RFP-2023-211-STDF EVALUATION

EVALUATION OF THE STANDARDS AND TRADE DEVELOPMENT FACILITY

STDF/PG/567: F³: FRUIT FLY FREE

ESTABLISHMENT AND MAINTENANCE OF FRUIT PRODUCTION AREAS FREE AND UNDER LOW PREVALENCE OF FRUIT FLY PESTS IN SOUTHERN AFRICA

PROJECT IMPACT EVALUATION REPORT

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SUBMITTED BY

Project Economics Consulting

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ACRONYMS AND ABREVIATIONS

ARC	Agricultural Research Council
ALLP	Area of Low Pest Prevalence
CRI	Citrus Research International
DAFF	Department of Agriculture, Forestry and Fisheries
DALRRD	Department of Agriculture, Land Reform and Rural Development
EMU	Eduardo Mondlane University
FF	Fruit Fly
FFF	Fruit Fly Free
IPM	Integrated Pest Management
IPSM	International Standard for Phytosanitary Measures
NARES	National Agricultural Research and Extension System
NPPO	National Plant Protection Organization
PFA	Pest Free Area
PG	Project Grant
PIE	Project Impact Evaluation
PPG	Project Preparation Grant
SPS	Sanitary and Phytosanitary
SADC	Southern African Development Community
STDF	Standards Trade and Development Facility
SU	Stellenbosch University
SDG	Sustainable Development Goal
WP	Work Package
WTO	World Trade Organization

1 HIGH LEVEL SUMMARY

1. **Project aims and objectives:** The project 'STDF/PG/567: F³: Fruit Fly Free Establishment and Maintenance of Fruit Production Areas Free and Under Low Prevalence of Fruit Fly Pests in Southern Africa' was a project co-funded by the Standards Trade and Development Facility (STDF), a MoU between the Department of Agriculture, Land Reform and Rural Development (DALRRD) and FruitFly Africa (FFA), and funds left over from Tephritid workers in Europe, Africa and the Middle East. The goal was: to improve market access, revenues and employment in South Africa and Mozambique with regard to export fruit markets where targeted fruit fly pests constitute risks; and the objective was: to facilitate fruit export in the main horticultural areas in South Africa and Mozambique.

2. The project supported National Plant Protection Organizations (NPPOs) in South Africa and Mozambique to establish and develop a framework for the maintenance of Pest Free Areas (PFAs) and Areas of Low Pest Prevalence (ALPPs) of fruit fly pests in South Africa and Mozambique. The targeted fruit fly pests were Mediterranean fruit fly, C. capitata; melon fly, Z. cucurbitae.

3. **Partners and beneficiaries:** The Agricultural Research Council (ARC) was responsible for overall project management, implementation and coordination of the project from 2016 to 2023. ARC is one of the principal agricultural research institutions in South Africa, which acts as the research branch of the Department of Agriculture, Forestry and Fisheries (DAFF). Eduardo Mondlane University (EMU) assisted ARC with project management and implementation in Mozambique. Activities were implemented by a consortium of eight (8) organizations representing government, NPPOs, research organizations, and fruit growers' associations. Delivery was overseen by Steering and Technical Advisory Committees.

4. Targeted beneficiaries were the fruit industries including fruit growers, as well the agricultural departments within the target ministries.

5. **Evaluation:** The project impact evaluation (PIE) included document reviews and interviews. Between January 2024 and March 2024, the project evaluator reviewed documents, data, and survey results, as well as conducting virtual interviews and undertaking field work in South Africa and Mozambique. Interviews included a broad range of representatives from across the consortium as well as visiting growers and commercial farms at the province level in Mozambique.

1.1 SUMMARY OF FINDINGS:

6. **Relevance:** The project is deemed to have been relevant, with evidence of alignment to regional and national strategies and the stated priorities of beneficiaries in both countries. These highlighted fruit flies as a priority given their impact on production of main horticultural commodities. Establishing PFAs and ALPPs, with associated buffer zones, according to International Standards for Phytosanitary Measures (ISPMs) standards was therefore highly relevant. The approach was developed through a Project Preparation Grant (PPG) in broad consultation with NPPOs and other Government bodies, research

organizations, and fruit growers' associations, including DAFF and DSV, the regulatory bodies in plant health in both countries. Priority issues, pests and target regions were agreed collectively.

7. **Coherence:** The project was highlighted as a first in terms of its approach establishing PFAs and ALPPs over such a wide region. However, limiting the project to South Africa and Mozambique was consistently flagged as a shortcoming given the cross-border impact of the pests, and need for a coordinated approach across Southern Africa. A broader systems approach was also recommended.[1] Synergies with partners were consistently and effective leveraged, with evidence of the project complementing other fruit fly initiatives by STDF partners, as well as working on other pests (many of which are also ending). The presence of other databases monitoring pest prevalence may have resulted in duplication of efforts.

8. **Efficiency:** Despite delayed activities given the impact of COVID-19, implementation was efficient overall with the majority of the budget disbursed by project close. Resources were optimized, with funds reallocated to address logistical hurdles in Mozambique. Project partners contributed 75% of total project budget through both in-kind and financial contributions. Project and reporting deadlines were largely well-respected, with strong and consistent coordination through the implementing partner, ARC.

9. **Effectiveness:** The project formalized PFA and ALPP definitions, a process for monitoring surveillance data, and allowed mapping of "hot-spot" corridors, with results largely achieved against initial targets. All targeted regions were monitored effectively with data shared to formalize PFAs and ALPPs, however delays in notification of pest areas by participating authorities impacted full completion of outputs. The main challenges faced for setting up PFAs and ALPPs related to procurement of control materials, security risks, climatic factors, and most importantly political risks (e.g. notification delays). Research was largely carried out effectively, although establishing ALPP thresholds was complicated by limited data, and the relationship between trap catches and fruit fly infestation could only be tested for two crops. Online monitoring tools and protocols were developed, though duplication was an issue. The quality and timing of reporting was largely adequate.

