructure	0	1	1
Other challenges in Pakistan were: No printed material provided, no technical support for IT, no refresher trainings provided, no building/infrastructure to hold the clinic, male farmers reluctant to interact with a female plant doctor.			
Numbers in country columns represent the number of times a challenge was mentioned by the 10 plant doctors in a given country.			

There was some diversity between countries in the number of plant doctors confirming that measures were in place to monitor and improve the plant clinics. Out of 10 plant doctors 10, four and only two confirmed that measures were in place to monitor and improve of the plant clinics in Ghana, Kenya and Pakistan, respectively.



Plant doctors in Ghana mentioned routine monitoring visits from district coordinators with assessments and feedback, as well as a performance-based incentive system as a good measure.

Plant doctors in Kenya mentioned occasional oversight by CABI staff and supervisors and feedback from farmer clients to plant doctors as confirming that measures are in place. Those who did not confirm that these measures were in place mentioned that (1) the system is not consistent in collecting farmer feedback, (2) targets are not keenly followed, (3) bundling services with other roles as an extension agent while collecting and submitting data is challenging and (4) there are limited surveys to measure outputs and outcomes in their area.

Plant doctors in Pakistan who confirmed that measures for monitoring and improving plant clinics were in place, mentioned that the Directorate monitors extension staff activities using the Agri-Smart application on tablets provided to the extension staff. However, the majority did not confirm that measures were in place to monitor programme performance. In addition, two plant doctors in Pakistan raised the issue of having no mechanism to monitor private companies and agro-dealers, as these stakeholders also provide advice and inputs to many farmers, which may be incorrect and biased.

### 4.1.3 Efficiency of the plant clinics according to plant doctors

When looking at efficiency, eight, 10 and five plant doctors out of 10 in Ghana, Kenya and Pakistan, respectively, stated that Plantwise and the plant clinics were complementary to other advisory services in their area. Reasons for complementarity given are that working with the district Department of Agriculture helped complement the more “supply driven and input focused” existing services and helped provide opportunities for coordination and synergy in Ghana. In Kenya a similar reason for complementarity was that the plant clinic approach “blends” well with the objectives of other duties performed by extension agents and of national and county government programs.

A reason for non-complementarity in Pakistan was that there are no working arrangements with companies and input-dealers, as they are perceived as having their own agenda to sell chemical pesticides, fertilizer and seed and have a perceived conflict of interest. A reason for complementarity in Pakistan was that farmers needs are interrelated and so naturally the plant doctors link up and refer farmers to other actors as per their needs.

## 4.2 Innovation of Plantwise according to plant doctors

According to plant doctors in all three countries, the plant clinic approach itself is the most innovative aspect of the Plantwise programme (Table 7).

Table 7. Innovative aspects of plant clinics and Plantwise programme according to plant doctors

Innovative aspects of Plantwise	Ghana # responses	Kenya # responses	Pakistan # responses
None	0	0	1
Plant clinic approach	6	10	4
Documented query and prescription for problem	1	5	3
Access to quality information	1	0	4
Access to Knowledge Bank	2	0	1
Profiling of extension agents as plant doctors	0	1	1
Use of digital tools / e-plant clinics	0	1	1

Before Plantwise, there was no such thing as a clinic for farmers to attend to address issues around plant health, with the only familiar concept being human and veterinary clinics. Other important innovative aspects of the Plantwise programme mentioned by plant doctors were (1) a documented

query and prescription, (2) access to quality information, (3) access to the Knowledge Bank, (4) profiling of plant doctors as special, high quality extension agents and service providers and (5) the use of digital tools (e-extension).

### 4.3 Benefits of plant clinics to farmers, according to plant doctors

The most important benefits to farmers of attending plant clinics according to plant doctors in all three countries were that plant clinics provide access to knowledge, increased yield and increased income (Table 8).

It should be noted that while benefits for men and women farmers are very similar in Ghana and Kenya, there is a strong difference between benefits to men and women farmers in Pakistan, with women hardly benefitting at all from the plant clinics, because of the very low participation of women in plant clinics – except for a few plant clinics run by women plant doctors, with a mention of specific advice for home vegetable gardening for women. This is another reminder that gender norms and traditions in societies like in Pakistan prevent women from accessing agricultural information in general and plant health services in particular. It appears that the plant clinic approach has not been designed to address and change gender inequalities and as such, it is not surprising that these have not changed in Pakistan in relation to the Plantwise programme.

Table 8. Benefits for farmers from plant clinics organized by plant doctors.

Reported benefits of plant clinics	Ghana # responses		Kenya # responses		Pakistan # responses	
	Men	Women	Men	women	Men	Women
No benefits	0	0	0	0	0	1
Access to knowledge on plant health, pests and IPM	5	4	8	8	5	0
Reduced pesticide use	1	1	0	0	2	0
Reduced losses of yield	1	1	0	0	2	1
Increased yield	2	3	2	2	3	0
Increased income	1	1	3	2	1	0
Other: quality of produce	0	0	1	1	0	0
Other: No or very little women farmers attend	0	0	0	0	0	2
Other: Benefit from specific advice on home vegetable gardens	0	0	0	0	0	2

When looking at the benefits from community events, we notice a similar general result (Table 9), but with community events having slightly more mentions of benefits for women attendants in Pakistan. This may be linked to a higher level of attendance of community events by women, as compared to plant clinic sessions that are often located in market places that women cannot access.

Table 9. Benefits for farmers from plant rallies organized by plant doctors

Reported benefits of plant health rallies	Ghana # responses		Kenya # responses		Pakistan # responses	
	Men	Women	Men	Women	Men	Women
No benefits	0	0	0	0	1	3

Access to knowledge on plant health, pests and IPM	8	7	4	4	4	1
Reduced pesticide use	0	0	1	3	2	2
Reduced losses of yield	1	1	5	6	2	1
Increased yield	1	1	5	2	1	1
Increased income	0	0	3	3	1	1

In all countries, some plant doctors thought that men and women benefit in a different way from plant clinics. Reasons given for different benefits were that men tend to have more weight in decision making on agricultural practices and tend to take more risk with new technologies. For Pakistan, it was mentioned that men will benefit for the large fields for arable crops and vegetables, whereas women will benefit on their small, kitchen garden plot for vegetables and tree crops.

#### 4.4 The impact of COVID-19 and suggested responses from plant doctors

All plant doctors in Ghana and Kenya and six out of nine plant doctors in Pakistan reported negative effects of the COVID-19 crisis on the functioning and performance of plant clinics, which in many cases had been (temporarily) halted. The factors and reasons contributing to reduced frequency of the plant clinic sessions and low attendance included:

- Fear of becoming infected, leading to (1) the cancellation of activities whenever the means needed to observe the safety protocols are lacking and (2) low farmer attendance rates.
- Accessibility of plant clinics and mobility of plant doctors hindered following guidelines requiring extension officers to work from home, and especially so the aged.
- Government (temporary) restrictions on gatherings and lockdowns in all countries, leading to reduction or even cancellation of plant clinic sessions for prolonged periods, mostly between March and June. In many cases, activities appear to have resumed in the countries, taking into account the safety recommendations and measures to avoid COVID-19 infection and spread.

The following suggestions were made by plant doctors to maintain advisory services during the COVID-19 crisis:

- Avoid large gatherings (plant rallies and community events) and plan plant clinics in such a way that few farmers are present at the same time.
- Follow recommendations and precautions to avoid infection and provide protective gear and equipment (face masks, hand sanitizers, washing stations etc.) for plant doctors to run plant clinics safely and farmers to protect themselves.
- Educate farmers about COVID-19 and measures to prevent infection and adhering to these as a condition for attending a plant clinic.
- Plan and try out different ways of running plant clinics to avoid large numbers of farmers aggregating around the plant clinic (mobile clinics, rotation etc.).
- Avoid the running of plant clinics by plant doctors over 50 years of age, as they are a vulnerable group.
- Resort to mass media dissemination methods (such as radio, television and video) to reach out to many more farmers and use phone calls and social media messaging such as WhatsApp as an alternative to face-to-face meetings.

Plant doctors also suggested to include plant clinics and related activities in national, regional and district work plans and budgets in order to sustain the gains made by Plantwise and to further reach unserved or new areas. Further suggestions were to include audio-visuals (short videos) in future trainings and reference manuals and a need to train and refresh all agricultural extension agents.

## 5 Most significant changes perceived by stakeholders

### 5.1 Responses from the most significant change stories in Sprockler

An online survey tool (developed by Sprockler) was used to collect most significant change (MSC) stories from key informants and plant doctors. From 53 responses out of about 120 invitations sent, eight key informants and seven plant doctors from Ghana, seven key informants and two plant doctors from Kenya, 15 key informants and eight plant doctors from Pakistan and six key informants from the global level responded. The figures below are a selection of extracted figures and quotes from the automated, interactive online database. The information obtained by this method is complementary to the other information sources, in that it allows for prioritization of the MSC subject by the participants and classification of the MSC stories by participants themselves. They classified their own story as to how it relates programme performance, more specifically relevance, effectiveness and efficiency and benefits to stakeholders.

### 5.2 Performance the Plantwise and Action on Invasives programmes from most significant change stories

As can be deduced from Figure 1 **Error! Reference source not found.**, the most valued components of the Plantwise and Action on Invasives programmes were (1) capacity building and technical expertise of plant doctors, (2) a system to detect and respond to emerging and invasive pests and diseases and (3) the impact the programmes had on farmers. Demand-driven advisory services were much appreciated by respondents from Pakistan.

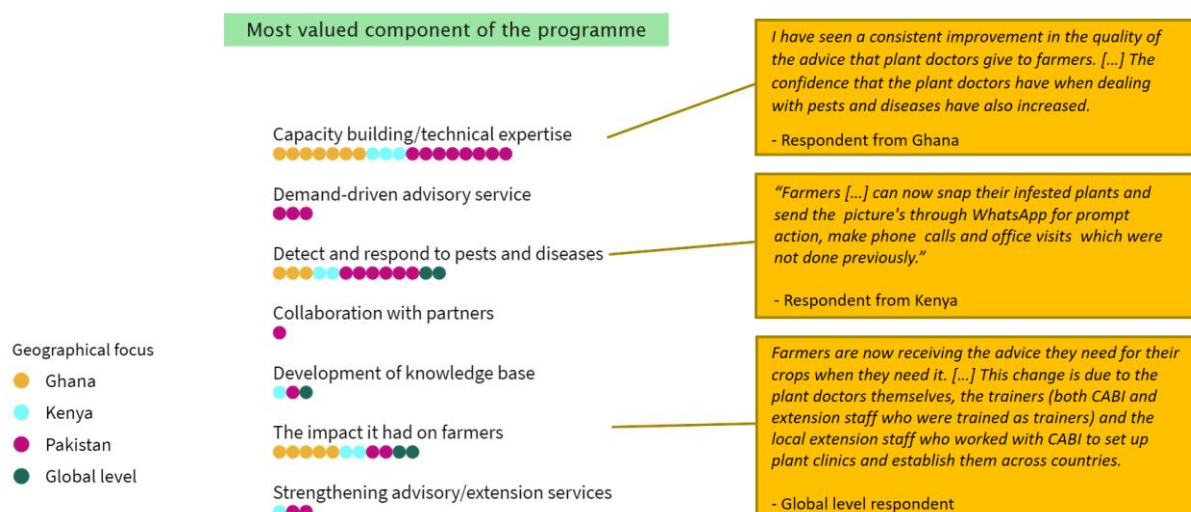


Figure 1. Most valued components of the Plantwise and Action on Invasives programmes emerging from self-analysis and categorization of authors of the most significant change stories.

The MSC stories are pretty much equally distributed over relevance, effectiveness and efficiency, three key measures of programme performance (**Error! Reference source not found.**). This means that changes have taken place that are relatively equally distributed over these three indicators of programme performance. The captions are quotes from the MSC stories and/or remarks related to the ordering of the MSC story.

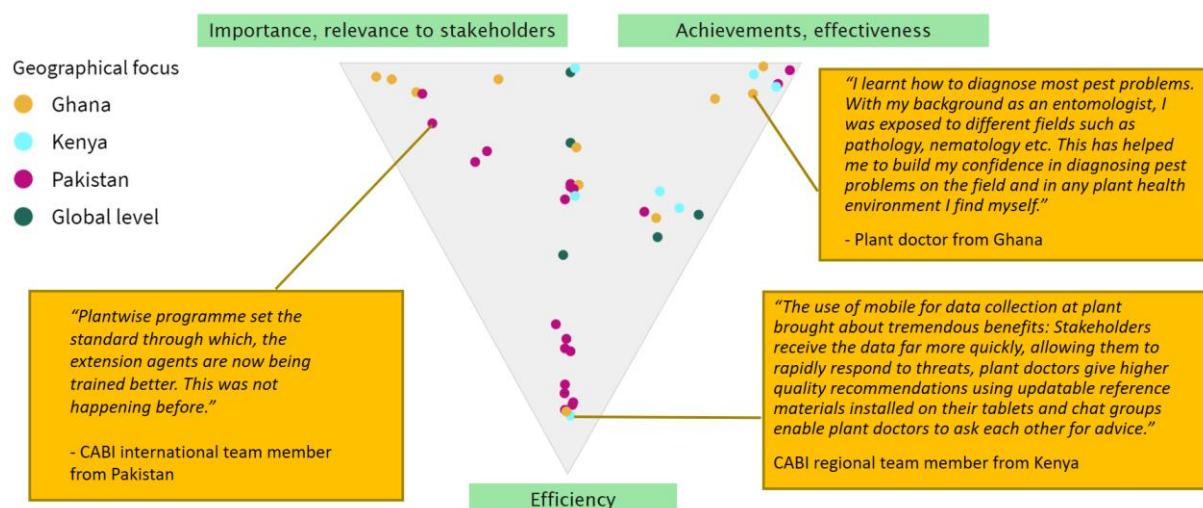


Figure 2. Tripole mapping of MSC stories by respondents towards relevance, effectiveness and efficiency of the programme.

### 5.3 Frequency and appreciation of change

**Error! Reference source not found.** shows that changes described are largely positive and that some occur often and others occur rarely. There does not seem to be a clear relation between country geographical focus of respondent and the nature of the change described.

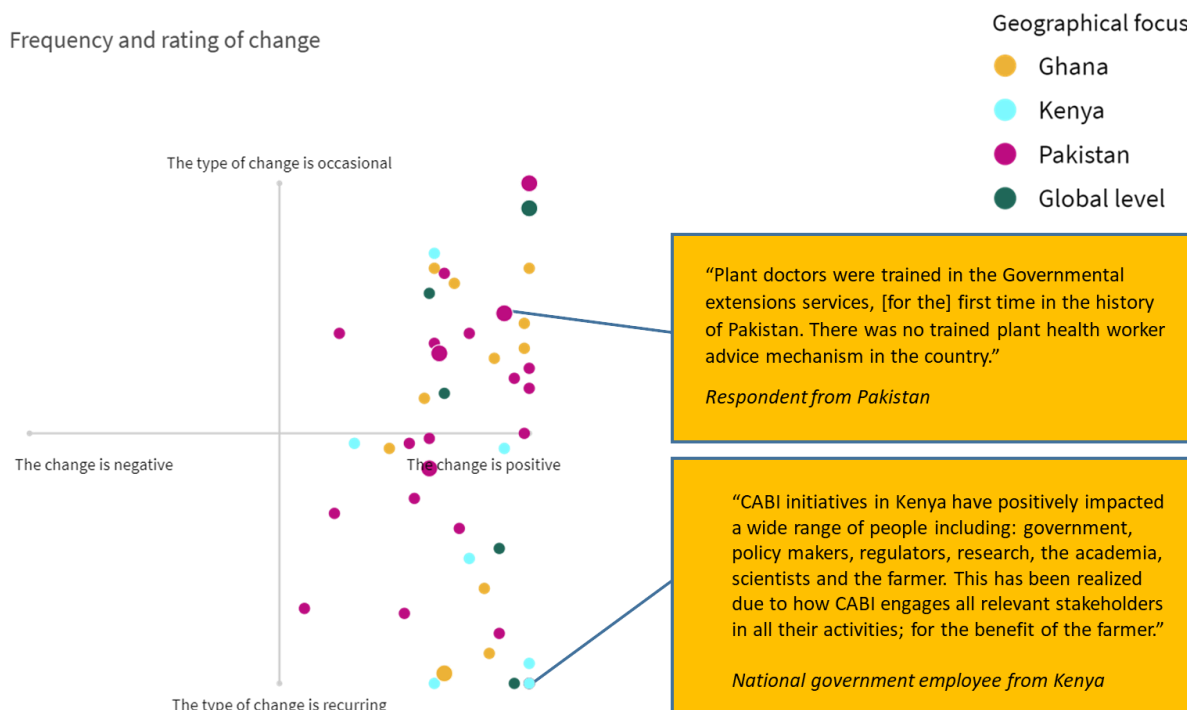


Figure 3. A four quadrant ordering of the MSC stories by respondents according to frequency of the change and whether the change was negative or positive.

Respondents only reported positive changes and they associated the stories with positive emotions such as inspired, hopeful, happy, empowered and connected. Most reported change stories had taken place in the last one to three years.

## 5.4 Sustainability of change and the impact of the programmes

**Error! Reference source not found.** shows that most changes described in the MSC stories are perceived to be lasting in the long term and that the programmes were essential to drive the change. This and the results in **Error! Reference source not found.** shows that the programme has been a driver of lasting positive change, according to most of the respondents.

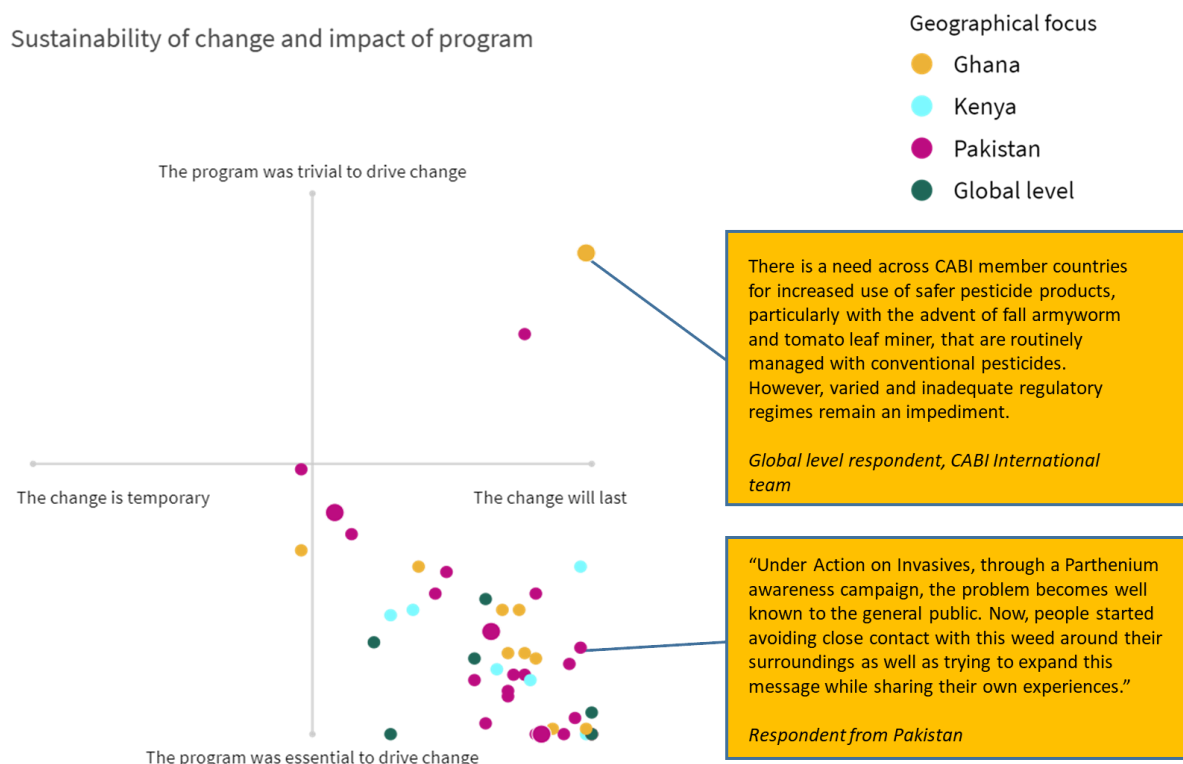


Figure 4. A four quadrant ordering of the MSC stories according sustainability of the change and the extent to which the programmes were essential to drive the change.

The results of the Sprockler analyses give us some additional insights, namely which were the most appreciated components of the programmes, and that some respondents have other priorities for the Plantwise and Action on Invasives programmes than others. The figures also show that many changes mentioned are positive, recurring and lasting and that the programme was essential in driving the change.



## 6 Key informants' perceptions of Plantwise and Action on Invasives in relation to other information sources

In this section, a synthesis is provided based on the information obtained from key informant interviews (KIIs), CABI publications and other literature. In addition, these information sources are triangulated with the information obtained from the farmer LQAS survey, the plant doctor survey and the most significant change stories to draw conclusions for each of the evaluation questions.

CABI staff at the global and the country level provided lists of key informants and their contact details, which were mostly CABI staff and collaborators from implementing partners (government and research institutions) in the case study countries. Key informants were interviewed according to the main evaluation questions as stipulated in the terms of references for the evaluation and described in It appeared challenging to arrange remote interviews with external stakeholders, such as private sector and farmer organization representatives, within the short timeframe of the evaluation, resulting in an under-representation of these stakeholders. Interviews were held with 51 key informants from the global (20), country (12) and local (19) level, not taking into account plant doctors and farmers. The vast majority of key informants were CABI (22) and government (19) staff, with only a few respondents from research (4), NGOs and private sector (6). In addition, two global experts (external to CABI) were interviewed.

### 6.1 Programme performance: Relevance to stakeholders

#### 6.1.1 To what extent do the programmes respond to the needs of different stakeholder groups?

##### **Stakeholders at the national level**

The manner in which Plantwise and later Action on Invasives has engaged stakeholders in the countries has been participatory and assessed the needs of the plant health system, setting up a national steering committee (NSC) and plant clinic coordination clusters at the district, county and province levels. Some respondents mentioned that the process was not always fully participatory in the early beginning, but that over the years the process has very much improved.

Decisions made by the Plantwise programme board led to a prioritization of interventions in communication with the countries through the NSC. In some countries, there is a very strong engagement commitment of the NSC, whereas in other countries this is less the case. Examples of strong ownership and an active NSC are Rwanda, Malawi and Mozambique, where the programme is able to run even without a CABI in-country presence. Other countries with a good engagement from national partners are Ghana and Kenya. The Plantwise programme was initiated in 12 African countries from 2009 to 2013, but due to several challenges (including problematic financial reporting in some countries), it was scaled down in Tanzania, Sierra Leone, DRC and Burkina Faso in recent years.

Specifically for Action on Invasives, the programme was designed to assess and focus on the needs of stakeholders, building on and complementing the Plantwise programme and working in areas that Plantwise was not able to fully address (for instance policy, detailed research on (biological) control of invasive species, preparedness for invasive species and national and local responses to outbreaks of

invasive species). Some prioritized species through the assessments with the NSC and stakeholders were FAW across Africa and recently in Asia, Tomato leaf miner (Ghana, Kenya and Zambia), *Cuscuta* spp. (parasitic weed on avocado, citrus, coffee), Citrus greening disease (Kenya), papaya mealybug (Kenya) and *Parthenium* weed (Pakistan). As a result of this relevance, there is strong engagement from government, research, and other relevant partners.

Overall, government partners in plant health and research from Ghana, Kenya and Pakistan are very satisfied with the Plantwise programme and find it relevant, because it filled a gap in several aspects, namely by (1) providing Plant Protection Directorates and Extension Directorates with an approach and adapted infrastructure to deliver plant health services to farmers, (2) data collection and surveillance system for plant pests and diseases (POMS), which did not exist before Plantwise, (3) training and supporting extension agents to do diagnosis and provide up-to-date, appropriate recommendations based on scientific evidence from the Knowledge bank (4) monitoring the work and providing feedback to plant doctors through analysis of queries submitted by plant doctors and analysed at district, region and/or national level.

*“Yes, it really addresses the needs of MoA. We did stakeholder analyses and every player was able to have a say in what data needs to be captured. In the future the programme can only become better. We are discussing at a national level to implement Plantwise in all 47 counties (from 27 today). Then we can address food security, as we will better prevent pests, and have real impact.”* MoALFI staff, Kenya, confirming the relevance of Plantwise.

There are multiple examples of the relevance of Plantwise, the most striking being that FAW was first officially identified and detected through plant clinic queries in Ghana, Kenya and Pakistan. In fact, the arrival of FAW and its destructive impact at scale in countries during the Plantwise programme has confirmed the relevance of addressing pests and new invasive species and thus the relevance of the Plantwise and Action on Invasives programmes.

*“We know that plant clinic data is used in many ways. For instance to monitor pests, for PhD research ends in Ghana and Kenya, and activity monitoring and reporting. In Kenya, data on FAW was used in Trans Nzoia county to decide to mobilize funds for control. The POMS database also allows technical partners to assess the ability of plant doctors to diagnose and recommend practices and take corrective action where necessary.”* Global CABI staff, Plantwise.

*“Data is collected and feeds into the national system and research, which then feeds into the Knowledge Bank. People are now aware where they can access information when they need it and participating countries are very happy.”* External global expert.

*“As a nation it is difficult for us to put figures behind the problems we face, for instance in the case of FAW. The data that was made available was good for convincing politicians and decision makers.”* Government directorate of MoFA, Ghana.

In the context of food security in Pakistan, the Plantwise programme is relevant because it has contributed to the government's goals of increasing production of staples such as maize, rice and wheat. Maize is an important crop in Punjab and farmers tend to use hazardous chemicals to kill pests. This not only affects the quality of grain but also that of water due to chemical leaching. Given that 60% of the maize producers are subsistence/smallholder farmers, the programme's emphasis on promoting the use of low cost cultural practices and bio-pesticides has proven to be of great value to improving the productivity and safety of food crop produce and subsequently livelihoods of the small farmers. In addition, plant doctors were trained, encouraged and monitored to recommend least toxic pesticides and discourage the use of red-list pesticides. This is equally relevant in Ghana and Kenya.

### **Stakeholders at the district, county and province level**

The plant clinics are relevant for the Departments of Agriculture at sub-national level, as they respond to the need to improve coverage and quality of agricultural extension services with a concrete approach that integrates (1) capacity building of extension agents, (2) improved and documented services to farmers, (3) a data collection and monitoring tool (POMS) that can assess the quality of the services and collect real-time data on pest incidences and (4) a system that allows for the development of new knowledge that can be made available to plant doctors and farmers at scale (Knowledge Bank). There is ample evidence from Pakistan, Ghana and Kenya of the use of data and knowledge at these sub-national levels and linkage and feedback between plant doctors, clusters and national level actors from both research and the Ministry of Agriculture.

### **Stakeholders at the community level: Plant doctors and farmers**

The intermediary and ultimate beneficiaries of the Plantwise programme are the plant doctors and the farmers that attend plant clinics or are informed via other means (fellow farmers, plant rallies or mass media messages) about the advice from plant clinics. For the plant doctors the most important aspect of relevance of Plantwise is capacity building, access to quality information, the POMS system and the Knowledge Bank. The tablet-based work allows for easy data entry, access to the Knowledge Bank and the peer-to-peer support through social media platforms (WhatsApp, Telegram) that are experienced as very positive.

*"I learnt how to diagnose most pest problems and was exposed to and learned about new pests such as nematodes and disease. This has helped me to build my confidence in diagnosing pest problems on the field and in any plant health environment I find myself."* Plant doctor Ghana.

According to key informants at the global and national levels, the advice and recommendations from plant clinics that reaches farmers directly and indirectly is relevant as a result of the demand-driven nature of the plant clinic approach. Several plant doctors' testimonies and the LQAS survey seem to confirm this. The Plantwise programme initially did not have a specific gender strategy and male farmers dominated as plant clinic attendants. A recent assessment has made some suggestions to address gender differences in access, relevance and implementation of plant clinic advice. In terms of reaching male and female farmers of different ages, some efforts have been made. For instance, Ghana has a low proportion of female extension agents, which often results in a bias towards providing services to male farmers. This was confirmed by a recent assessment on gender (Terefe, 2020). Despite efforts by the Plantwise team to include more women as attendant of plant clinics, for example to organize women-only groups and planning mobile clinics, women participation at the national level has not changed much and varied between 22% in 2013 and 34% in 2016 and 2017 and is currently about 30%. However, this level of participation by women is far higher than the levels of participation by women farmers in conventional extension activities estimated at about 2-5% (Williams & Taron, 2020). Interestingly in Ghana, women were less likely to ask advice for maize and tomato than men and more likely to ask for advice for cocoa than men, a crop that is considered male dominated. It appeared that in general, men and women made queries about the same crops, contributing to evidence against the existence of typical men and women crops in Ghana. Based on 2019 plant clinic query data, it was estimated that about 4,267 out of a total of 9,892 queries (43.1%) were from youth, under 35 years of age<sup>2</sup>, and that out of 9,601 queries, 2,856 (29.7%) were from women (Plantwise in Ghana, 2019).

The extreme case of low attendance of plant clinics by women is Pakistan, with only 1% queries between 2012 and 2018 submitted by women. The recently adopted approach of specifically training women as plant doctors and to have women-only plant clinics is a start to resolve low attendance and adapt to cultural barriers that prevent male plant doctors interacting with female farmers and vice-

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<sup>2</sup> Plantwise results for DGIS 2019. Presentation.

versa. This will allow for increased participation of women and may even bring about some change in gender norms as these plant doctors are an inspiration for women farmers to pursue a career outside farming.

One aspect that makes the plant clinics less relevant currently is that they are not set up to provide bundled services (e.g. direct linkage to products related to the advice and provision of services). This aspect of farmer expectation for a “quick fix” or immediate access to a tangible product that the plant doctor cannot provide, is a problem that needs to be addressed. There are some indications that a response is being sought in Kenya and has evolved in China (linkage of plant clinic prescriptions to a subsidy scheme for appropriate, less hazardous plant protection products). It is obvious however that stronger linkage and collaboration with the private sector is necessary and will increase the relevance and sustainability of Plantwise in the future.

*“Why don't we bring in and present the views of the farmers. The impact assessments are convincing and trustworthy, but what we would like to see is whether the farmer is supported the way he/she is expected. Through the plant clinic system, we could identify needs of farmers, and a more packaged service could improve the impact of Plantwise. For instance, we can link up to other programs, with agro-dealers and subsidy schemes.”* External global expert.

*“We need to create more awareness because only a few agro-input dealers are aware of the Plantwise intervention. We also need to make a better link between farmer clients of the plant clinics and agro-input dealers for their supplies”* Agro-dealer, Ghana

#### **6.1.2 To what extent does the data collected through the programme respond to the information needs of different stakeholder groups?**

In terms of data use, an example from Kenya describes how data capture and use was planned, and who is using which type of data. In Kenya, stakeholder consultations provided the space for interested parties to express what data should be collected at plant clinics and how it can be used. This was confirmed in all KIIs, and is apparent in internal documents. The data uses include being able to know (1) trends in pest and disease prevalence per crop (2) season-specific pest incidences, (3) gender-disaggregated data on persons visiting clinics (4) which days and time farmers visited, and distance to plant clinics (5) feedback from farmers on availability and efficacy of prescriptions (6) newly recorded pests and diseases and (7) priority research areas. Data uses are relevant to the needs of each stakeholder, as summarised below:

- Extension staff: monitor pest outbreaks and develop targeted extension messages
- Plant doctors: identify and better plan to address common crop problems
- Research institutions and universities: focus their research to address emerging problems, develop appropriate curricula, and develop new prevention and curative strategies
- Regulation: monitor use and efficacy of inputs, surveillance and vigilance
- Agro-input manufactures and dealers: monitor efficacy of existing chemicals, appropriateness of use and need to develop others
- Politicians: monitor threats to food security to advise on policy

While this description is almost “too good to be true” and reality may be less ideal, most aspects and examples of data use were also confirmed by respondents from Ghana and Pakistan, with the exception of agro-input manufacturers, and to a lesser extent agro-input dealers, as users.

#### **6.1.3 What are the lessons learned that have helped or are expected to help guide decision making and planning of subsequent in-country activities and/or programmes?**

Some key lessons learnt have been mentioned at the global and national levels, namely:

- Valuable skills have been learnt by a large group of extension agents, which are useful in establishing plant clinics and in other activities of extension agents.

- The migration to tablet-based data collection and services, in combination with the social media platforms, have accelerated data and information sharing and allows for peer-to-peer support and problem solving, while only the most difficult problems are referred to subject matter specialists and researchers.
- Cluster meetings, monitoring visits and feedback from validation of queries allow for the plant doctors to be monitored, improve their services and stay engaged in the programme and data collection.
- There is a strong need for sustainable collaboration with and commitment from governments at the national, regional and district level and other partners mainstreaming and budgeting for the Plantwise and Action on Invasives activities.
- Good partnerships are essential for institutional anchoring, national ownership and achieving scale and sustainability.
- With the short time frame of Action on Invasives it was essential to build upon existing infrastructure and tools, following principles of digital development, reuse and improve on existing tools.

It was also felt that Plantwise and Action on Invasives can continue to be relevant in the future with new tools (such as the horizon scanning tool and the use of artificial intelligence/machine learning for cleaning and validating submitted queries and possibly photo-interpretation) and improvements of existing tools (Knowledge Bank, ISC, POMS) and the applications for plant doctors.

### **Conclusions for programme performance: Relevance to stakeholders**

The Plantwise and Action on Invasives programmes are very relevant to all stakeholders interviewed (farmers, agriculture extension agents, government extension from local to national level, plant protection services and other government stakeholders, researchers, NGO's and development partners intervening in the agriculture sector as well as private sector actors). Unfortunately, we were not able to contact representatives from farmer organizations in the case study countries as few (if any) contacts were provided and we were not able to contact these stakeholders.

We conclude that private sector (mostly local agri-input dealers and service providers) and farmer organizations were not sufficiently involved and engaged in the case study countries. In addition, there is a lot of interest from in-country NGOs and development partners to integrate plant clinics or components of the Plantwise and Action on Invasives programmes into other initiatives and programmes. This constitutes an opportunity for new and improved partnerships, resource mobilization to increase coverage, scale and impact of the programmes.

## **6.2 Programme performance: Effectiveness**

### **6.2.1 To what extent have the expected results been achieved so far?**

The Plantwise indicators related to outputs of the programme at a global level, include only two targets: total number of plant clinics and countries, namely 1,465 plant clinics in 40 countries, and total number of national trainers (100). KII data confirm that the focus of the coordinators and stakeholders is on output level targets, which are not specifically set at national levels. This can be regarded as a major shortcoming in the management of the programme. One reasonable explanation from one key informant is that achieving results is very dependent on each county/district/province government and budgets, more specifically on their willingness to integrate plant clinics into their agricultural strategies and attempts to obtain funding from the national government.

The CABI Plantwise Monitoring and Evaluation (M&E) strategy (CABI, 2016, p.25) mentions more output indicators related to (i) National networks of plant clinics established, (ii) Innovative linkages between key actors established, (iii) Data and information management tools, content and processes developed, (iv) Comprehensive Knowledge Bank developed, and (v) M&E schemes implemented.



Analysis of programme documents (from Ghana, Pakistan and Kenya and global annual reports) and KII data builds a better picture of the programme objectives (named milestones in the Plantwise annual reports). These are split into (i) General, (ii) Knowledge Bank, (iii) PHS Development, (iv) Monitoring, Evaluation and Learning, and (v) Fund raising and market development. However, the milestones are not translated into country-level targets. The M&E strategy (published in 2016) presents the global framework used for measuring achieved outcomes and impact, but also in this document no targets are set at country level (CABI, 2016, p.7; log frame was updated in 2017) :

Impact: Adoption of the Plantwise approach enables male and female farmers in Plantwise countries to lose less crops through increased productivity and income.

1. Change in crop loss through reduced pest damage
2. Change in pesticide use
3. Change in male/female farmers' crop productivity
4. Change in male/female farmers' household level income
5. Number of countries adopt the Plantwise approach, with more integrated extension response and delivery, diagnostic services' and use of plant health information and data for management strategies

Outcome: Agricultural institutions and organisations' capacity to strengthen plant health systems sustainably increased, using the Plantwise approach within their country.

1. Number of countries that have incorporated plant clinics into national extension strategies and budgets to sustain them.
2. Number of countries using data from plant clinics and other PWKB information to inform operations that improve plant health management
3. Number of new or re-emerging plant health problems identified rapidly through Plantwise-related activities, prompting management responses
4. Number of male and female farmers received appropriate, timely and locally relevant information and advice on plant health through plant clinics, complementary extension methods and farmer-to-farmer sharing
5. Percentage of female and male farmers adopt improved agricultural technologies and practices having received extension advice through the Plantwise approach

Having seen these global-level impact and outcome indicators, it was not always clear how these translate into concrete indicators and targets at the country level. It was confirmed that there were no targets for annual country-level indicators for Ghana and Kenya, but that activities were prioritized according to the annual global indicators. It appears that this is a major challenge for evaluating advancement of individual countries. Having said that, it is also difficult to make yearly, let alone multi-year country targets when the implementation and funding is dependent on commitments of a dynamic consortium of partners, such as many district / county governments, national government programmes and directorates, development partners and in-country donors, in addition to funding from the CABI Plantwise and Action on Invasives programmes.

The extent to which objectives have been achieved varies from country to country. Initially there was no major baseline survey, so the programme depended on retrospective assessments that vary in rigour, from Randomized Control Trials (RCTs), other experimental designs, donor commissioned evaluations, special studies on specific outcomes and impact related topics and internal evaluations (CABI 2016, Plantwise strategy for M&E and social research 2015-2020) often comparing users of plant clinics to non-users in the same area or neighbouring "control" areas. In terms of impact, several studies have shown that yields and incomes from specific crops of plant clinic users were significantly higher compared to non-users through adoption of advice and a reduction of pest incidence and damage. Increased income was often determined by a value of increased yield and/or reduced production costs through, for instance, reduced cost of pesticides and spraying services.



### **Evidence of achievements of impact in Ghana**

Despite ample evidence of the effectiveness of the programme to increase yield and income for farmers in other countries (Kenya, Rwanda, Pakistan), a recent evaluation with robust evidence for positive changes in Ghana is lacking. One study assessed knowledge and adoption of IPM practices, yield and income of plant clinic users versus non-users (Silvestri & Musebe, 2016). The study showed that plant clinic users were better able to identify signs and symptoms of pests and diseases and cited and adopted more IPM options (mostly organic pesticides in combination with early planting, use of resistant varieties and time of weeding). However, non-users outperformed users for yields of groundnut and cowpea, but not maize, while net value per hectare for groundnut, cowpea and maize appeared higher for non-users, although differences were not statistically significant. It was concluded that more quantitative research was necessary to allow for a more conclusive evaluation.

### **Evidence of achievements of impact in Kenya**

An impact evaluation study was performed by the American Institutes for Research (AIR), targeting Plantwise activities in Kenya (2018). CABI published an impact report focused on Plantwise outcomes and impacts achieved between 2011 and 2018 (CABI, 2018), and a working paper covering Kenya's plant clinics and how they can be integrated into the national agricultural advisory service systems (Chege, et al. 2020). When asking about Plantwise' effectiveness in terms of yields and incomes, the key informants from CABI and MoALFI always referred to the AIR study's positive results on these outcome and impact level indicators.

The AIR assessment conducted interviews with 2,800 households, equally distributed between 90 Kenyan sites with active plant clinics, at three moments in time: 2014, 2015 and 2017 (AIR, 2019, p. 19). The study explicitly shows that the benefits of the programme outweigh the costs of its implementation, with a cost–benefit ratio of 1:3 and an internal rate of return of 58% (by comparison, a 2019 study from Pakistan gives corresponding figures of 1:1.2 and 28%, respectively). The difference between the findings can be attributed to the socio-economic contexts and administrative systems within which Plantwise is implemented in the two countries, the study designs used for each country and the choice of crops that were targeted for data used to derive the programme costs and benefits (CABI, 2020. Plantwise Annual Report 2019, p. 9).

The AIR impact evaluation found that farmers in plant clinic catchment areas in Kenya were 4 percentage points more likely to use different agronomic practices than those in areas with no plant clinic. Farmers were also 6 percentage points less likely to prefer chemical pest control compared to the control group, and 7 percentage points more likely to avoid chemical drift when spraying, and they showed a decrease in pesticide use on perennial crops. Yields of maize plots increased with 13% on average in clinic areas (both users and non-users) (CABI, 2019, Plantwise Annual Report 2018 p. 28).

### **Evidence of achievements of impact in Pakistan**

With regard to overall effectiveness, the external evaluation commissioned by CABI in Pakistan indicates that as a result of the programme, farmers who attend plant clinics are applying good agricultural practices, have reduced use of red-list pesticides, had a higher value of production per acre and increased net income (AIR, 2019, Impact Assessment of Plantwise-Pakistan).

### **Perceptions of key informants on achievement of expected results**

Key informants at the global level and in Ghana, Kenya and Pakistan are unanimously very positive about the likelihood of Plantwise achieving the set objectives (e.g. stakeholder collaboration, establishment of plant clinics, plant doctor capacity development, reducing crop losses and increasing income of farmers, countrywide surveillance).

*"We have substantial evidence of improved practices, often leading to increased yields and incomes from rigorous evaluations by AIR in Kenya (very strong) and Pakistan (less so) and from other countries with quasi-experimental studies. For land area under sustainable practices we started using*

*this indicator later when DGIS started requesting it. Fortunately the data collection from the plant clinics is pretty rigorous and we were tracking land size of the field related to queries in question. We assumed that if a farmers apply the practices recommended, the area would be under sustainable practices (IPM focused).*” – CABI Plantwise, global staff.

Despite the lack of recent impact assessments and quasi-experimental studies in **Ghana**, the (anecdotal) evidence from KIIs, plant doctors and farmers all suggest that there have indeed been positive impacts on adoption of IPM practices, yield and income (see section 3.3 “Benefits”). While coverage of plant clinics is far from complete, it has increased significantly over the years with in 2019, nine out of 10 regions and 96 out of 216 districts being covered (44%).

Regional key informants from **Kenya** reported that, in their view, the Plantwise programme has resulted in higher yields and reduction of crop losses though all acknowledge that there is no consistent data collection at district level. Their conviction is thus largely based on anecdotal evidence; the following examples were shared by three different district coordinators to support their positive perception:

*“Invasion by pests (fall army worm) affected yield gains that were projected, but the food losses that were prevented were significant. The program enabled a good response that minimized losses (our estimates show maize losses were reduced from 30% to 8-12% in 2017, and 2-4% 2019).”*

*“As an example, Irish potato yields in wards covered by plant clinics were higher than in those not covered. Generally there is no hard data.”*

*“We see high adoption rates and performance in yields in the served wards compared to non-participating wards.”*

According to the implementing partners in **Pakistan** at the provincial level, Plantwise has contributed to making smallholder agriculture in Pakistan profitable for smallholder farmers. Major results of the programme are:

- Significant decrease in excessive, haphazard use of pesticides not only by farmers visiting the clinics, but also by virtue of a multiplier effect.
- Decreased application and/ or reduced use of pesticides has resulted in reduction in cost of production. Farmers are more aware of ‘pre-harvest application intervals’ thereby reducing residues.
- Farmers applying prescriptions given by the plant clinics report that the quality of their produce especially vegetables has improved and their produce has more export value.
- There is a significant reduction in crop losses, although it varies per crop. For example:  
*“in Gilgit/Baltistan (GB), earlier farmers reported over 80% loss in apples due to severe moth attacks, this was brought down to 30% with better quality, by promoting use of pheromone traps through the plant clinics”* – Department of Agriculture staff, Pakistan

### **Sustainability of the Plantwise programme**

It is acknowledged that the long-term wide coverage, sustainability and legacy will depend on whether district and county governments, as well as national government organizations and other partners, will continue to support the plant clinics or not. In that light, a key milestone in the Plantwise programme is to move countries from “consolidation phase” (with funding and strong support from Plantwise), to “scale-up phase” (with more and more engagement and commitment from the national partners) to the final, “sustainability phase” which implies full commitment of governments and partners to take on the costs and responsibility of the Plantwise programme in the country. This implies for instance, training of plant doctors, establishing and running the plant clinics, including all operational costs, organizing and managing the NSC, organizing district or county coordination and meetings and managing the

databases. In 2019, Ghana and Kenya were in the scale-up phase and Pakistan was in the sustainability phase. With the withdrawal of funding support for operational cost for the plant doctors and NSC meetings, we can assume that Ghana and Kenya are currently transitioning into the sustainability phase.

In Ghana in 2019, there was significant co-investment from the Modernizing Agriculture in Ghana (MAG) program, the Market-Oriented Agriculture Program (MOAP), Kuapa Kokoo (cocoa sector) and NGO Solidaridad MASO of a total of GBP 50,648 (CABI 2020, Plantwise Annual Report 2019). However, the investment from the district governments in-kind and for operational costs was not specified, which would have likely been substantial.

In Kenya in 2019, six county governments invested a total of KES 1.5 Million (GBP 10,200) in plant clinics to cover expenses on equipment (e.g. banners, umbrellas, furniture) and running costs (e.g. fuel, data bundles), and on training of plant doctors. Key informants indicated though that less funding was now available to support the plant clinics in operational costs, as well as for support stakeholder meetings which hampers information exchange and collective learning within the plant health system.

In Pakistan, it appears the government has taken full responsibility of the operational costs and sustainability is mostly assured.

### **6.2.2 Which unexpected results have been achieved? How do these inform a new programme?**

Several unexpected results were mentioned at the global and country level and it seemed that while some aspects were planned at the global level, these were experienced as unexpected by national and local levels. This indicated that there may be some disconnect between the global expected results and milestones of the project, and those at the country level, that national and local implementers are aware of.

Examples of unexpected results mentioned at the global level were:

- China has demonstrated an innovativeness in linking the data in ways that was not predicted. China has linked the clinic data and prescription sheet to subsidy scheme for green products.
- The way plant doctors have started using social media platforms to interact and use it to interact and request information and peer-to-peer support in responding to farmers' queries. Feedback to the plant doctors from research partners has been accelerated. Response rates have increased.
- At the regional level the East African Community has developed guidelines for lower risk products (biological pesticides, rather than chemical pesticides) with facilitation of Action on Invasives. These guidelines can now be implemented in Kenya, Uganda, Tanzania, Rwanda, Burundi and South Sudan without having to pass through country level development.

Unexpected results mentioned for Ghana were:

- The outbreak of FAW in Ghana, was first identified in 2016 by extension agents trained as plant doctors from the Eastern and Volta Region (Cock *et al.* 2017). Despite the unexpected arrival, the Plantwise programme, later complemented with the Action on Invasives programme have been able to respond with early detection, risk assessment (FAW modelling of control scenarios exercise), coordinated response (FAW task force), concrete recommendations and mass media communication, as well as some in-depth research on biorationals and biological control (these are clearly mentioned in the Plantwise and Action on Invasives theories of change).

- Continued (although reduced) plant clinic sessions and submission of queries in 2020, despite the stop of payment of transport fees, lunch fees or data bundles to plant doctors by the Plantwise programme and with restrictions on travel and gatherings of groups of people as a result of the COVID-19 pandemic (sustainability is a key milestone in Plantwise annual report).
- Good use of POMS, the Knowledge Bank and social media platforms of stakeholders at different levels, particularly the plant doctors to continue and improve its services.
- Training of extension agents in cocoa, a subject that previously was not handled by extension services of MoFA, but by the parallel cocoa extension system.

*“Cocoa was not a crop of interest to MoFA so farmers were initially directed to cocoa extension agents but through the Plant Clinics, Agricultural extension agents have been equipped to address cocoa issues too.”* District Department of Agriculture representative, Ghana

Unexpected results in mentioned in Kenya were:

- The uptake of digital technology for e-extension by the plant doctors and the use of social media (WhatsApp and Telegram) to interact with fellow plant doctors. This digitization motivates the plant doctors and facilitates their work. The professional development of plant doctors has also been boosted, resulting in major changes in the performance of the plant doctors.
- Another major result (though not entirely ‘unexpected’) was the establishment of an early warning and rapid response structure for notifiable pests like FAW. This also led to the engagement of youth of sprayers and scouts to control the pest. It was also noted that at national level, stronger leadership is required to strengthen the system.
- One key informant noted that the spill-over effect has been considerable via peer-to-peer information exchange and farmers who attend plant clinics although they do not come from the covered wards. But no follow up has been done to investigate this phenomena.
- Only one key informant reported negative unintended effects at grassroots level, such as cases of misdiagnosis or farmers using crop protection products from Uganda that are not regulated in Kenya.

Unexpected results mentioned in Pakistan were:

- Initially the farmers did not expect non-technology based solutions to work. It was difficult to change farmers’ expectations regarding the solutions prescribed but as they experienced reduction in production costs and increased yield, their perceptions changed.
- The plant doctors were faced with additional request from farmers about other issues, such as agronomic practices and questions related to the value chain of certain crops. This showed the need for plant doctors to have a broad base of knowledge and flexibility to adapt to the needs of farmers. Fortunately, while it may be outside the mandate of the plant clinic, it is within the mandate of the extension worker who is the plant doctor.
- The data collected by the programme revealed that some of the insecticides/pesticides and also crop varieties that were banned by the government were still being used by farmers in some districts. This indicated the need to share information about regulations regarding the sale, purchase and use of banned products, and was added to the training modules.

### **Action on Invasives**

Apart from some exceptions with specific partners (mostly research) in-country key informants did not reveal any evidence of effectiveness specifically attributed to this program. Most in-country stakeholders interviewed see Plantwise and Action on Invasives as a homogenous programme, with activities contributing towards the same outcomes and impacts. The Theories of Change and impact pathways of the programmes confirm that attributing specific effects on effectiveness to Action on

Invasives would be extremely difficult. Action on Invasives also does not yet have an M&E strategy to guide internal or external studies on outcomes and impacts related to farmer yields and incomes. In addition, Action on Invasives is still a relatively new programme and it would be unrealistic to evaluate the impact and provide evidence of impact at the farm level for this programme.

### **6.2.3 What is the likelihood that the programme objectives will be met and what are internal and external underlying factors for likely success or failure?**

For Plantwise, most respondents felt it was on track to meeting the programme objectives. Plantwise has shown consistently that indicators in the Logframe that it set out to reach, have been achieved. For Action on Invasives, this is much more difficult to show, because the goals were long-term (10 years) while programme has only been running for three years. A key issue and a recurring theme is that CABI is not able to implement these programmes without the partners. Of course this is inherent to the way the programmes have been conceived, with the ultimate goal of national governments and partners taking full responsibility of implementing the programs nationally and CABI (Plantwise and Action on Invasives) providing technical support to adapt, consolidate and scale the approach, with development of tools capacity building and facilitating M&E and learning. It is expected that for Action on Invasives, the development of the programme needs more time to assess and respond to the needs of national partners, before scaling and building a sustainability model.

Internal and external factors for success mentioned in countries were:

- Appropriate anchoring of the Plantwise programme in government institutions and consultative decision making on priorities through the NSC.
- Political will and leadership at the national and district, county or provincial level.
- Convincing evidence that the Plantwise and Action on Invasive programmes are improving the plant health system holistically from the extension services to national-level preparedness and responses to emerging and invasive pests.
- Strong engagement of research as resource persons for validation in Plantwise and for research on new and emerging pest and disease issues in Action on Invasives.
- Stable and growing funding and/or resource mobilization from governments and in-country partners and willingness of development partners to invest in training and plant clinics.
- Increased and continued establishment of plant clinics and data collection and use in POMS.
- Documentation, communication and recognition of the quality of the services provided to farmers and the benefits it brings.
- Timely and technically sound and unbiased advice, based on actual diagnosis, and given by qualified and trained plant doctors helped farmers to obtain results (improved production) with lesser input costs in contrast to advice received from other service providers.
- Increasing awareness and recognition of the importance of pests, diseases and invasive species and willingness to invest in the plant health system and preparedness for invasive species from government institutions.
- Strong push for funding of certain invasive species and major pests, such as FAW.
- Gradual transfer of responsibility for training plant doctors and establishing plant clinics to in-country stakeholders, who are mostly government organizations, but who can be complemented by other organizations such as development partners, NGO's and private sector.
- Implementing partners laud CABI for its professional and participatory approach, technical expertise, up-to-date knowledge and information on the pest and disease management, and also monitoring systems.



*“It is the participatory approach of the programme and the many stakeholders that have been involved that are key to the success of the programme. Decentralization has also led to the engagement of district stakeholders (Departments of Agriculture, NGOs and Agrodealers). Consolidation of and with this group of stakeholders will bring about sustainability”.* Department of extension staff, Ghana.

Internal and external factors for failure mentioned by national and local key informants were:

- Limited reach and commitment of some local governments leading to poor implementation of plant clinics and limited critical mass.
- Lack of funds and means for plant doctors to travel to sites and run the plant clinics and replace faulty equipment and materials. Provincial governments have limited financial resources to set up plant clinics.
- High staff turnover (and retirement) among extension agents at local and national level and the needs for continued training and refresher training of extension agents and other government and partner staff.
- High workload and limited time of agriculture extension workers to run the plant clinics as plant doctors. Besides the workload of the plant clinics, they are also expected to carry out other tasks assigned by the district level agriculture personnel. This is likely to have a negative impact on their performance, and quality of work.
- Limited opportunities for refresher training to the plant doctors.
- Sometimes plant doctors are not able to respond immediately and they refer the farmers to research institutes for sample testing. These delays could lead to distrust among farmers, especially those visiting the plant clinics for the first time.
- The programme follows a generic design for the entire country and the training material used is not contextually relevant to the specific needs and contexts in the different provinces, districts and counties.

Specifically for Ghana:

- The imminent end of the Modernizing Agriculture in Ghana programme in 2021, funded by the Canadian government, which is being used by districts and regions to support transport and activities of extension agents, including plant doctors running plant clinics.
- Some components of the programme that are too much dependent on a few champions need to become more institutionalized.
- Insufficient use of Research and Extension Linkage Committees (RELC) at the region level, which could play a role in sustaining the plant clinics.
- Apparent weak linkage to and engagement of private sector actors and initiatives (for instance Esoko’s online data platform with FAW early warning system<sup>3</sup>).
- In many cases, there seems to be a gradual decline in participation after a few plant clinic sessions as farmers become aware of the major pests and the solutions and start “self-medicating” and experimenting with recommendations. Low attendance can be demotivating for plant doctors and plant clinic attendants alike.

Specifically for Pakistan:

- Unsustainable ways of running the plant clinics related to additional costs (renting of materials and venues).
- Low level of digitalization and use of tablets for running e-clinics.

#### **6.2.4 What are the strengths and weaknesses of the advice provided by CABI, compared to advice that farmers receive from other service providers?**

<sup>3</sup> Esoko online data platform for FAW. <https://esoko.com/fighting-fall-armyworm-ghana/>



The question related to what farmers see as strengths and weaknesses of the advice provided by CABI, compared to advice from other service providers, was difficult to answer for two reasons. Firstly, the service provided by the Plantwise programme is almost always done by an extension agent from the Department of Agriculture and this is often the same person to deliver services from other programmes (government programmes, farmer field school interventions etc., fertilizer and seed subsidy schemes). In addition, it appeared that in many cases and for many farmers, plant clinics were the only channel for interaction with an extension agent. As a consequence, it is difficult for farmers to recognize and compare different programs and delivery methods. A few exceptions are the services provided by agro-input dealers and the service provided by the parallel cocoa extension system in cocoa growing areas. This will be discussed in the next section (Efficiency).

Comparing the results with evaluations of other extension approaches allows some level of benchmarking. Unfortunately, recent robust evaluations of extension programs are very sparse. The most evaluated extension approach is Farmer Field Schools (FFS). Waddington et al. (2014) conducted a systematic review on the effects of FFS based on 92 distinct evaluations. The results of the statistical meta-analysis showed that FFS are beneficial in improving farmers' knowledge on IPM and adoption of good practices, as well as agricultural production and farmers' incomes. However, no evidence could be found that neighbouring non-participant farmers also benefitted from diffusion of knowledge through farmer-to-farmer exchanges. The authors also concluded that the measured positive effects of FFS are limited to short-term evaluations of pilot programmes. For the few cases where FFS have been scaled out, no evidence could be found that this resulted in improving agricultural outcomes or diffusion of IPM practices beyond non-participants in the community. The complexity of IPM practices and the experiential nature of the farmer trainings pose barriers to spontaneous diffusion, as well as the recruitment and training of FFS facilitators at scale, according to the authors.

In FFS, farmers are trained to diagnose common pests and diseases and to find (biological) solutions themselves. Such complex knowledge is difficult to transfer through peer-to-peer contact. In that sense, the plant clinic model makes this knowledge accessible to a much larger population of farmers. Similar to FFS, the evidence on effects of plant clinics on agricultural productivity are largely anecdotal and short-term effects directly linked to plant doctors' recommendations, but there is no evidence that positive effects on agricultural productivity have been established at larger scale. However, it is impossible to estimate what the counterfactual of the FAW outbreak would have been if there had been no Plantwise and Action on Invasives programme at the time. Waddington et al. (2014) also noted that FFS participants do not effectively transfer their knowledge to non-participants. Part of the plant clinic attendants reported that they share the recommendations with their peers, so Plantwise might obtain better results in diffusion of knowledge than FFS, but it has to be noted that this evaluation did not look at the effectiveness of this farmer-to-farmer diffusion of knowledge.

Davis et al. (2020) recently released a comprehensive review of agricultural extension and advisory services. They report an increasing pluralism in advisory services in developing countries as public extension services declined since the 1990s. However, the public extension system is still the major provider in many countries. Governments have been decentralizing these public extension services in many countries, but it is yet unknown whether this has made the extension services more relevant, efficient or demand-driven. The authors highlight three dimensions (governance structure, organizational capacity, advisory methods) that determine the effectiveness of advisory services in a particular country:

- Governance structure (policy, funding, pluralistic institutions):

- Existence of specific policies and strategies affect the financing and implementation of extension. For example, extension programs in Rwanda and Ethiopia are driven by the countries' agricultural strategies rather than donor priorities. In Malawi, on the other hand, is characterized by low investments in extension services as the agricultural budget is largely allocated to fertilizer subsidies.
- Public-sector funding for extension services has been declining since 1990. In many African countries, this resulted in an emergence of a new funding model where the public sector pays salaries of extension services and donor-assisted programmes pay (part of) the operational costs. This is partly the case in Ghana with the MAG programme funded by Global Affairs Canada. Private-sector support tends to be brought in for specific commodities and value chains.
- It is estimated that there are over one million agricultural extension agents across the globe, belonging to a huge variety of organizations within the public, private and non-governmental sectors. Such pluralistic systems require coordination, quality control and regulation to avoid conflicting messages and duplication of efforts. Linkages and partnerships thus become crucial for good performance of advisory services.
- Organizational capacity and management: human resources (including high vacancy rates and staff turnover) are reportedly a major constraint to increasing the effectiveness of extension systems in most countries. Capacity weaknesses include staff skills, infrastructure and equipment, transport, and foundational and continuing education for extension agents.
- Advisory methods: in many countries, extension methods have shifted from top-down to more participatory methods and market-oriented approaches. More recently, digital methods have also become more available, but the authors plead for maintaining tradition approaches to allow context-specific knowledge sharing and development of local solutions.

Having said that, a number of strengths and weaknesses have been cited by stakeholders. Some major strengths of the Plantwise / plant clinic advice mentioned by key informants were:

- The programme has allowed extension agents to interact with communities and made plant health services easily accessible to farmers.
- The approach is demand driven, based on a concrete sample, followed by a quality diagnosis and most often an immediate and practical recommendation of the plant doctor in the form of a "prescription".
- Plant clinics put considerations and problems of farmers first.
- Trained extension agents are more convinced of their capacity to respond to farmers' problems.

Some major weaknesses of the Plantwise / plant clinic advice mentioned were that:

- Apart from Pakistan, the coverage of plant clinics is not national and only in a few sites / districts / counties.
- Recommendations related to inputs are not combined with facilitating access to these (subsidized) inputs and marketing of agricultural produce.
- Participation often drops after a couple of initial plant clinic sessions (specifically for Ghana).

*"Plant Doctors are quite knowledgeable and provide several options to deal with a pest problem. The weakness of the programme is that it did not subsidize the price of chemicals nor assist in marketing of produce in order to guarantee increased incomes."* Agro-dealer, Ghana.

#### **6.2.5 Are there measures in place to monitor and improve programme delivery and decision making?**

Monitoring, evaluation and data-driven learning and decision making are key to the Plantwise and Action on Invasives programmes. Farmer queries from plant clinics are documented, submitted to the POMS database, validated and analysed to be used for feedback to plant doctors, development of new resource materials, surveillance of emerging pests and diseases and research. In Ghana, Kenya and Pakistan most stakeholders, with the exception of a considerable proportion of plant doctors in Kenya and Pakistan (see section 4.3 performance of plant clinics) agree that measures are in place to monitor and improve the effectiveness of plant clinics and other outreach activities and in capturing data as well as the quality of training implemented by the partners. They also believe that measures are in place to monitor and improve the quality, timeliness and quantity of data transmitted and analysed.

However, with the Plantwise programme no longer paying transport and lunch allowances in Ghana and Kenya and transferring that responsibility to the district and county governments to provide the plant doctors with the means to run the plant clinics and submit data, all stakeholders are concerned that the frequency of plant clinics will reduce and that farmers queries, which requires data bundles for submission, will not be uploaded into the POMS system.

### **Conclusions for programme performance: Effectiveness**

Overall, the Plantwise and Action on Invasives programmes have been effective in reaching impact at multiple levels in intervention countries, from farm level impacts on IPM practices, productivity and income to government level, to plant health system improvement and coordination and policy changes related to (new and emerging) pests and diseases. Furthermore, from a global point of view, the programme is set to reach its objectives and targets.

The programme's strong focus on, and engagement of government organizations in the research-extension continuum can be a strength or a weakness, depending on the country of intervention. In countries where public institutions in the agricultural sector are effective, the programme is effective, but in countries where these institutions are weak, the programme fails to achieve impact at scale. It is therefore recommended to diversify partnerships to complement gaps in coverage and programme delivery and implementation and make the plant health system more effective overall.

## **6.3 Programme performance: Efficiency**

### **6.3.1 Is the programme complementary to other projects/programmes and existing national and regional advisory services?**

Global respondents all agreed that the programmes are efficient and complementary to other existing programmes and initiatives in agriculture advisory services. Evidence for this were multiple examples of mainstreaming the approach in national programmes and NGO's and development partners engaging and collaborating with Plantwise in Bangladesh, Pakistan, Malawi, Mozambique, Ghana and Kenya) with varying sources of funding (IFAD, World Bank, Canadian funding, FAO working groups, GIZ, Self Help International, among others).

#### **Example of complementarity with other initiatives and programmes in Ghana and Kenya**

All key informants in Ghana mentioned some way in which the Plantwise programme was complementary to other projects and programmes such as the Canada funded "Modernizing Agriculture in Ghana (MAG)" programme, the government initiative "Planting for Food and Jobs (PFJ)" and the GIZ funded "Market-Oriented Agriculture Program (MOAP)". Individual accounts mentioned complementarity to FarmUSE and PRISE projects, as well as the MoFA's E-agriculture programme, that aims to increase the use of ICT in extension and agricultural services. In addition, the knowledge-

driven plant clinics were found to be very complementary to the more (subsidized) input and market-oriented activities of other programmes. Finally, Plantwise, with complementary funding from DGIS, contributed to the implementation of phytosanitary and food safety measures that may have helped in the lifting of a ban on Ghanaian vegetables for import into the European Union. Collaboration with the Statistical programme directorate, Cocoa Research Institute of Ghana (CRIG) and cross-training of agents from the parallel cocoa extension system were also mentioned as complementary.

Key informants in Kenya confirmed that Plantwise is complementary to other programs and projects they are involved in. Some key partners actively try to integrate Plantwise in other new or existing programs (e.g. on irrigation, crop resilience, rice production, or climate-smart agriculture). Plantwise develops very specific diagnostic skills at extension level which was not available before. There is currently an initiative to implement a pilot where plant clinics will be integrated with animal health services that do not require a professional vet.

### **6.3.2 Are the most suitable partners cooperating and do roles and responsibilities of partners take into account their respective comparative expertise?**

Most respondents felt that with the establishment of the NSCs in each country, most of the relevant organizations had been included and are collaborating with Plantwise and Action on Invasives. The major partners in each country are the Ministries of Agriculture through different organizations, often headed by a plant protection agencies or directorates, extension and the local governments and Agriculture Departments. There is some disagreement though whether the district, county or provincial governments are actively involved and supportive or not, but this is likely to vary between individual local governments. The engagement and roles of other organizations, such as NGO's, private sector partners and farmer organizations for instance is not always very clear and there seem to be ample opportunities for stronger engagement and collaborations with these stakeholders, from the local to the national level.

*"The approach has been adapted to country contexts, but this could have been done better. Diversity in the engagement of other partners than government organizations between countries. Engagement with NGOs, private sector actors and grassroots organizations could be improved."* - Global CABI Plantwise staff.

*"We need to create more awareness because only a few agro-input dealers are aware of the Plantwise intervention. We also need to make a better link between farmer clients of the plant clinics and agro-input dealers for their supplies"* - Agro-dealer, Ghana

### **6.3.3 Do programme structures and working modes support efficient use of human and financial resources?**

Project structures and working modes were considered participatory, interactive and transparent by global and national respondents. The digital platform facilitates sharing of information between actors. However, the regional key informants advocated for more regular face-to-face interactions to share experiences and allow learning between plant doctors and other stakeholders. These meetings have reduced in frequency due to declining resources.

In Kenya, very little information on the efficiency of the Plantwise program as a whole or on other parts of the program was obtained. A high turnover rate and number of transfers of plant doctors is mentioned in the Plantwise 2019 Annual Report (CABI, 2020, p.68). CABI's study based on 2018 data, found the following factors that may lead to an inefficient use of human resources (Chege, et al. 2020, p.13):

- Funding for day-to-day clinic operations (lunch allowance and transport) was not catered for in a consistent manner. *“In all the counties officers were expected to perform their duties, irrespective of whether they received lunch and transport allowance: they could claim a reimbursement, but a refund was not always guaranteed. In two counties, the sub-county officers were quite sceptical that plant clinics would continue running if funds were not provided by a donor or by the county. They felt that the plant doctors’ commitment would not be an adequate driver for individuals to go to the extent of using their salaries to run plant clinics.”* – Government staff, Kenya.
- All counties reported that they had inadequate numbers of extension staff, mainly resulting from natural attrition (retirements and deaths) without staff replacements. In 2019, there were 42 reported plant doctors who stopped or left, without immediate replacement. This leads to a continuous need to train new persons. Many sub-counties expected to have only one or two trained plant doctors by 2021 compared to having had at least 10 at the time of the study

Similar examples for staff attrition and lack of funds for transport were given in Ghana, although it seemed to be less of a problem than in Kenya and there has been a recent considerable effort by the government to recruit new, mostly junior staff as extension agents.

### **Efficient use of financial means and costs related to achieving programme results**

According to some global staff, it would have been possible to reach similar results at slightly lower costs if the programme would have focused on fewer countries initially, work more in-depth and then scale to more countries, based on sound assessments of the country situation and decision to intervene. The quick spread to new countries in such a short time was considered inefficient and it would have been more appropriate to focus on about eight countries in Africa and Asia each and four countries in the Americas. Taking into account the ambitious targets of Plantwise at the start, the programme has worked efficiently.

The costs associated in reaching farmers from 2012 to date has gone down consistently, through the hand-over of training to national government staff as well as hand-over of responsibility to initiate and run plant clinics. The AIR studies in Kenya and Pakistan showed positive return on investment. In the future, the cost is likely to go down at the programme level, because more costs are taken over by other partners and the need for new tools, materials and factsheets will reduce.

In the case-study countries, stakeholders and partners were of the opinion that financial means were used efficiently in progression. For example in Ghana, with the introduction of e-plant clinics and tablet-based data entry, the system was made much more efficient, even though internet and data bundle costs have increased of course. National, regional and district government organizations co-fund with staff, motorcycles, cars and transport allowances and/or fuel. Other partners have contributed as well (GIZ, some cocoa producer agencies have been involved in using the e-plant clinic approach as well as some other NGO partners).

*“The little funds were able to reach a big result. We need to mainstream it in national, regional and district plans. Bring on board more partners such as GIZ. Trying to bring in the input dealers to play a role in financing and the products and recommendations they supply to the farmers.”* – National government staff

#### **6.3.4 How sustainable is the programme in the light of global and in-country funding sources and what does this mean for the new programme?**



In Pakistan, all provincial agriculture extension departments have adopted the plant clinic approach to some extent as an activity and hence it is likely that plant clinics established will continue without donors' funding. Similarly, Plantwise staff envisages that most of the other activities such as running of e-clinics, district level training programs, training of master trainers, data collection, management and use will also continue without external funding. However, for some provinces that have recently joined, Plantwise Pakistan clearly stated that they would need support to scale up the programme especially for setting up the clinics, training plant doctors, ICT support and equipment needed to set up POMS, and costs for scaling up, digitizing and running e-clinics.

*"The setup cost of a plant clinic is small because it needs simple equipment like a tool kit, table chairs, tablet, prescription sheets, etc. The initiative is more cost-effective because it is being implemented in collaboration with the agriculture departments (establishes at public places/buildings). Operational cost only includes the cost/salary of plant doctors. The other budgetary items are supplementary like provision of transport allowance and refreshment to the farmers who come to attend the training courses. Therefore the cost per farmer from the CABI approach seems low because it encounters a one-time low cost at the start and then almost no cost. The CABI approach is cheaper in the longer term- as coverage costs are lower as no mobility, no daily allowances are needed – Department of Plant Protection staff.*

The Plantwise Pakistan programme can continue on its own for extension activities on identified and existing problems. However for new emerging problems they will need support, especially for research with Action on Invasives to forecast problems and take preventive actions. Most provinces need expertise and resources to adopt and upscale the Action on Invasives activities.

#### **6.3.5 How do the costs per farmer from the CABI approach compare the costs per farmer in other advice delivery methods?**

In almost all instances, programme documents (global annual reports, country annual reports and working papers) and key informants refer to the efficiency of the clinics (specifically the process of plant doctors installing and running clinics and offering advice to farmers). Key informants reported that the main costs are for the initial training of extension staff and purchase of equipment. The mobile plant clinics are relatively cheap to set up, and plant doctors can cover a relatively high number of farmers, compared to other extension activities. In Ghana, the costs per farmer of the Plantwise approach compared to other advice delivery methods (e.g. Farmer field schools and commodity organized extension) as experienced by MoFA Department staff is lower for Plantwise, because the plant clinic brings together farmers in a known place and time and responds directly to farmers needs through the queries.

*"The plant clinic approach is the best, because the cost is very low, farmers bring the problem to the plant doctor, so costs are low for extension, but also to farmers themselves. Farmers often save on costs of spraying so the cost are low for farmers too." - PPRSD staff, Ghana.*

However, the regional key informants acknowledged that no rigorous costing exercise has been done to make an exact comparison in efficiency with other extension activities. One key informant in Kenya noted that the efficiency varies per plant clinic as some receive few queries during the plant clinic; relocation and more advertisement might help increase the number of farmers visiting these plant clinics. The plant clinics are considered efficient from the farmer point of view, as they can combine their visit with other public events.



In the wider literature and at the global level, some sparse information is available, comparing plant clinics with other extension models, such as farmer field schools (FFS), training and visit, farmer field days plant health rallies, use of village-based intermediaries and various large-scale dissemination approaches (radio, printed media, mobile services). One study from Uganda (Kansiime *et.al.* 2017) estimated that in terms of cost per farmer, plant clinics (5.02 USD/farmer, 13 farmers reached), were *less expensive* than FFS (22.76 USD/farmer, 30 farmers reached) and farmer field days (8.65 USD/farmer, 85 farmer reached) and *more expensive* than the use of village-based intermediaries (4.24 USD/farmer, 100 farmers reached, training and visit by an extension agent (1.56 USD/farmer, 600 farmer reached), plant health rallies (0.41 USD/farmer, 300 farmers reached) and radio programs (0.02 USD/farmer, 150,000 farmers reached). However, the cost for the plant clinic and the farmer field days was based on one session, whereas the farmer field school cost was based on 12 sessions in terms of cost per farmer and there seemed to be some inconsistencies with the calculation of the variable costs related to each of the models.

*“This question has been plaguing us for some time now. If you look at reach, the question is relatively easy. But if you look at the extension model, the effectiveness is a mix of the method, and the technologies related to the recommendations given. The cost of plant clinic approach is relatively low compared to other approaches. In addition, there are other benefits then reaching people directly.”* - Global CABI staff.

Besides the different costs of these extension models in reaching farmers, the effectiveness of the models in achieving adoption of improved practices and technologies by farmers is variable and dependent on many different socio-economic and environmental factors. In that sense, FFS, covering a range of subjects and technologies, may lead to higher levels and numbers of technologies, than a farmer field day would. Therefore, when Kansiime *et al.* (2017) took into account the probability of adoption of simple and complex message, the effectiveness of the different models changed considerably. For instance, for simple messages, radio programs had the highest efficiency index (1052.6) followed by plant health rallies (487.8), extension agent visits (192.3), plant clinics (60.6), village based intermediaries (47.2), farmer field days (34.7) and finally, FFS (17.6). But the efficiency ranking changes for complex messages. It is obvious that different situations require different approaches. For instance, for a well-known crop problem, with a simple control method, it is probably best to use radio and plant health rallies to reach out to many farmers efficiently. However, in order to identify new and emerging pests and respond to these, radio and plant health rallies will not provide the opportunity for identification and in this case, plant clinics and FFS may be more appropriate. In addition, plant clinics have the additional advantage that they play a role in linking different actors, surveillance and detection of new and (re-)emerging pests and diseases and in that way, feed into databases and research, as well as inform governments and extension services at a higher level, how to deal with these problems and what channel of communication to use. In conclusion, every model has a role to play in extension and dissemination of agricultural technologies and in that sense, plant clinics have a clear complementary role to the other existing models.

Many investments have been made (for instance by the Food and Agriculture Organisation) in establishing FFS and their networks in many developing countries and it seems that these platforms could easily integrate (components) of plant clinics and plant health rallies (for instance, by having one session per season dedicated to hold a plant clinic).

*“With Plantwise, data is collected and feeds into the national system and research, which then feeds into the Knowledge Bank. People are now aware where they can access information when they need it. Participating countries are very happy, but still many countries are not covered, so putting Plantwise*

*curricula in other extension programs (such as FFS and Conservation Agriculture platforms) can also help to scale reach of quality extension services in plant health.” – Global FAO staff.*

We have not come across any published studies that compared plant clinics to more private-sector and commodity-based extension models. It seems that similar to what has been done with public extension services, the Plantwise approach could be adapted and integrated into Agri-business based advisory services (ABAS) and this has been suggested by several respondents. The question then is, how to maintain unbiased, quality advice and cater to the needs of all farmers and all relevant crops, not only to those farmers and crops linked to the commodity value chain. It appears that a combination and integration of public and private services in a pluralistic extension approach could address issues of accessibility while maintaining a certain quality and reducing strong bias in diagnostics and recommendations.

### **Conclusions for programme performance: Efficiency**

The Plantwise and Action on Invasives programmes are highly complementary to other existing programmes and initiatives and it appears that human and financial resources have been used efficiently. Programme components (e.g. plant clinics, the knowledge bank, ICT tools for communication) can be integrated into other initiatives and programmes through adaptation and capacity building of diverse stakeholders that provide agricultural services and advice.

Given that continued funding from the programme, national and local governments is uncertain, it is urgent to encourage integration of Plantwise and Action on Invasives programme components in large agricultural development programmes and as part of the regular extension services as much as possible. Resource mobilization at the national and local level with government and other stakeholders is essential to ensure continued implementation and increased coverage. More diverse, in-country funding and engagement with private sector partners to explore the delivery of plant clinic services will lead to a more sustainable programme and complementary and alternative delivery channels. For both advocacy and resource mobilization, a more compelling story needs to be developed on farm and plant health system level outcomes and impacts and the cost per farmer of different programme interventions, which requires additional information and data analyses.

## **6.4 Programme performance: Programme management**

### **6.4.1 How are the multiple demands, programme reporting and financial management structures of different donors managed to ensure a coherent programme of activities with common aims and objectives?**

Plantwise is a very large programme with multiple donors, such as UKAID, the ministry of Foreign Affairs of the Netherlands (DGIS), the Swiss Development Cooperation (SDC), the European Union (EU), Irish Aid, International Fund for Agricultural Development (IFAD), the Ministry of Agriculture and Rural Affairs of the People's Republic of China. Therefore, considerable effort has gone into responding to multiple demands, programme reporting and financial management structures of different donors to ensure a coherent programme of activities with common aims and objectives. For instance, in the beginning the EU wanted to be visible in each document that Plantwise produced, but later donors agreed that there is a Plantwise logo, and that in each document, all donors were acknowledged. Some donors, such as SDC, UKAID, DGIS, agreed to any country, whereas the EU wanted to fund specific countries only. Plantwise tries to capture all the milestones and indicators of all donors and make one annual report. There is only some specific reporting for IFAD and DGIS, and UKAID has a performance review in May every year. CABI manages all its projects and programmes

through a project management framework called PRINCE2 and each programme has a board that meets four times a year.

The most important way to report to, and receive input from, donors is the annual donor forum, which is held annually in May (CABI, 2020, Plantwise Annual Report 2019). In this two-day meeting, all donors come together, CABI Plantwise presents results from the annual report and complementary studies, discussions are held and where donors can give guidelines and recommendations for future directions of the programme and interventions.

#### **6.4.2 How are roles and responsibilities divided among CABI centres, project field units in relation to work in the different countries?**

Plantwise is managed by a Programme Board comprising senior management from CABI. Decisions from the board are communicated to the CABI centres and CABI country coordinators, who then communicate with the NSC and their coordinator (Ministry of Agriculture staff). An organizational setup is provided in the Plantwise strategy document (CABI, 2015, Plantwise Strategy 2015-202) that explains the global and regional governance structure. For in-country governance and processes, the establishment of the NSC and the plant clinic clusters provide the governance structure of the programme implementation.

The Action on Invasives programme is smaller than Plantwise; it is present in fewer countries (Ghana, Kenya, Pakistan, Zambia, Rwanda and Bangladesh), has fewer donors and therefore is easier to manage and report. It has four work packages (1) Stakeholder engagement, (2) Best practice solutions, (3) Community action and (4) Knowledge and data, with their leaders, having separate work package leaders for community action in Africa and Asia and a relatively compact team. The structure of Action on Invasives does not envisage a country coordinator in each of the implementing countries and builds on the presence, partners and infrastructure of the Plantwise programme, including the NSC. The Action on Invasives programme is governed by an Action on Invasives board and implementation team at the global level.

A document that describes how the two programme structures interact and more detail on how the organizational structures operate and interact at the country level, would allow for a more in-depth assessment whether and how programme structures are fit-for-purpose, whether they complement each other or overlap, and consequently, make appropriate recommendations on possible adjustments.

#### **6.4.3 Are the priorities set appropriately across the Plantwise themes and the Action on Invasives work packages?**

Global staff respondents unanimously agreed that the priorities were set appropriately across the Plantwise themes and the Action on Invasives work packages, generally referring to the Plantwise Logframe (reviewed in 2017) and milestones which are set on a yearly basis. Work package priorities and work planning are updated every six months. It appeared that Action on Invasives does not seem to have a specific M&E strategy document, but that M&E is embedded across the work packages and not treated as a separate entity.

#### **6.4.4 How effective and efficient are the existing structures and working processes of programme management at different levels and could these be improved, if so how?**

A challenge encountered in the programme structure is accommodating feedback from countries by the global leadership from CABI. If countries want to take specific actions or initiatives, the leadership does not always approve which can lead to conflict. Some respondents gave the impression that the Plantwise programme was initiated in a rather top-down manner to countries, but that the programme has evolved toward more inclusive planning and communication. In the current structure however, there is no clear evidence that countries and national partners have a clear way to influence the direction of the programme and decision making at the global level. Some mechanism of feedback from countries to the global level would appear useful. Another issue that was mentioned was that NSCs are informed on an annual basis of the budget available for the programmes, which makes it difficult to develop a longer-term vision, work plan and budget for some partners.

*“Some people in the senior management of CABI in the UK don't have a development background. So regional centres were created more top-down, but CABI is moving in the right direction using co-creation mechanisms.”* – CABI Global staff.

Another challenge is efficient communication and coordination between Plantwise and the Action on Invasives programmes. As the Action on Invasives programme has built on the Plantwise structures and partners, they are often considered one programme by national stakeholders.

*“On paper there is strong interconnectivity, but in the countries this is not always the case. If Action on Invasives and Plantwise had one board and annual report, integration and interconnectivity would be assured. Actions and responses from Action on Invasives are not always communicated and planned with Plantwise and vice versa.”* - CABI global staff.

*“We need to be better in our communication with the broader project teams. People implementing on the ground are not always informed about what is happening at higher levels.”* – CABI Global staff.

*“Plantwise is an older programme, Action on Invasives is relatively new and focused. However, farmers do not see them as separate programmes. Also at the departmental level Action on Invasives uses the same agreement to work with governments at provincial level, no differentiation is needed.”* - Government staff, Pakistan.

#### **A new programme going forward, Plantwise+**

After about 10 years of Plantwise implementation CABI wants to evolve Plantwise into a new global programme tentatively called Plantwise+ with a stronger focus on climate change, sustainable crop production and its impact on rural communities in developing countries (CABI, 2020, Plantwise Annual Report 2019). Plantwise+ will build on the systems, products and services already established under Plantwise and the Action on Invasives programme and deliver improved food security and economic development. The focus of Plantwise+ activities will be to:

- Accelerate the uptake of climate-smart pest management practices by smallholder farmers.
- Increase the supply of higher quality and safer food.
- Strengthen detection and the response to pest outbreaks.
- Enhance the availability of safer plant protection products.

Plantwise+ will begin in 2020 with a three-year proof of concept phase during which its interventions will be tested in six to seven countries in Africa, Asia and the Americas. The programme is envisioned to run for over 10 years in 20 countries.

Some suggestions for the new Plantwise+ programme and improved programme management are to:

- Merge the organizational structures of Plantwise and Action on Invasives and create one programme board.

- Adjust the programme board membership to include regional directors.
- Start in a smaller number of countries initially, learn and then scale to other countries.
- Improve communication and decision making between the global, regional and country team staff.
- Better accommodate feedback and input from the NSCs and countries to increase engagement and ownership.
- With the four new core components mentioned above, CABI has to do country and regional assessments to identify which partners can handle the different components, including regulation.
- Identify what component(s) of the plant health system in each country needs strengthening and build the right capacity and infrastructure.
- Explore intervention into non-CABI member, non-commonwealth countries, for instance in Francophone and Lusophone Africa and encourage new countries to become members.

Some suggestions from the country respondents here are:

- Mobilize additional resources with in-country development partners, investors and private sector.
- Allocate funds for specific research areas and institutional strengthening, for instance for training and infrastructure for laboratories that do research on biological control.
- If the programme expands, it might be better to add a dedicated expert with area-specific experience in provinces, districts and counties.

### **Conclusions for programme performance: Programme management**

We conclude that the Plantwise and Action on Invasives are experienced by most in-country stakeholders as one programme and it appears logical and necessary to merge these into one programme, with one programme management and operational structure and harmonized objectives and work packages. We also recommend improving communication and exchange of successes and lessons learned between countries and between countries and the global management structure, allowing for increased influence of countries and stakeholders to the overall direction and activities of the programme. Given the new priorities for Plantwise+ (climate-smart pest management practices, safer food, detect and respond to new pests, increase availability of safer plant protection products), the programme also needs to significantly change its way of working and move beyond business-as-usual implementation. This requires careful assessment of in-country needs for new capacities and (new) private and public sector partnerships and co-creation of the programme with these partners. Additional capacities of programme staff and/or partnerships will be needed to facilitate access to agricultural input along the distribution and marketing chain and working with stakeholders in the areas of nutrition and food safety.

## **6.5 Programme performance: Risks and potentials**

### **6.5.1 What are the risks that may negatively affect programme success in the next one to five years? How can they be addressed and minimised?**

The risks that may negatively affect the Plantwise and Action on Invasives programme success in the next five years are:

- (1) (Lack of) commitment of local governments to affect human, infrastructure and financial resources to the plant clinics and the programmes (Global and all countries).



- (2) Issues related to running e-clinics, from damaged and faulty tablets, to problems with the applications and cost and coverage of transport allowances and connectivity (Global, all countries).
- (3) Continued rise in cases of the COVID-19 pandemic, with restrictions on travel and movements of people and goods nationally and internationally, effects on health of farmers, extension agents and other actors and strong negative effects on global, national and local agricultural value chains and economies (Global, all countries).
- (4) Attrition and staff turnover at all levels from the plant doctor to the Directors of Departments, leading to loss of capacity and institutional memory in the extension, research and policy continuum (Global, Kenya, Ghana).
- (5) Discontinuation and/or reduction of funding from the Plantwise and Action on Invasives programme and in-country donors for running cost of plant clinics and data and knowledge management (Global, Ghana, Kenya).
- (6) Instability in the national institutions working in plant health and the political will to support the programme with government funding and policies to maintain the functionality of the PW and Aoi programmes (Global, Ghana).

### **Risk of funding and sustainability**

In Ghana, at present, MoFA and the District Departments of Agriculture have significant budget support for extension from the Canada funded “Modernizing Agriculture in Ghana” program and some NGO’s and programmes (MOAP) have bought into the Plantwise approach. However, MAG is scheduled to end in 2021, after which it is unlikely that government funding will take over many of the running costs of the plant clinics. Therefore, the risk of large-scale discontinuation of plant clinics is real.

*“Funding (support for per diem, fuel, data etc.) is going to be a major challenge. There is a need to encourage development partners and new projects to continue funding for the programmes. There is also a need to put activities of the Plant Doctors into the yearly national budget.”* NGO collaborator, Ghana.

In Kenya, an internal study was conducted by CABI to help understand what factors had encouraged funding in some counties; whether and how the programme had influenced the evolution of county extension systems; and whether and how the programme was being institutionalized and integrated at county level. The selected counties represented some that had invested in the programme and some that had not. The study intended to draw lessons from both scenarios in order to guide how the programme could accelerate uptake in more counties for sustainability (Chege, et al. 2020, p.7). Results show that plant clinics are being transformed into a one-stop-shop, ‘huduma centre’, where farmers can obtain other products (i.e. seeds and fertilizer) and services provided by the government, and that in two out of four counties researched, the local ministers had managed to secure funding for expansion of the plant clinic network to all their administrative wards.

Another indicator that points towards the medium and long term sustainability of the programme in Kenya is the farmers’ willingness to pay, which was proven in 2019, in a case study in Elgeyo Marakwet County. This study investigated how youth could be engaged in provision of advisory services to farmers in their communities, and found that farmers were willing to pay for a ‘bundle of services’. This led to the training of 58 (9 female, 49 male) youth on safe use of and professional application of pesticides, of which 48 (3 female, 45 male) will start a related agribusiness (CABI Plantwise Annual Report 2019, p.68).



During 2019, plant clinics were integrated into eight County Integrated Development Plans which enables planning and resource allocation into the future (CABI Plantwise Annual Report 2019, p.68), however no clear results have been identified in terms of number of plant clinics supported per county.

In Pakistan, the issue to provincial support was also mentioned as a significant risk as well as a range of other risks. For instance, respondents mentioned the increased incidence of new and re-emerging pests and diseases as a result of changing climate and intensified agriculture as an important risk. However, it is assumed that a continued Plantwise+ programme should be able to respond to these. Other risks mentioned were natural calamities, pandemics other than COVID-19, outbreaks coming from China, global warming and terrorism.

Local input suppliers and pesticide dealers who provide poor advice or suggest red list chemicals were also seen as a potential risk to the programme and the results achieved so far; a good reason to involve them in the programme and provide them training in safer and greener options especially using low risk chemicals and bio-pesticides.

#### **6.5.2 How has the COVID-19 pandemic affected the programmes and what has been done or should be done to mitigate its effect?**

The COVID-19 pandemic, with health risks for farmers, extension agents and stakeholders alike and with subsequent restrictions on gatherings, travel and field activities imposed by governments obviously poses a huge and continuing risk to extension, research and knowledge management activities in general and the Plantwise and Action on Invasives programmes in particular. Some countries, such as Kenya and Zambia, have (had) very severe lockdowns, blocking almost all travel and extension activities. Additionally, in Pakistan there was a stop on funding of plant clinics in province during the COVID-19 pandemic.

*“The financial shortfall was the major challenge. The 200 plant clinics established by the Government of our province remained unfunded during this year due to the Corona crisis because the Government stopped all the development projects due to a lack of financial resources.”* – Department of Agriculture director, Pakistan.

However, several countries (including Ghana) have exempt rural areas and agriculture production activities from severe restrictions and have made a conscious effort for the agriculture sector and actors to continue most activities, provided they adhere to recommendations for reducing the risk of widespread infections. In fact, several government and donor initiatives have educated farmers and extension agents and provided protective gear and equipment to run extension activities as safe as possible. Of course, besides the direct effect on the programmes, there is a likely much indirect effect of the COVID-19 pandemic on local and international markets, with a likely strong negative effect on poor and vulnerable urban and rural populations. In that sense, it will be key to boost local production of food and local value chains, especially where farmers are net buyers of food and where farmers strongly depend on sales of (exported) cash crops (Morton, 2020).

In general, respondents mentioned that after an initial scare and prohibition of gatherings of large groups of persons by the government from March till June, most activities related to extension and agriculture appear to have resumed. In Ghana, the programme has provided protective gear and sanitizers in trainings, but counted on districts and extension agents to do this themselves for running plant clinics. Many development partners, including the World Bank and AGRA have provided protective equipment to extension agents in the last couple of months.

*“With the fear of contracting COVID-19 some plant doctors have reduced the number of plant clinic sessions and some farmers have been reluctant to attend gatherings”* Director of a MoFA Department, Ghana.

Several suggestions were made to address and respond to risks, including COVID-19:

- Mainstream the Plantwise approach and preparedness for and management of invasive species in government programs and extension efforts, by planning these activities at different levels with dedicated budgets.
- Mobilize resources with development partners in-country for Plantwise and Action on Invasives approaches, activities and research.
- Explore and engage with private sector actors and private agriculture advice services to have them deliver plant clinic services by charging farmers a small fee for advice and reasonable commissions on linkage to agro-dealers for appropriate agro-chemicals and botanicals.
- Improve digital tools and use of artificial intelligence/machine learning for diagnostics, making diagnosis less dependent on the skilled and experienced eyes of plant doctors.
- Allow for training and facilitate less skilled local actors (for instance input dealers, youth and lead farmers) to play an intermediate role for plant health advice, through improved use of digital tools and in collaboration with plant doctors.
- Increase the use of digital tools and social media for training of staff, peer-to-peer support between plant doctors and troubleshooting of diagnosis and recommendations with subject matter specialists and researchers.
- Train programme staff, extension workers / plant doctors and farmers in the use of COVID-19 preventive measures and protective gear and provide protective gear where possible. In addition, preventive measures should be promoted during plant clinic sessions.

*“Solutions are already out there, social distancing, focusing on the virtual approaches and digital tools already used by the Plantwise programmes and extension department (video, radio, online factsheets). The one-on-one sessions would have been accompanied by appropriate measures, observing the recommended practices.”* Extension Department staff, Ghana

*“From data point of view, this year has been quite un-affected by the COVID-19 pandemic. People who have internet access can access the data and use it.”* – Global staff Action on Invasives.

### **6.5.3 What is the potential of the programmes to deliver outcomes that contribute towards food and nutrition security in the medium- and long-term?**

However, if the above-mentioned risks can be addressed and the programme can continue functioning, the potential of the programme to deliver outcomes that contribute to food and nutrition security are considered high by key informants.

*“There is a very high potential for the programme to contribute to food and nutrition security. We need to increase the involvement of all partners. The current policies [in Ghana] favour agricultural development and we can argue for plant health as an important contributor to agricultural production.”* – University staff, Ghana.

The programmes contribute to food and nutrition security indirectly through reduced losses, increased yields and lower production costs. Key informants from all levels and all countries see potential as crop losses due to pests and diseases are still high, and plant clinics are effective to reduce crop losses according to several studies (AIR, 2018; AIR 2019). However, it would require an increase in the number of plant clinics (e.g. one clinic per county/district/province) to see an effect at national

level. Others suggest that plant doctors could also expand their advisory services, including household nutrition, post-harvest management or soil management.

*“While many plant doctors have been trained, there is significant staff turnover, attrition and loss of capacity in the pool of extension workers. Recently, a lot of new PPRSD staff have been recruited and posted to districts, this pool of agents is well positioned to run plant clinics and need to be trained in the different Plantwise modules.”* – CABI staff, Ghana.

#### **6.5.4 What is the resilience of both programmes towards adverse effects (political changes, social unrest, natural disasters, etc.) that may occur during a long-term time period of 10 years?**

With regards to the resilience of the programmes towards adverse effects (political changes, social unrest, natural disasters, among others) most respondents felt that the programmes were resilient, because it was anchored in multiple organizations through the NSC and has shown its benefits over the years. It was also believed that Plantwise and Action on Invasives programmes have laid the basis and developed the infrastructure for the plant health system to continue to function as long as running costs could be covered. The FAW invasion as an example of a natural disaster, has confirmed the importance of the programmes and the way the programmes have facilitated a coordinated response has convinced both government and donors to invest in preparedness and response to invasive and pest species.

*“The programme is very resilient by virtue of the way it has been conceptualized. Involvement of key stakeholders should be maintained if they see the benefits, they will continue to engage and make sure the programme keeps running and remains functional.”* Former Extension Department leader, Ghana.

#### **Opportunities for Plantwise+ considering the risks mentioned**

As mentioned above, there are ample opportunities for the Plantwise+ programme. Some key opportunities are:

- Increased digitalization of services of Plantwise and linkage of these to other services (for example the China subsidy scheme for less hazardous pesticides).
- E-plant clinics present a great opportunity for plant doctors to expand their outreach especially to remote areas, and farmers with mobility challenges (for instance in Pakistan).
- Use of social networks may allow local actors and resource persons to become intermediaries between farmers and plant doctors, with a business opportunity if farmers are willing to pay a small fee for the advice and/or a small commission on products sold by the resource person.
- Private sector engagement: The risk of inappropriate recommendations of red list pesticides and inability of agri-input dealers and service providers to do diagnostics and provide good recommendations should be turned around by having them engaged in advice and charging a small fee.
- Private sector engagement: Opportunities exist to link up with commodity-based private sector extension services (example with Ghana cocoa sector) which can complement the limited reach of the public extension system.
- Collaboration and engagement with functioning farmer organizations (cooperatives, unions and federations) with local resource persons appears a good opportunity to increase outreach.

*“The more we can work with diverse service providers and support institutionalizing the programmes in government structures and policies, the more resilient the Plantwise programme will become.”* – Global external informant.

### **Conclusions for programme performance: Risks and potentials**

The Evaluation has identified many risks that threaten successful implementation and sustainable continuation of the programmes, with commitment of government partners and funding at different levels, and extension staff attrition appearing as most important. While the COVID-19 pandemic poses an obvious risk to programme implementation, it appears that for the time being the programmes have adapted and resumed most activities after a temporary halt on activities imposed by lockdowns and restrictive measures by the governments in the first half of 2020.

We further conclude that the programme has a high potential to contribute to food and nutrition security and is resilient to adverse effects given the approaches and tools developed in the programmes and providing a number of adaptations and changes. First, the programmes should diversify partnerships and explore complementary sustainability models in addition to the predominantly government-focused approach currently. Second, the tools developed have the potential to benefit a wide range of stakeholders in intervention and non-intervention countries. It is essential encourage use of the tools through communication, awareness raising and capacity building of interested stakeholders. Third, the transition to digital and tablet based e-extension services and ICT enabled extension campaigns hold great promise for increasing reach and enabling implementation in challenging contexts (COVID-19, insecurity, difficult-to-reach communities) and needs to be accelerated and scaled to enable increase coverage and scaling to new areas and countries. E-extension and ICT enabled extension campaign also allow for the dissemination of complementary, climate-smart agricultural practices that can increase yield and income besides controlling pests and diseases.

## **6.6 Innovation**

The majority of respondents mentioned the Plantwise programme, including the plant clinics and e-plant clinics, the POMS database, the Knowledge Bank and the NSC as innovative in itself. It is true that the programme has changed the plant health system radically and has created a more connected and coordinated plant health system, where there was hardly one in most countries. Key informants reported several aspects of the Plantwise programme that are considered innovative in the country and to some extent, also sub-regional and global contexts.

### **Demand-driven extension**

Demand-driven extension is strongly advocated by most research published on the subject, but in practice, it appears hard to realize (Birner & Anderson, 2007). The plant clinic approach is seen as an innovative and promising way to establish demand-driven extension by global, national, local respondents, including plant doctors and farmers (see sections 3.2 and 4.6). Another innovation were the “mobile clinics” where plant clinics were rotated and/or installed in large markets where farmers aggregate.

*“Setup [of the plant clinic] is in front of my input supply store at a prominent/visible place in the vegetable market, so more farmers can access it easily. Farmers contact the plant doctors as per their needs and choice. Having their own interest in view the farmers consider the advice technically sound and implement it” – Agro-dealer, Pakistan.*

### **Knowledge Bank, POMS and data-driven monitoring and decision making**

The CABI study in Kenya (Chege, et al. 2020, p.11) highlights that before the programme, it was difficult to get a ‘general picture’ of plant health issues that farmers were dealing with in a specific location. There was no systematic way of collecting and analysing data, and the POMS system and the Knowledge Bank has helped to solve this problem. The main innovations mentioned by key

informants often refer to the data being collected as part of the plant clinics activities, as the first and most complete effort ever done in Kenya, Ghana and Pakistan. CABI, ministries of Agriculture, researchers and departments of agriculture in all countries reported that the access to real-time information informed their decision making.

### **E-extension and use of social media**

The use of digital services for diagnosis and recommendations is also considered innovative within advisory services. Advice can be provided at real-time, using the Knowledge Bank, and provided to the farmer by phone. In addition, data entry is facilitated and peer-to-peer support, knowledge sharing and capacity building is realized. Respondents from all levels and countries agreed that digitalization (move from paper-based plant clinic services to tablet-based services, data entry and information sharing) needed to be accelerated and completed, especially in Pakistan, where the proportion of plant doctors using a tablet appears to be low.

Many key informants testified to the relevance and innovativeness of the digitalization of data collection on plant health problems as integrated part of the plant clinic services.

*“We can now react in time on prevention measures. We have more time to develop programmes.”* – Plant protection agency staff, Kenya.

Another key informant points to similar strengths in the area of innovation: *“Another very different thing is the capturing of agricultural data, which is looked at by different institutions. Making decisions based on such data is very important, and a relevant innovation.”* – Plant protection agency, Kenya.

*“Pakistan has been very innovative in data mining and extracting information for use by ministries and research. Plantwise has evolved very much since the start, trying out new approaches, diversifying our partners and collaborators, introduction of digital tools. The programme is now data driven and now digital data driven. The partnerships are also moving towards private sector.”* - CABI Plantwise global staff.

The Action on Invasives programme was considered innovative for a similar reason, as it enabled a quick response to new notifiable pests and diseases (e.g. Fall armyworm). Through Action on Invasives, a lot of innovative research and approaches/tools have been initiated and developed, for instance:

- Taking a systemic approach to the plant health and invasive species system, assessing gaps and needs and intervene accordingly.
- The horizon scanning tool to prioritize invasive species threats in a specific geographical area<sup>4</sup> and the Pest Risk Assessment tool to aid the selection of appropriate measures for reducing the risk of pest introduction and facilitating the safe movement of plants and plant products<sup>5</sup>.
- Research on biological control, biorational pesticides (Bt botanical extracts) as alternative to large scale use of chemical pesticides for FAW control.
- Increased use of data and tools for risk assessments, forecasting and decision-making.

*“Action on Invasives’ innovation comes from looking at the problem of invasive species through the whole system. Most projects work with individual stakeholders, while Action on Invasives brings all the stakeholders together to work as a team to deal with a common enemy. Invasive species assessment, self-reflection on roles of individual stakeholders and exploration of how roles can be best divided and*

<sup>4</sup> <https://www.cabi.org/horizonsscanningtool>

<sup>5</sup> <https://www.cabi.org/PRA-Tool/signin?returnUrl=%2FPRA-Tool%2F>

*assigned to the most appropriate organizations makes this programme truly innovative.” – Action on Invasives global staff.*

A recent study by CABI on an ICT enabled extension campaign for identification, monitoring and management of FAW in Uganda showed that only 28% of households surveyed had been visited by an extension agent in the 12 months preceding the campaign, that took place between March and August 2018 (Tambo et. al., 2019). In addition, radio, video and sms reached 65%, 30% and 8% of surveyed households, respectively and while radio had the highest reach, video had a greater effect on knowledge and management practices of participating farmers. There was strong evidence for additive positive effects of participation in multiple campaigns to adoption of management practices. It was concluded that ICT campaigns have great potential to improve farmers’ knowledge and sustainable management of pests such as FAW. It would therefore be desirable to make ICT enabled campaigns a central part of the approach to scaling the knowledge and management practices promoted by Plantwise and Action on Invasives programmes.

### **Conclusions for Innovation**

The programmes have been very innovative and continue to innovate in the field of digital extension services, data collection, storage and use, monitoring, evaluation and learning, research on new and emerging pests and diseases, as well as natural enemies and biological control and these efforts should continue.

We conclude that additional areas of innovation should include institutional innovation and innovation in partnerships to enable scaling of the programme. The example where Action on Invasives has played a key role in coordination and building synergies between dispersed efforts of stakeholders for the control of FAW, can be used as inspiration.

## **6.7 Benefits**

Some issues of benefits to farmers (including yield and income improvements) from the Plantwise programme were earlier discussed under section 5.1.2 “Effectiveness”. The AIR studies from Kenya and Pakistan showed the impact and benefits in terms of practices, yields and income to farmers that were users of plant clinics compared to non-users. While there is evidence of impact and benefits from other countries such as Rwanda, Bangladesh and Zambia, there is little robust evidence on farm-level impact of the Plantwise programme in Ghana. However, key informants refer to many examples of anecdotal evidence of farmer benefits. There is also mention of a certain “spillover” effect by some respondents. This is confirmed by both the farmer LQAS results and the plant doctor results (sections 3.1 and 4.1.2 in this report).

*“There is a benefit to attendants, but also a benefit to other farmers (outside plant clinic attendants). The cost ratios and internal rates of return are very high for extension intervention.” – CABI Plantwise global staff.*

Some benefits for farmers mentioned by respondents in Ghana were:

- Farmers are able and confident to show their plant health problems to the plant doctors and receive clear recommendations on the use of control methods and pesticides.
- Many vegetable farmers attested to experiencing increased yield, reductions in postharvest losses and as a result, increased income.
- Three district and national respondents mentioned farmer testimonies of a doubling in rice (from 1.5-2 tons/ha up to 4 tons/ha) and/or maize (from 0.74 tons/ha to 1.7 tons/ha) yields because of the use of pest-free, certified seeds and IPM practices by plant clinic attendants,



while other estimates were more conservative, stating that losses of about 30% had been reduced to losses of about 10%.

- Feedback from the districts mentioned reduced “abuse” of pesticides on okra and several vegetables, use of improved tomato seeds, control of fungal disease on onion using the appropriate fungicide and improved pest and disease control in cocoa, all leading to increased yields.

Some benefits to farmers mentioned in Kenya were:

- Crop losses caused by FAW were reduced from 30% to 8-12% in 2017, and 2-4% in 2019 in one county due to the programme’s response.
- Higher crop yields (e.g. Irish potato) were reported in wards covered by plant clinics than in wards without plant clinics.

Some benefits to farmers mentioned in Pakistan were:

- Farmers are encouraged to use only appropriate types and doses of pesticides.
- The doses of pesticide, numbers of sprays, and the interval between two sprays recommended by the plant doctor cost less as compared to that recommended by the dealers.
- Increased yields, decreased post-harvest losses and increased income.

However, in some cases, no decrease in pesticide costs was observed.

*“I observed a decrease in crop losses and an increase in the crop yield during my contact and discussion with the farmers. Income may be increased due to more yield but I didn’t observe any reduction in the expenses incurred by the farmers on plant/crop protection.”* – local agro-dealer, Pakistan.

Of course there are several benefits to other stakeholders, such as the extension agents who become plant doctors, often mentioned as “the pride of the extension services”. Key informants agreed that Plantwise has resulted in an increased level of knowledge and subsequently confidence of extension staff. Plant doctors have significantly better knowledge in plant health than other extension staff, and farmers’ confidence in the plant doctors’ skills has increased as a result.

Respondents stated that it was too early to make statements about the benefits to farmers for the Action on Invasives programme. Some other benefits mentioned in relation to the interaction between Plantwise and Action on Invasives to interventions /results were:

- The data and information is now available in the POMS and the Knowledge Bank to be used for surveillance, giving recommendations even for the general public who can now solve a problem encountered in the field by consulting the Knowledge Bank because almost all current pests with their solutions have been documented.
- Data is now actively used by research, thus reducing the costs for individual surveys and scoping missions for specific pests and diseases.
- Action on Invasives complementing the Plantwise programme with higher level plant health system interventions such as coordination of responses to invasive species, assessment prioritization of emerging pests, advocacy for investment into prevention, preparedness, early response etc. and initiating community action and research on (biological) control of new and emerging pests.
- Action on Invasives is also piloting community based, area-wide management approaches that can reduce populations of mobile pests over a wide area, which is likely more effective than efforts of individual farmers.

- Action on Invasives also tested the use of mass media extension approaches for specific (invasive) pests.

## Conclusions for Benefits

There is a lot of anecdotal evidence and in some countries (Kenya, Pakistan) scientific, rigorous evidence of concrete benefits of Plantwise to farmers. The programme has the potential to benefit even greater numbers of men and women farmers, providing the programme achieves coverage at scale. We conclude that the priority of the Plantwise+ programme is to take away barriers to scaling of the intervention, rather than improving on the intervention itself. The options for taking away these barriers have been provided in the previous chapters and should consist of a combination of (1) more engagement with private sector and local organizations actors, (2) persistent resource mobilization and advocacy in-country and in regions, (3) experimentation with diversified partnerships, delivery channels and sustainability models.

## 6.8 Good practices and key lessons learnt

Several good practices and key lessons learned were mentioned by key informants from the global, national and local level. The major key lessons learned, for the Plantwise and Action on Invasives programmes mentioned by respondents are summed up below.

1. **Plant clinics have filled a gap in the linkage of stakeholders in the plant health system and extension**, in the sense that there was no specific approach for extension on plant health issues before the arrival of Plantwise. Government plant protection agencies had the mandate to provide this type of service to farmers, but did not have the agents or capacity in the field to implement this service and lacked the resources to train and support extension agents to provide this service. The Plantwise programme has delivered a holistic system for delivering this service and has built not only capacity, but also the confidence of extension agents to respond to farmers' needs and give quality advice on pests and diseases. The usefulness and benefits for farmers have been confirmed by several impact studies, and in this evaluation by key informants, plant doctors and farmers (sections 3.2, 4.8 and 5.2).
2. **The move from a focus on single, synthetic pesticide solutions to a holistic, integrated pest management approach** for plant health in some countries has been a major shift. This has helped reduce the frequent, inefficient use of hazardous pesticides by farmers, reducing their cost and health hazards, as well as improving the safety of the food produced. In addition to the advice provided for pesticides, plant doctors also encourage the use of other important inputs, such as quality seeds of improved varieties. To a certain extent, the Plantwise programme in Ghana has helped raise food safety standards for vegetable producers which, in combination with efforts from other stakeholders, has helped a recent lift of the EU ban on imported vegetables to Europe from Ghana<sup>6</sup>. However, it appears that many farmers still use (hazardous) chemical pesticides to treat plant health problems, likely suggested by agri-input dealers and untrained or uninformed extension agents. As mentioned in the LQAS, advice from the plant clinics is supposed to provide both non-chemical solutions and least toxic pesticides where this is deemed necessary, while discouraging the use of red-list pesticides (section 3.2). Therefore, depending on the context, it is possible that in certain cases, the advice may not imply an increase in the use of chemical pesticides. This has often been the case with FAW on maize, where previously, farmer were not using pesticides on maize, but where infestation with FAW obliged the use of pesticides to prevent complete loss of harvest.

<sup>6</sup> Blog stories of impact. <https://www.cabi.org/stories-of-impact/vegetable-exports-from-ghana/>

3. **Adoption of a data-driven approach and data-driven decision making** for plant health issues by the government is a good practice and lesson learnt. Before the Plantwise and Action on Invasives programmes, most countries were not able to make decisions based on current data and evidence, simply because quality data on pests and diseases was hardly collected and the little data collected (mostly by research) was not easily accessible. Plantwise and Action on Invasives have proposed a concrete infrastructure (plant clinics, linked to the POMS, Knowledge Bank, Invasive species compendium) and methods for standardized data collection, validation, management and analysis and has encouraged a culture of data driven advocacy, decision making, policy development and planning (see Section 6.1).
4. **ICT and social media platforms have significantly increased efficiency** of data collection and has accelerated the speed at which diagnosis and advice is delivered to farmers and plant doctors. The migration from paper-based to tablet-based data collection with specialized apps has circumvented the slow and tedious process of collecting and entering paper queries into a database. In addition, social media platforms initiated by Plantwise have resulted in a network of plant doctors, department of agriculture staff, subject matter specialists and researchers for peer-to-peer troubleshooting, capacity building and even virtual training (see sections 4.1, 4.2, 5.2, 6.3 and 6.6).
5. **The Action on Invasives programme has significantly complemented Plantwise** with innovative approaches and research. For instance through (1) forecasting and (bio-)economic modelling of the effect of FAW and different control scenarios on damage to crop yields and economic losses, (2) facilitating specific research on (biological control) of the invasive FAW and linking research from different countries to a global platform, (3) large scale media campaigns on common and prioritised (invasive) pests and diseases in a joint effort with Plantwise, (4) facilitating the establishment of FAW action plans and a FAW task force and to coordinate efforts of many organizations and partners focused on particular invasive species and (5) making data and information available to additional audiences and users (see section 6.6).

On how the programmes have responded to challenges in implementation, the respondents mentioned the following.

1. To the challenge of **high staff turnover**, particularly of extension agents and to a lesser extent staff at agriculture departments and directorates, the Plantwise programme has responded by continuous training and by transferring responsibilities of training of plant doctors to partners in-country. However, still a very small proportion of all extension agents have been trained in the basic plant clinic modules. Another way in which the programme has responded and plans to respond to this challenge is an effort to introduce key plant health and plant protection modules in the national curriculum of the Agricultural colleges (for example, entomology and pathology modules in Ghana).
2. The challenge of **reduced funding for certain activities of the Plantwise programme**, particularly **cancelling of allowances for plant doctors** has been partly solved by substitution with funding from the local governments and other development partners in-country (GIZ, Canada, Self Help Africa, local NGOs). This funding is however, dependent on local government and development partners' priorities and commitments and so not available in each district, county or province. Some additional funding is provided by development partners, who are convinced of the benefits of the plant clinic and it may be useful to explore more in-country advocacy and resource mobilization for the Plantwise approach.

3. In addition, as a result of **the COVID-19 pandemic and government imposed restrictions**, the number and/or frequency of documented plant clinics held in the beginning of 2020 has reduced significantly in comparison to last year. While lifting of restrictions vary between countries, it seems that the number and frequency is picking up again, now that some of the COVID-19 related restrictions are being lifted. There have been several suggestions to overcome the restrictions by adapting the plant clinics to the “new-normal” situation, taking into account protective measures and relying more on virtual /digital tools for diagnosis and advice. Local resource persons, who may not have all the skills of a plant doctor, but who have access to a connected smartphone and are “tech-savvy” could play an important role in facilitating interactions between farmers and plant doctors.
4. There is also a challenge of **reduced or low plant clinic attendance rates by farmers over time** when plant clinics continue to be held in the same place. In Ghana, this may be related to a certain level of saturation of the plant health issues brought to the plant clinic in a given period and area and an increased level of own problem solving, peer-to-peer advice and “self-medication” by the farmers after advice has been given. In some countries, the programme and partners have responded to this challenge by organizing the plant clinics on a rotational basis, serving additional communities at a lower frequency and making use of weekly markets and one-stop-shop locations where farmers aggregate to set up plant clinics and reach a wider audience. It appears that some more experimentation and learning about how to run and rotate mobile clinics in different environments and some harmonized strategy and guidelines would be useful.

## **7 Future adaptations in response to the BHOS policy of the Dutch Ministry of Foreign Affairs**

### **7.1 BHOS policy of the Ministry of Foreign Affairs of the Netherlands**

Two key features of the new Dutch policy for Foreign Trade and Development Cooperation are (1) the focus on specific regions (e.g. the Sahel, the Horn of Africa) and (2) the focus on fragile states. These settings are often affected by armed conflicts, frequently intertwined with politics, an insecurity situation for the civil population leading to internally displaced persons, and a rather dysfunctional public sector that often lacks appropriate leadership and good governance and thus enables corruption. The question therefore arises, how could the Plantwise+ programme intervene and/or collaborate with organizations in these areas and countries, to the benefit of farmers, agriculture extension agents and other agricultural service providers and other actors and improve the plant health system in general? The situation of fragile states would require an adaptation of the Plantwise approach into a more flexible, inclusive and pluralistic manner to deliver (part of) the programme and plant health services to farmers.

### **7.2 A regional, flexible and inclusive approach to plant health system improvement**

Considering likely initiation of Plantwise+ in new, often protracted crises countries and the COVID-19 pandemic that will continue to challenge travel and gatherings, it seems relevant to take a regional, flexible and inclusive approach to plant health. Such an approach regional approach does not imply full intervention in all the region's countries, but rather to assess needs and adapt and implement components of the Plantwise+ programme where useful, feasible and with the right consortium of partners. Linking up with regional networks of for instance research institutes and producer organisations allow other countries to benefit (indirectly) from the programme's outputs. In combination with the strong knowledge management and communication and policy aspects of the current Plantwise and Action on Invasives programme, this might eventually incite national stakeholders to formulate their own programmes and mobilize the necessary funds, and hence strengthen ownership.

The programme's strong link with and feedback from research institutes contributed to its impact in the field and strengthen its credibility with other stakeholders, specifically the national governments. In several regions (e.g. West Africa), rather well-functioning regional networks of national research institutes allow for countries where the programme does not intervene directly to benefit indirectly from its outputs. The same reasoning is valid for regional networks of producer organisations.

In fragile states, the programme could open its networks and partnerships to a wider array of (civil society) organisations; particularly agricultural producer organisations that are firmly rooted in rural areas. They not only offer an opportunity to reach more men and women farmers and hence have a greater impact, but also offer an additional institutional embedding for the programme. Nevertheless, the institutional embedding remains a challenge in fragile states, where weaknesses in good governance affect the society as a whole, for a programme that seeks to address systemic weakness and strengthen the plant health system.

Finally, drawing lessons learnt from and collaboration with similar projects and programmes and those interventions in the agricultural sector that work at grassroots level in fragile states, specifically on gender equality (e.g. reaching women farmers) and youth employment (e.g. youth as service providers), may help to fit the programme's interventions with the context..

From the point of view of a larger stakeholder engagement, the programme could assess the advisory and extension system for plant health and protection through a more pluralistic lens, in order to identify key gaps and functions that need to be filled and strengthened. Coalitions of state and non-state actors could then take the lead. Yet, striking the right balance between the role and leadership of these actor categories remains thought provoking. In that respect, rehabilitating and strengthening the public sector's role may emphasize its role in governance, coordination and regulation and to a lesser extent its role as service deliverer per se. In many countries with advanced decentralization policies, local governments and departments (chambers) of agriculture may be entry points for involving the public sector. Yet, they are often the first victims when central governments reorient or cut budgets.

### 7.3 The risk of insecurity, possible responses and partners

The prevailing, expanding and even persistent insecurity in some countries is a systemic risk for the programme's implementation. First, it makes it more difficult for the programme to reach farmers at grassroots level. Firmly grass-rooted farmer and producer organizations may be instrumental in enhancing outreach through such practical approaches as mobile plant clinics. Furthermore, the use of digital tools, such as easily accessible information and data websites, exchange of experiences through social media, e-clinics, etc., have proven to be effective and efficient. Their potential might be further explored, specifically when considering that youth are at the forefront in developing and using such digital tools. Overall, there seems to be scope for diversifying methods for information and communication. Subsequently, besides evaluating the country's plant health and protection system, assessing its ICT infrastructure and use (internet connectivity, mobile phone penetration in rural areas) thus becomes part of programme identification and formulation.

Second, as the experience from Burkina Faso has shown, public funding of the programme may decrease or even stop, because the government legitimately prioritized security over rural development, and consequently put a halt to the programme's implementation. Therefore, the assessment of the plant health system should lead to identifying those core functions and competencies that need to be strengthened and for which substantial funding needs to be ensured by the programme. In that respect, it is interesting to note that despite the disruption of co-financing by the government, plant doctors and plant clinics continued to function because they respond to urgent need, are effective and, more importantly, have the required capacities.

Unlocking the co-funding potential of the local private sector could also be considered because of the benefits they may reap of the programme<sup>7</sup>. In fact, the programme contributes to the development of markets for agricultural inputs (quality seeds, fertilizers and plant protection products). In many countries, the agricultural inputs sector has been liberalized with an increased role for small and medium input enterprises, whose networks gradually expand. Governments' input subsidy schemes for fertilizers have proven to facilitate the expansion of such networks. Equally, the demand for quality seeds remains or even increases, once farmers have experienced the benefits from using quality seeds. A thriving (formal and informal) seed sector now supplies quality seeds and offers an institutional opportunity for the programme to link.

However, getting the private sector on board requires adopting a cropping systems perspective, instead of plant health and protection in a strict sense, by the programme. This also corresponds to the farmers' perspective and crop management practices. Advice for integrated crop management contributes to sustainable agricultural intensification and hence to improved agricultural productivity. Already existing supply chain-based models could integrate plant clinics as embedded services for which farmers pay through purchasing plant protection and other agricultural inputs. The development, testing and rollout of such business models may include public (programme) – private (agri-input dealers) partnerships. A stronger engagement of the private sector may also involve a bias towards cash crops and marketable staple food crops at the expense of minor crops, often cultivated and sold by women. Within public-private financing arrangements, public funds may be geared towards these crop sectors.

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<sup>7</sup> See for example Geurs et al. 2020 for examples of investments in agri-business in fragile settings.



Finally, there's a strong presence of programmes and projects from the humanitarian sector, of which some may have a keen interest in integrating (part of) the plant clinic approach in their basket of options for food security interventions (often also with an agriculture component) to provide plant clinic-type services to vulnerable populations. Therefore, an exploration of collaboration with organizations such as the United Nations organization (e.g. World Food Programme, Food & Agriculture Organization, UNDP) and international humanitarian NGOs (e.g. Red cross society, CARE, Mercy Corps) may be an opportunity to deliver plant health services as well.

Focus regions and countries of the BHOS policy are, Horn of Africa (Ethiopia, Kenya, South Sudan, Somalia, Uganda), East Africa (Burundi), Sahel (Burkina Faso, Mali, Niger), Northern Africa (Tunisia, Egypt), and the Middle East (Palestinian Authorities, Jordan, Lebanon and Iraq), some of which are known to CABI. CABI could explore options and encourage these BHOS focus countries to become a member of CABI by reaching out to partners in these countries. In addition, CABI could seek collaboration with existing initiatives and programmes funded by the Dutch government and other Plantwise donors through the embassies present in these countries and regions.

An important element of entering and intervening in new areas is to make an assessment of the needs, stakeholders, the feasibility and the risks of initiating the programme in a new country. Then, Plantwise and Action on Invasives approaches and delivery systems can be adapted to the specific (fragile country) context and the new consortia of partners. Eventually a strategy and tentative workplan can be established that explains how the programme can support interventions by specific training and technical support to in-country partners and facilitation at distance.

There is great potential for translation (e.g. French, Arabic) and adaptation of training materials, factsheets and Pest Management Decision Guides from the Knowledge Bank and from neighbouring countries that have been covered by Plantwise and Action on Invasives. With some flexibility and adaptation, the new Plantwise+ programme could envisage piloting in a selection of countries in the fragile areas, providing this is a donor priority and providing specific funding is made available.

## 8 Conclusions, future perspectives and recommendations for Plantwise+

### 8.1 Conclusions in the light of the programmes' theories of change

The main goal of Plantwise and Action on Invasives is to strengthen national plant health systems in order to reduce crop losses caused by plant health problems and thus improve agricultural productivity and food security. Plantwise distinguishes the following main components of a plant health system in its Theory of Change: (1) extension, (2) research, (3) input supply, (4) regulation. Action on Invasives complements Plantwise in that it adopts a systems-based approach to managing biological invasions across sectors in three stages, namely (1) Prevention, (2) Early detection and rapid response and (3) Control and restoration. This evaluation did not take a counterfactual into account (i.e. what would have happened in the countries without the presence of Plantwise and Action on Invasives). As both programmes pursue systemic change in the plant health system at national system, it is impossible to construct a counterfactual. Comparing the performance of the two programmes to other similar programmes is also problematic as Plantwise and Action on Invasives are unique in their approach. Despite the lack of a counterfactual, we attempt to draw some key conclusions related to the four main components of the plant health system, essential to the theory of change for Plantwise.

#### Extension

There is sufficient evidence that Plantwise has made a positive contribution to extension services on plant health with innovative approaches such as plant clinics, plant rallies and in more recent years the introduction of e-extension tools and platforms. As such it can be confirmed that farmers' access to reliable and locally relevant information on plant health has improved as plant health problems are being identified more quickly and farmers receive timely recommendations from trained plant doctors.

The capacity building of extension agents and public services staff responsible for plant health has also made a lasting effect, but challenges remain with high staff turnover rates, limited refresher trainings, and a large proportion of extension staff that have not received this Plantwise training. It is unclear to what extent the Plantwise programme would continue in different countries should funding from the programme be reduced or stopped and these will depend on the mechanisms that have been created to foster national and local leadership and funding. Some key informants thought that more evidence on the effectiveness of the program and more lobbying / advocacy was required to convince governments to dedicate funds to the Plantwise programme. A few respondents mentioned some performance-based incentive scheme for extension agents or fee-per-farmer query mechanism to support continuation of plant clinics.

This poses a question whether there is scope to train (public and/or private) extension agents into specialized plant doctors that can operate with a sustainable business model to cover the expenses of their services, or whether the knowledge and skills should be mainstreamed into the tertiary education curricula for the national agricultural research and extension system. Local context may determine which option is most relevant. Private sector service providers in plant health require an enabling businesses environment (including certification and registration of plant doctors, regulation of agro-chemical inputs, etc.) and farmers who are willing to pay for the services which is more likely in areas where farmers are involved in commercial farming of crops susceptible to pests and diseases (e.g. horticulture, cash crops). Integrating the Plantwise approach into the national public services requires a strong long-term commitment of national and local governments to agricultural extension. There are

concerns, however, to what extent national implementing partners (such as local governments) are willing and/or able to fund and facilitate the agricultural extension services in general and the Plantwise+ programme in particular. In most countries, a more pluralistic approach to the plant health advisory services will be required, where public and private advisory service models could be developed for different areas, commodities and types of farmers, thus complementing each other in terms of coverage, scale and reach.

Most evidence refers to the effectiveness of the plant clinics, but the effectiveness of community events such as plant health rallies are less clear – there is little reference to these activities and evidence on the cost-effectiveness of these events (in terms of the impact they have on knowledge, practices, yield and income) is lacking. Other methods, such as radio, video screenings or social media platforms, may be more (cost) efficient in awareness raising on plant health issues at scale, but this would need to be verified with robust data on the costs and benefits of each dissemination method which is currently only available to a limited extent.

## **Research**

Linking up different national stakeholders (including researchers) in the plant health system, and collecting real-time data on crop pests and diseases through the plant clinics, has strengthened the national research capacity on plant health. Emerging pests such as FAW can now be identified more rapidly and through surveillance, hotspots can be located, facilitating targeted responses. The NSC, plant clinic clusters, stakeholder meetings, POMS data and the Knowledge Bank have all been important instruments for this.

One underlying assumption of the Theory of Change is that research will feed new knowledge on plant health back into higher level (tertiary) education. It is not known whether this is indeed the case in different countries. As most national research organisations are separated from universities and colleges, this linkage is not always evident. More effort should be made to engage with higher level agricultural education to improve the national curricula with the experiences from the Plantwise trainings (both content and skills training modules). Another assumption is that the linkage of extension and research (through the POMS database) would allow for validation of diagnostics and recommendations and lead to new factsheets and pest management decision guide materials. While new materials have been produced in Kenya and Pakistan as recent as 2019, the production of information materials seems to have come to a halt since 2016 in Ghana, where no new factsheets or PMDG have been developed posted on the Knowledge Bank.

## **Input supply**

Input supply is a key factor in the plant health system that will determine the achievement of the goal of reduced crop losses, increased yields and increased income. Even if extension and research are able to deliver the right recommendations to farmers at scale, it is of little use if farmers cannot access the recommended products at affordable prices. This is still the weakest component in the plant health system in many countries. There are still many reports of agro-dealers providing incorrect recommendations, a common preference among farmers and agro-dealers to use chemical inputs to treat plant health problems, and sales of hazardous products that are registered on the red list and prohibited. Regulation and enforcement is often lacking, due to a lack of capacity (human and financial resources) for inspection services. Informal markets and porous borders make it difficult to control the sale of such products. But the availability of safer biological pesticides is also very limited. So far, the engagement of the private sector in the Plantwise programme has been weak, and this is acknowledged as being a problem. More engagement with, and capacity building of, agro-dealers is required, as well as investments in (local) production of safer biological inputs and building a business case for agro-dealers to provide alternative recommendations and products.

## Regulation

CABI invests in strong collaboration with the ministries of Agriculture and plant protection departments which are mandated with the detection and control of emerging pests (including invasive species) and the regulation of agricultural inputs. This collaboration has improved the capacities of the ministries to strengthen their regulation function.

The Action on Invasives programme has further contributed to the improvement of this plant health system component and has complemented Plantwise in areas of preparedness of the plant health system for new and re-emerging pests, diseases and invasive species and responses to specific and destructive invasive pests. Additionally, the Action on Invasives programme has identified and executed activities to strengthen regulatory systems so that they encourage private sector investment in and registration of lower-risk products. This innovative programme is more or less integrated into the Plantwise programme in some countries, but this could be improved in the future.

## 8.2 Future perspectives and recommendations for Plantwise+

It is clear that the Plantwise and Action on Invasives programmes have come a long way to introduce a holistic approach to improving the plant health system. The interventions ranged from providing plant health advice services at the community level and documenting these, to collecting this data and analysing it for surveillance, monitoring and decision making, to content development for further recommendations and dissemination and finally to support national level responses and preparedness for new and emerging (invasive) pests and diseases.

However, a number of weaknesses were identified by respondents that need to be addressed, such as: (1) unsustainability of funding at different levels, (2) low national coverage of the plant clinic services, (3) high staff turnover, especially for extension agents, (4) varying degrees of engagement of different partners at the district, regional and national levels, (5) indications of issues with data collection, submission and use and (6) weak linkages to and engagement with agri-input dealers, farmer organizations and other local, non-government stakeholders.

The Plantwise programme structure and activities are fit for purpose given the current context of agricultural extension systems as described by Davis et al. (2020). It works with governments to improve the policies and strategies on plant health, provides additional funding to resource extension services and facilitates stakeholder collaboration and coordination through the NSC. However, a larger diversity of advisory service providers could be invited to these national multi-stakeholder platforms.

The observations on constraints related to organization capacity were also confirmed in this evaluation; recent experiences with e-extension however show that some of the constraints can be partly overcome by using more digital tools to give plant doctors better access to information sources and facilitate some of their administrative tasks. Plantwise should continue to invest in the digitalization of the plant clinic services. In terms of advisory methods, Plantwise has piloted a demand-driven approach which is still rather unique. It could, however, explore the option of working more with lead farmers, in particular those who can disseminate new knowledge to other farmers.

Having considered the leading evaluation questions, the BHOS policy, the plans for the new Plantwise+ program, suggestions made by plant doctors and key informants and our own opinions and experiences, KIT articulated the following recommendations.

**1. We recommended the development a two-step approach to Plantwise+ with an initial piloting phase of three years, followed by a consolidation and scaling phase of seven years.** In the first phase, the focus should be on (1) accelerating sustainability in current “successful” Plantwise and Action on Invasives countries that “graduate out” of the programme and (2) piloting of a flexible and adaptable Plantwise+ approach in a few diverse countries that represent different contexts and varying levels of fragility/insecurity. The first phase should be specific about objectives and outputs in each of the two types of countries, what is to be “learned” from each country and how this should translate into scalable approaches for other countries.

For accelerating sustainability, it will be essential to define and develop vision of success with outputs and targets for each country, which should include a minimum standard for coverage in terms of geography, focus crops and target populations, indicators for quantity and quality of queries and data submitted and validated. The vision should provide clear indicators at the country level for use of programme data for decision making by governments and research organizations, knowledge management, policy development and informing and engaging with non-governmental and private sector actors, including farmer organizations. A second important element of the vision of success should be a national resource mobilization plan that takes into account all relevant options and sources of funding (including government, donors and development partners and private sector sources of funding) and how these are expected to evolve over the three-year pilot phase and the seven-year consolidation and scaling phase. Based on this information, a concrete, three-year action plan will be developed to support a country to graduate from the Plantwise programme.

For piloting the approach in new countries, including fragile states, another approach should be taken on the short term, but that is expected to evolve towards the accelerating sustainability on the long-term. We suggest an exploratory phase of six months to identify partners and assess the in-country stakeholders’ needs, assess feasibility and define how the programme would need to be adapted to fit the context. In addition, a realistic vision of success, with appropriate objectives, outputs and indicators should be developed through a co-creation process with identified diverse partners that represent pluralistic agricultural extension and plant health systems.

The findings from the first phase, should allow for a pathway for scaling the approach to more countries based on the findings from implementation and scaling in diverse countries and adapting a scaling strategy based on the experiences and the realities of those new countries. For the success of such a programme, it will be essential to build in an efficient monitoring, evaluation and learning strategy from the start (including baseline studies) and to quickly establish collaborations with private sector and development partners in each country for investment and co-funding to build in sustainability from the start of the programme, rather than this being more of an afterthought. A baseline study / assessment would be developed based on the vision of success for selected countries, and should take into account the expected results, outputs, outcomes and impact at the farmer, extension system and plant health system levels. In addition, a reliable M&E system should be developed to ensure optimal allocation of resources toward the different (extension) activities and tracking of the benefits for farmers and other stakeholders. Especially for pilot countries, it is suggested to do a baseline study *after* the inception and co-creation phase and to define how indicators will be monitored over the three-year period. With similar funding the program should start in 10-12 countries in the first phase and scale to a maximum of 25-30 countries in the second phase.

**2. We recommend establishment of more diverse partnerships, specifically engaging with the private sector and farmer organizations, under Plantwise+.** Private sector stakeholders (e.g. agri-input dealers, off-takers, agri-food processors, financial services) are important actors and stakeholders in the plant health system, interacting intensively with farmers and providing advice of

varying quality. Not only should the private sector feature more strongly in the national partnerships, but also at the local level in the implementation of plant clinics. Agri-input dealers may be motivated to invest in advisory services to increase their sales, whereas off-takers may be motivated to invest in advisory services to improve the quantity and quality of produce they purchase from farmers. Financial service providers may be motivated to invest in advisory services to reduce risks in farming, e.g. in combination with crop insurance. A recent study on agri-business based advisory services (van Veldhuizen et al., 2020) describes several models that can be used to develop a more pluralistic approach to plant clinics. Other real-life models of private sector services and input supply to smallholder farmers include: (social) enterprises such as East-West Seed, Koppert or One Acre Fund; public-private partnerships such as 2SCALE; or impact investments through for example the Africa Agriculture and Trade Investment Fund (AATIF). Such private sector initiatives can provide insights and lessons learned on how to engage private sector and develop business models for last-mile delivery of advice and inputs to smallholder farmers. Farmer organizations often have a network of lead farmers in communities who can serve as intermediaries between farmers and plant doctors, or if their skills and level of education allow, become plant doctors themselves.

In conclusion we recommend that the Plantwise+ programme develops specific activities towards actively engaging private sector and local (farmer) organizations by (1) training local agri-input dealers, service providers and lead farmers and linking them up with plant doctors and other stakeholders, (2) exploring beneficial collaboration between plant doctors and agri-input dealers and service providers, (3) facilitate access to safe, non-red list pesticides by input dealers and farmers and (4) explore fee-based plant clinic advice and incentives for public extension agents and private sector services providers. It will be useful to build on the experiences of KIT and CABI with the Agribusiness-based Advisory Services (ABAS) study to identify and engage with private sector partners to explore collaboration for the integration of plant doctors services and/or plant clinics in ABAS models during the Plantwise+ programme.

The advances made in relation to **e-extension and ICT enabled mass media dissemination should be further developed and scaled in Plantwise+**. These e-extension and ICT enabled communication tools will extend reach to new areas and new countries and to facilitate services by moderately skilled local service providers and intermediaries between farmers and plant doctors. Such an effort should allow for inclusiveness towards youth entrepreneurs, local agri-input dealers, lead women and other local resource persons. In addition, such tools allow for reaching farmers in challenging environments, such as difficult-to-reach areas and areas with insecurity where there is no presence or reach of extension personnel.

We have summarized and complemented what we consider additional key recommendations for successful continuation and consolidation of the current Plantwise and Action on Invasives programmes into Plantwise+ and to pilot new approaches to plant health in the light of climate change and evolution of the food systems in the coming years. These are to:

- Merge the Plantwise and Action on Invasives into one overarching programme, with one steering committee and harmonized and unified programme and organizational structure. While some significant changes may happen to the programme management structure at the global level and within CABI as an organization, it seems that in-country the two programmes already seem largely integrated (section 6.4).
- Establish a minimum standard for plant clinics at the national level in terms of geographical coverage, target populations and advocate for adoption in national policies, strategies and work plans to be complemented by a pluralistic consortium of partners (sections 6.2 and 6.3).
- Articulate and execute country-specific national resource mobilization strategies to obtain funding at different district, regional and national level, with research organizations, private



sector actors and in-country development partners for the Plantwise+ programme (sections 6.2, 6.3 and 6.5).

- Improve engagement and coordination between and with the regional and district departments of agriculture and the national Plantwise team and steering committee (section 6.4).
- Increase training of extension agents and encourage more and peer-to-peer training, using social media platforms such as Telegram and WhatsApp, which is already being done at a small scale (section 6.6 and 6.8).
- Pilot and test alternative delivery channels of plant health services, with private sector agriculture service providers, lead farmers, farmer organizations, NGOs and other interested community level actors, building on the experience with social media and peer-to-peer support (sections 6.1, 6.2, 6.3, 6.8).
- Explore use of artificial intelligence / machine learning for diagnosis and validation of picture based queries (section 6.6).
- Develop regional, flexible and inclusive strategy and workplan that takes into account the risks related to COVID-19 and working in protracted crisis, fragile countries and areas (sections 6.5 and 7).
- Explore how existing approaches, tools, training materials, factsheets and Pest Management Decision Guides from the Knowledge Bank from current programme countries can be adapted and translated for neighbouring, new countries in the Plantwise+ programme (section 7).

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# Annex 1. Methodology

## A1.1 Objectives of the evaluation

The Terms of Reference (ToR) states that the overall purpose of the evaluation is to assess the effectiveness of the unique approaches of Plantwise and Action on Invasives in order to inform the new global flagship programme 'Plantwise plus' as well as the funding decisions of potential future donors. More specifically, the proposed evaluation aims to provide a quick assessment of the performance of Plantwise and Action on Invasives as interrelated activities, specifically the impact against main objectives, its relevance for target groups and stakeholders, effectiveness, efficiency, programme management and risks/potentials.

The evaluation is guided by the following questions as stipulated in the ToR:

6. What is the performance of Plantwise and Action on Invasives programmes as interrelated initiatives, paying particular attention to the impact against main objectives, its relevance for target groups and stakeholders, effectiveness, efficiency, programme management and risks/potentials (see below some example questions, to be refined as part of the evaluation methodology development)?;
7. To what extent are both programmes innovative, with a focus on country activities in Africa and Asia?;
8. What are the benefits (incl. yield and income improvements) experienced in both programmes as compared to alternative interventions/results (opportunity costs)?
9. What are the good practices and key lessons learned to date and how have the programmes responded to challenges in implementation?
10. What should be done differently if the same programmes had been initiated in response to the new BHOS policy of the Dutch Ministry of Foreign Affairs.
  1. What activities could work well in the BHOS focus areas (in particular in fragile states of West Africa/Sahel, Horn of Africa, Middle-East and North Africa), where programme activities have not yet taken place.
  2. How should CABI go about identifying the need for and relevance of those activities (identified under a) in the DGIS focus countries, to confirm which countries could be relevant for CABI's programme activities to help improve national plant health systems and/or advisory to the ultimate benefit of smallholder farmers in those countries?
  3. What should CABI do to identify the relevant stakeholders and partnerships needed in selected countries (confirmed under b) so that future programme work could be implemented in those countries?

The evaluation is based on qualitative data collected from stakeholders involved in reaching program impact, from the coordination and program management, to country implementers and key partners, as well as from community level implementers (plant doctors) and beneficiaries (attendants of plant clinics) of the programme. Data was collected through semi-structured key informant interviews, online surveys, structured interviews with plant doctors and farmers and document reviews. Three country case studies were included: Ghana, Kenya and Pakistan.

## A1.2 Limitations and risks

The evaluation was conducted during July-August 2020. The evaluation methodology was subject to several limitations. The main constraints to the evaluation were (1) the Covid-19 pandemic, restricting personal travel to, and within, the countries of the evaluation and face-to-face in-depth interviews or focus group discussions with key stakeholders and (2) the very short timeline for this evaluation, limiting the time of conceptualization of the approach and development of the evaluation and tools, collection, analyses and interpretation of the data and synthesis of the report.

These limitations and risks have been taken into account by choosing the most appropriate approaches for the evaluation, namely by:

- (1) Using KIT's long-standing experience and extensive networks of consultants and stakeholders in the area of plant health in the countries where the evaluation will take place (Ghana, Kenya and Pakistan);
- (2) Contracting national competent consultants to facilitate data collection with in-country stakeholders and programme beneficiaries in each country;
- (3) Using data collection and interpretation tools that can be deployed online or over the phone, and allow for collection in an online database with customized real-time dashboards for a quick turnover of data collection, processing and analysis;
- (4) Choosing an evaluation team with complementary knowledge, experiences, capacities and skills and have regular team meetings (mostly virtual) to advance the process in a timely manner.

## A1.3 Programme theories of change

### A1.3.1 Plantwise

The main goal of Plantwise is to enable farmers around the world to 'lose less and produce more' of their crops, thus contributing to increased food security, improve (rural) livelihoods and alleviate poverty. This is done through the strengthening of plant health systems (in particular the components extension, research, input supply and regulation) so plant health problems in farmers' fields can be addressed more effectively. Plantwise as a change agent aims to strengthen the linkages between the different system components within the countries, leading to the following outcomes: (1) larger numbers of farmers having access to reliable plant health information; (2) rapid identification of new and emerging pests; and, (3) increased accountability of organisations to farmers. All this will ultimately increase national response systems to plant health threats, and thus increase agricultural productivity, decrease crop losses, and hence improve livelihoods and food security (see Figure 5).

Plantwise in particular seeks to strengthen the capacity of existing national agricultural institutions and organisations (Ministries of Agriculture, extension systems, agricultural research institutes, agrodealer networks) in order to improve the national plant health system. The Plantwise activities are grouped into five broad work areas: (1) plant clinics; (2) stakeholder linkages; (3) data management and use; (4) information exchange and knowledge bank; and (5) monitoring and evaluation. A strengthened plant health system is expected to deliver high quality information (on plant health management) and improved service delivery to farmers.

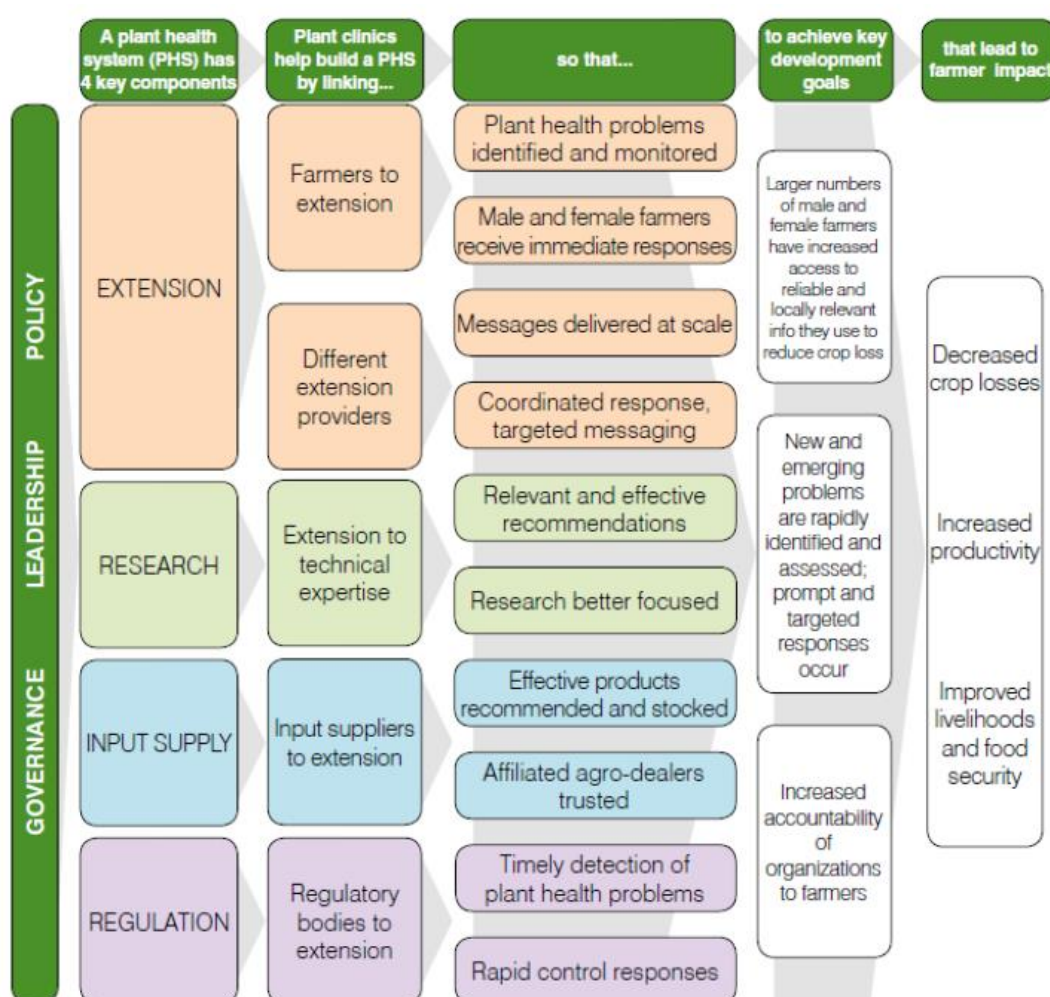


Figure 5. The Plantwise Theory of Change. Source: CABI Plantwise strategy 2015-2020

Key assumptions (as defined in the Terms of Reference) underlying the theory of change of Plantwise are:

1. A plant health system is defined by four key components: (1) extension, which delivers available knowledge intended to improve plant health; (2) research, which develops new knowledge about plant health and is often linked to higher level education; (3) input suppliers, who deliver knowledge and physical inputs such as seeds, biological and other crop protection products and fertilizers; and (4) regulation, which regulates sale and use of agricultural inputs, protects countries from new and emerging pests (invasive species included), and regulates produce trade requirements.
2. Plantwise will have even broader, but less measurable, impact over the long term through gradual systems change, or tertiary reach, that lead to increased effectiveness of plant health systems in addressing crop problems.

Additional assumptions that are relevant to achieve impact at farmer level include:

1. Farmers have access to input and produce markets, as well as other services (e.g. credit) and agricultural capital (e.g. land, labour).
2. Farmers implement / adopt the plant doctors' advice.
3. Countries integrate plant clinics into extension and plant health services structures.



### A1.3.2 Action on Invasives

Action on Invasives<sup>8</sup> is a regional, cross-sectoral partnership involving a coalition of stakeholders. It adopts a systems-based approach to managing biological invasions across sectors in three stages:

- Prevention – development and implementation of biosecurity action plans, raising awareness of threats at the local level (including through mass media campaigns), and preventing arrival and spread.
- Early detection and rapid response – development and implementation of surveillance and emergency action plans for detecting and eradicating listed species and building capacity to implement these plans.
- Control and restoration – evaluating and scaling up existing invasive species management solutions and developing and scaling up new solutions to ensure those living in rural communities have in place best practice and locally adapted solutions.

To pursue this three-stage approach, the programme is organised into four work packages, which are implemented together with relevant partners in the identified countries and regions. The work packages are (Action on Invasives annual report 2017):

1. Stakeholder engagement: bringing together local, national, regional and international stakeholders under operational frameworks, using established linkages through the Plantwise programme and other partnerships. The aim is to identify and evaluate implementation successes and problems, monitor compliance with national and international policies/agreements and addresses regulatory issues while monitoring institutional change and collaboration.
2. Knowledge and data: mapping existing knowledge against needs to identify knowledge gaps. In addition, information and data at regional, national and local levels are exchanged and/or created using online/offline content.
3. Providing best practice solutions for invasive species: developing and strengthening cross-sectoral risk assessment procedures, prevention protocols and contingency plans with partners in line with international guidelines to support diagnosis and surveillance for priority species. The programme trains relevant border/port staff to improve the rate of interception success and develop training curricula, business plans and protocols, paying particular attention to the use of biological control methods. The programme also works with partners, strengthening their capacities to identify and test invasive species control options, validating existing methods and testing new ones to help deliver sustainable solutions.
4. Community action: developing large-scale implementation plans based on identified best practice solutions and community needs. The programme works in partnership with rural communities and local actors to collect and analyse information and data on the negative impact of invasives on livelihoods, to strengthen additional extension approaches, and to understand the costs and beneficial impacts of managing invasives. In the longer term, local production of biological control methods will be facilitated, encouraging business plans that contribute to local employment opportunities.

Figure 6 summarize the Theory of Change of the Action on Invasives programme.

Key assumptions (as defined in the Terms of Reference) underlying the Theory of Change of Action on Invasives are:

- Adopting a systematic approach to tackle the most impactful biological invasions across agriculture and the environment will enable creation of the right 'critical mass' to reduce direct economic damages to agriculture and trade caused by invasive species.

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<sup>8</sup> Source of information: <https://www.invasive-species.org>

- Policy makers will be convinced by evidence of impact of invasive species and develop enabling policies. Stakeholders will be incentivized and/or have the political will to share knowledge for control of invasive species at regional levels.

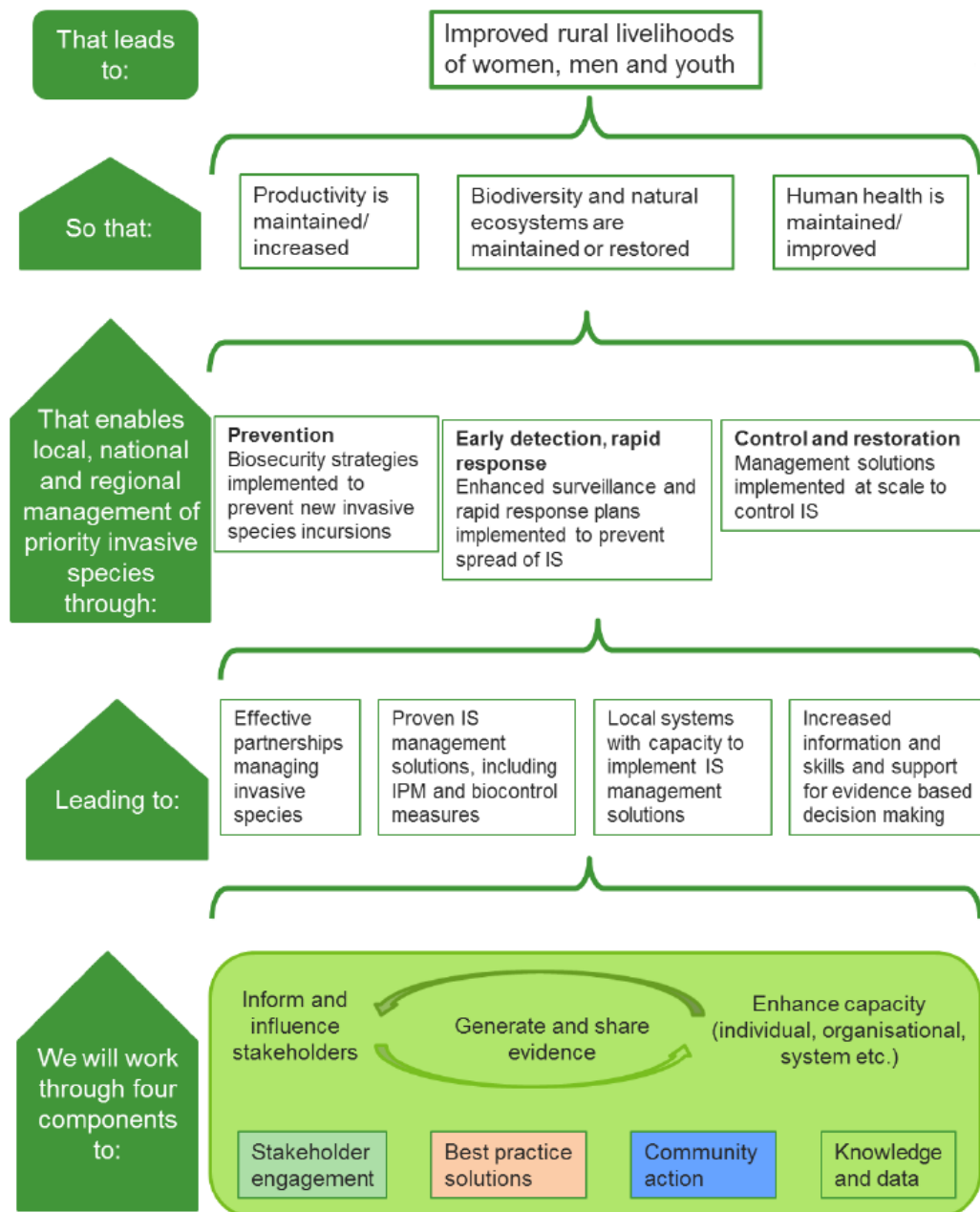


Figure 6. Theory of Change of Action on Invasives (CABI programme strategy document)

## A1.4 Evaluation approach

The main purpose of the evaluation is to contribute to the evidence base on the effectiveness of the approaches of the Plantwise and Action on Invasives programmes in order to inform decision making on the next phase of both programmes. As such, the evaluation approach is leaning towards a formative (rather than summative) evaluation with an emphasis on learning rather than accountability. The evaluation is qualitative in nature, where the principles of contribution analysis are applied. This means that evidence from different sources has been triangulated to look for evidence that the change pathways and underlying assumptions (as presented in the ToR) hold true.

Two main information sources have been used to answer the evaluation questions: primary data from key informants and secondary data from project documents and research reports. The following methods for data collection and analysis:

1. A desk study, based on secondary information on Plantwise and Action on Invasives.
2. Semi-structured Key Informant Interviews (KIIs) with CABI staff and donors, and in-country stakeholders in Ghana, Kenya and Pakistan.
3. Structured telephone interviews with plant doctors in Ghana, Kenya and Pakistan.
4. Structured interviews with selected stakeholders, including beneficiaries, using innovative surveying techniques (LQAS and Sprockler).

Table 10 presents the evaluation matrix, indicating which sources are used to answer each evaluation question.

Table 10. Evaluation matrix for the evaluation of Plantwise and Action on Invasives programmes

Evaluation Questions	Document review	Key informant interviews	Structured interviews
<b>1. What is the performance of Plantwise and Action on Invasives?</b>			
<b>1.1 Relevance</b>	<ul style="list-style-type: none"> <li>- Strategy documents</li> <li>- Plantwise policy statements</li> <li>- Gender strategy</li> </ul>	<ul style="list-style-type: none"> <li>- CABI staff (coordination)</li> <li>- Collaborators from national key partners (Ministry of Agriculture, Extension agencies, national agricultural research)</li> <li>- Donors</li> <li>- Embassies</li> </ul>	<ul style="list-style-type: none"> <li>- Beneficiary farmers</li> <li>- Plant doctors (extension agents)</li> <li>- Private sector (input suppliers, agricultural services providers)</li> </ul>
<b>1.2 Effectiveness</b>	<ul style="list-style-type: none"> <li>- External evaluation reports</li> <li>- 2017-2018-2019-2020 Milestones for Plantwise and Action on Invasives</li> <li>- 2017-2018-2019 Annual donor reports for Plantwise and Action on Invasives</li> <li>- 2017-2018-2019 Submissions against the DGIS' results reporting</li> </ul>	<ul style="list-style-type: none"> <li>- CABI staff (coordination, M&amp;E officers)</li> <li>- National key partners</li> <li>- National stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>- Plant doctors</li> </ul>
<b>1.3 Efficiency</b>	<ul style="list-style-type: none"> <li>- External evaluation reports</li> <li>- 2017-2018-2019-2020 Milestones for Plantwise and Action on Invasives</li> <li>- 2017-2018-2019 Annual donor reports for Plantwise and Action on Invasives</li> <li>- 2017-2018-2019 Submissions against the DGIS' results reporting</li> <li>- Published reports and papers</li> </ul>	<ul style="list-style-type: none"> <li>- CABI staff</li> <li>- National key partners</li> </ul>	<ul style="list-style-type: none"> <li>- Plant doctors</li> </ul>
<b>1.4 Program Management</b>	<ul style="list-style-type: none"> <li>- Strategy documents</li> <li>- External evaluation reports</li> <li>- M&amp;E strategy</li> </ul>	<ul style="list-style-type: none"> <li>- CABI staff (coordination, globally, in-country; M&amp;E officers)</li> </ul>	<ul style="list-style-type: none"> <li>- N/A</li> </ul>
<b>1.5 Risk/potentials</b>	<ul style="list-style-type: none"> <li>- External evaluation reports</li> <li>- Plantwise policy statements</li> </ul>	<ul style="list-style-type: none"> <li>- CABI staff</li> <li>- National key partners</li> </ul>	<ul style="list-style-type: none"> <li>- N/A</li> </ul>
<b>2. To what extent are both programmes innovative?</b>	<ul style="list-style-type: none"> <li>- Strategy documents</li> <li>- External evaluation reports</li> </ul>	<ul style="list-style-type: none"> <li>- National key partners</li> <li>- Similar projects</li> <li>- Donors</li> <li>- Embassies</li> </ul>	<ul style="list-style-type: none"> <li>- Plant doctors</li> </ul>
<b>3. What are the benefits in both programmes?</b>	<ul style="list-style-type: none"> <li>- External evaluation reports</li> <li>- Published reports and papers</li> </ul>	<ul style="list-style-type: none"> <li>- CABI staff</li> <li>- National key partners</li> </ul>	<ul style="list-style-type: none"> <li>- Beneficiary farmers</li> <li>- Plant doctors</li> </ul>
<b>4. What are the good practices and key lessons learned?</b>	<ul style="list-style-type: none"> <li>- 2017-2018-2019 Annual donor reports</li> <li>- Published reports and papers</li> </ul>	<ul style="list-style-type: none"> <li>- CABI staff</li> <li>- National key partners</li> </ul>	<ul style="list-style-type: none"> <li>- Plant doctors</li> </ul>

Evaluation Questions	Document review	Key informant interviews	Structured interviews
<b>5. What should be done differently in response to the BHOS policy?</b>	<ul style="list-style-type: none"> <li>- Plantwise policy statements</li> <li>- BHOS policy documents</li> </ul>	<ul style="list-style-type: none"> <li>- CABI Staff,</li> <li>- National key partners</li> <li>- Donors, particularly the Dutch Ministry of Foreign Affairs</li> <li>- Embassies</li> </ul>	

Below more detail is provided on each evaluation method.

## A1.5 Document review

During the evaluation, a database was constructed of relevant secondary data sources that was shared by CABI. The following secondary data sources were included:

- Annual reports of Plantwise and Action on Invasives programmes (2017-2020)
- CABI reports on programme results (including M&E data where relevant)
- Programme strategy documents (including gender and M&E strategies)
- Previous external evaluations
- Special study reports and/or academic publications related to Plantwise
- Academic publications on plant health systems and pest management in developing countries

The secondary data was used to contextualize and/or triangulate the primary data, and thus inform the synthesis of the findings.

## A1.6 Semi-structured interviews with key informants

The Key Informant Interviews (KIIs) were an important information source to inform the evaluation. KIIs were conducted with CABI staff involved in the program at the global and national level, the programme's implementation partners and in-country stakeholders. These semi-structured interviews were used to cover the evaluation questions, though the emphasis differs across various actor types, following their role in the program and expertise.

### A1.6.1 Key Informant Interviews method

Key Informant Interviews (KIIs) are qualitative in-depth interviews with resource persons who have first-hand knowledge on the research topic of interest. The purpose of the KIIs is to collect qualitative information from a wide range of people; KIIs in particular allow for in-depth answers and divergent views which may be difficult to collect in group settings. The set of respondents should be as diverse as possible, covering the different groups of stakeholders. KIIs are semi-structured, using interview guides with key questions and probing questions. In addition, KIIs allow for free discussion of specific issues that are relevant to the respondent. Due to the time limitations and travel restrictions, the KIIs were carried out through teleconferencing (phone or online) instead of face to face.

An interview tool was developed to use with key informants to structure the interview questions in line with the evaluation questions. The data was recorded in a large matrix existing of the main and sub-questions of the evaluation. Depending on the role of each respondent in the Plantwise and Action on Invasives programmes and their specific expertise and level of implementation, a selection of questions was posed to each respondent.

### A1.6.2 Sampling strategy key informants

The sampling strategy for the semi-structured interviews was based on purposeful sampling; i.e. respondents were selected based on their in-depth knowledge of the programmes Plantwise or Action on Invasives and/or plant health systems. The sample of key informants covered three levels, namely (1) the global programme level, (2) the national programme level and (3) the sub-national project area

level (e.g. province, county or district level, depending on the country where the evaluation takes place).

The sampling frame for the key informants was as follows:

1. Global level:
  - i. DGIS project officer for Plantwise and Action on Invasives,
  - ii. Programme manager Plantwise
  - iii. Programme manager Action on Invasives
  - iv. M&E coordinator Plantwise & Action on Invasives
  - v. Plantwise Regional Coordinators in Asia and Africa
  - vi. Regional M&E coordinators Plantwise
  - vii. Strategic Partnerships Director CABI
  - viii. Former FAO Plant Protection and Production Officer, Southern Africa Office
  - ix. Former IFAD program officer
  - x. Head of GFRAS
  - xi. Aol Stakeholder engagement work package leader
  - xii. Aol Best practice solutions work package leader
  - xiii. Aol Knowledge and data work package leader
  - xiv. Aol Community action Asia officer
  - xv. Aol Community action Africa officer
2. National level:
  - i. Country coordinator PW/Aol
  - ii. M&E officer PW/Aol
  - iii. National coordinator (government staff)
  - iv. Ministry of Agriculture, national representative crop protection
  - v. Ministry of Agriculture, national representative extension services
  - vi. Agricultural Research Institute/University representative (key partner)
  - vii. Farmer organization representative
  - viii. National level Agro-dealer representative
3. Project area implementation level:
  - i. Region/district MOFA representative
  - ii. Region/district coordinator of the plant doctors
  - iii. Private sector (input dealer)
  - iv. Private sector (other service provider)
  - v. Local/International NGO active in agriculture development/extension
  - vi. Representative of a collaborating farmer organization
  - vii. Extension agent, active plant doctors (10)

In total, 51 key informants were interviewed, predominantly CABI staff and government staff (including public services staff) at the global level and in Ghana, Kenya and Pakistan.

Table 11. Overview of key informants interviewed

Type key informant	Global / regional	National	Local
CABI / Plantwise / Aol	17	3	0
Government / public services	0	4	15
Research	1	3	0
NGOs / private sector	0	2	4
Other, external key informants	2	0	0
Total	20	12	19

## A1.7 Structured interviews

### A1.7.3 LQAS survey among farmer beneficiaries

The evaluation team thought it essential to capture the opinion of farmer beneficiaries, as they are key stakeholders in the Plantwise programme. Since the timeline and scope of the project did not allow for on-site farmer surveys or focus group discussions in the selected countries, a short phone-based survey was conducted following a Lot Quality Assurance Sampling (LQAS) method<sup>9</sup>. This method allows for a quick assessment of the basic experience of farmers who have attended plant clinics and have presented their problem to a plant doctor.

In the development sector, LQAS is used to assess the quality of services coverage in geographic zones and cohorts (known as 'lots'). Per indicator, it tests whether a target is achieved or not, comparing the total number of positive responses to a predetermined threshold value. The target is considered achieved if the threshold value is reached (Murthy, 2018). Contrarily, indicators that do not reach the threshold value are flagged as priority areas where it may be necessary to adapt the delivery of the programme. A lot quality assessment comprises a checklist of yes/no questions to identify if the program is on track to deliver its goals. In this instance, we developed 12 yes/no questions addressing the various evaluation criteria (anticipated outcomes and assumptions), being the delivery and quality of the service, the nature of advice, whether the advice was followed and solved the problem and to what extent farmers have shared the information with others. Furthermore, we inserted single-choice and numeric questions to provide a descriptive background of the sample. Yet, due to the small sample sizes typical for LQAS surveys, these descriptive statistics cannot be extrapolated to the wider population.

In Ghana and Kenya two lots were constructed based on two gender cohorts: male and female farmers who attended the plant clinics in the last two years. In Pakistan, we were only able to contact and interview a complete male cohort, as it appeared impossible to reach women by phone.

Each lot consisted of 19 respondents and the reported results indicate the lower threshold based on the results of the survey. The lower threshold indicates the minimum coverage of the indicator among the population, of which we can say with (almost) certainty that real coverage is higher. It should thus be read as: 'the real coverage among the population is almost certainly higher than the indicated percentage'. The sample size of 19 per lot is chosen as to optimize the tradeoff between high statistical reliability and small sample size. We indicate lower threshold values below fifty percent coverage as requiring additional attention. In order to statistically exclude the possibility that the real coverage is lower than fifty percent, at least 13 positive results are required per sample of 19 observations.

A stratified sampling technique was employed, based on regions, counties and provinces (hereafter called areas) in Ghana, Kenya and Pakistan, respectively. In each sample, subjects were selected based on the proportional representation of their area in the overall beneficiary population: areas with more beneficiaries have more respondents sampled, areas with fewer beneficiaries have a smaller number of respondents sampled. Interviews were conducted by telephone by a national consultant.

### A1.7.1 Plant doctor interviews

In each case-study country, 10 plant doctors were randomly selected for structured telephone interviews. The sample is too small for statistical analysis, but the responses give insight into plant doctors' experiences. The survey consisted of open and closed questions, based on the evaluation questions.

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<sup>9</sup> This method has mainly been used in health research. More information is available at <https://www.measureevaluation.org/resources/training/capacity-building-resources/outcome-monitoring-and-evaluation-using-lqas>.



### **A1.7.2 Sprockler – collecting change stories**

The innovative Sprockler<sup>10</sup> tool was used to collect most significant change stories (MSC) among key informants. The most significant change technique is a participatory method of evaluation which entails collecting change stories and identifying impact through these stories. This method captures the stakeholders' views on the contribution of Plantwise and Action on Invasives to the changes observed. These personal accounts of change were collected to determine the most important achievements (including unexpected results) and lessons from both programmes.

Sprockler enables the digitization of the stories through an online survey tool. It enables the collection and interpretation of people's opinions into a powerful narrative about change, contribution, relations and impact. Qualitative data are quantified for pattern recognition in people's stories. It enables uncovering the unexpected and unquantifiable; bringing-in an invaluable contribution to robust evaluation approaches geared towards learning from practice. Sprockler taps into the collective intelligence to deeply understand what and why things are happening. The focus of Sprockler is self-signification, putting the respondents at the core of the analysis process. The analyser and visualizer modules of Sprockler functionally and interactively display and share the results.

All selected key informants and plant doctors were invited to participate in the online survey. Fifty-three responses were obtained representing a mix of key informants from the global and country level and plant doctors from the countries

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<sup>10</sup> SPROCKLER is different from standard surveying tools because it uses a unique combination of statistics and stories. Statistics provide clear information and stories help to put the statistics into context. This unique combination makes that SPROCKLER's tools can provide you with more accurate data, which will allow you to respond better to trends that are emerging in the world. It allows you to deal with today's complexity in a clear, visual and user-friendly manner. SPROCKLER does not only give you a better picture, it can also provide you with proactive foresight so you will be able to react to trends, contribute to sustainable growth and maintain a competitive advantage in today's increasingly complex world." – FAQ <https://sprockler.com/>