10. **Impact:** The evidence suggests a positive correlation in terms of retained market access through defining low-risk areas for fruit trade, notably to main markets such as the EU which have strict regulations related to the targeted pests. However, NPPOs still need to request recognition of the PFAs and ALPPs by importing countries. The impact on market access will therefore only be seen following this official recognition. Nevertheless, there are already indications of maintained and enhanced trade between Mozambique and South Africa, as a result of collaboration on the project. The presence of other diseases and pests, affecting products including those targeted by the project, and the limited geographical reach

[1] It is important to point out some practical limitations to geographical expansion including funding limitations and the ability of STDF to fund larger scaled projects within its operational rules. The project was seen as a pilot project which could be expanded to other southern African countries with possible follow up projects.

of the project could mean that markets are lost regardless of project outcomes. Positive environmental outcomes were recorded related to reduced reliance on pesticides.

11. **Sustainability:** Sustainability was considered during project design with commitment obtained from NPPOs of both countries. While monitoring has continued since project close, this has largely been funded by larger-scale growers and association, with government contributions for this purpose flagged as insufficient (notably given monitoring covers other fruit flies and pests). A notable risk to continued status of PFAs and ALPPs relates to financial constraints of smaller-scale farmers for ongoing pest control, as well as spread through small households which requires continued awareness raising. The fact that the operational database platform for determination of fruit fly status in target regions cannot be integrated with other systems raises concerns about its continued use and sustainability of its data.

1.2 LESSONS LEARNED:

12. The current project focused on two countries i.e. Mozambique and South Africa.[2] The collaboration was positive allowing for a joint approach to the surveillance and response to invasive fruit fly species, notably on the Northern Mozambique border, with the identification of PFAs and ALPPs ultimately helping to facilitate trade between the two countries.

13. However, given the cross-border nature of pest management, the geographical scope was too limited. Establishing a more integrated regional management program would have meant other phytosanitary aspects could have been dealt with more efficiently and coherently.[3]

14. The partners were a diverse mix of private and public sector actors. The role of the private sector was especially important given their close links to growers. This ensured they were able to respond rapidly to fruit fly detections, as was evidenced in the Western Cape in South Africa.

15. The co-financing format of the project (75% from project partners) was essential for overall commitment, however there were some challenges and delays getting all contracts agreed at the outset. The role of the implementing partner and the first work package focusing on program management helped to mitigate consortium challenges.

16. The broader systems approach initially proposed in the PPG had to be scaled down given budget constraints. The project was therefore more narrowly focused on defining PFAs and ALPPs and working

[2] The two countries and research partners on the project had a long history of collaboration prior to the project. It was noted that the framework developed for the recognition of PFAs and ALPPS could potentially be extended to other countries.

[3] For instance, working with the SADC Secretariat on actioning its regional strategy (building on regionally focused initiatives such as the EU funded project (Strengthening Pest and Disease Management in the SADC Region) implemented by CABI which developed a harmonized regional strategy for MLN disease) was proposed as a viable way forward.

on more practical applied components. While this represented a good entry point/ baseline to tackle pest management, the research was consequently more limited in scope than originally planned.

17. One key lesson for the establishment of PFAs and ALPPs was the importance of streamlining trapping data. A major challenge was that trapping data was recorded in different formats across partners. This meant that all historical data had to be manually uploaded into the database in the correct format. As a result of the project, the partners have aligned their data collection methods, and the systems in place now allow for large scale mapping of PFAs and ALPPs specifically for fruit flies.

18. The project focused on large commercial farms, given these are the primary exporters and the project goal was to enhance market access and increase revenue. While some efforts were made to raise awareness of fruit fly management amongst other groups such as small-scale producers and household growers during delivery through sensitization, training and, in the case of Mozambique, collaboration with partner programs, the reach of these activities was limited. A more integrated approach would have been beneficial, as smaller-scale producers often lack resources and knowledge about pest control, yet they contribute significantly to agricultural outputs, and pose a critical risk to the spread of pests.

19. While the database was beneficial to streamline trapping data from project partners and allow for area-wide mapping specifically targeted at fruit flies, it was noted that the proliferation of mobile app technologies and the fact that growers use multiple apps[4] for surveillance purposes posed risks to efficiency and data collection. Making the project database accessible to growers (not just inspection technicians) through a mobile based app would have allowed them to access necessary data to combat pests effectively in real time.

1.3 RECOMMENDATIONS:

- Adopt a more integrated approach for future projects, in terms of geographical reach, with broader-based actors across the fruit industry (e.g. smaller scale farmers and households), as well as a wider-based monitoring of other pests beyond fruit flies,[5] to ensure results are sustained and market access is maintained. This could potentially be achieved through a multi-donor collaboration, and in coordination with Southern African Development Community (SADC).

[4] Including one of the project partners Fruit Fly Africa which has subsequently created their own database as per a KII.

[5] While the biggest commonality on the continent is fruit fly, pests such as moths represent a bigger threat to the citrus industry for instance. A number of diseases are currently spreading south from Northern Mozambique including the Panama disease affecting bananas, and the horse fruit fly. Establishing domestic quarantine measures has been challenging for these pests given political implications. This represents a significant risk to continued market access.

- Ensure a robust sustainability plan is in place for continued monitoring activities beyond the project end date. Notably, work with beneficiaries (e.g. Gov. Mozambique) to review options and solutions in place for continued purchase of control equipment.
- Support awareness raising of online monitoring tools (database and identification protocol) to relevant actors to promote their continued use.
- Ensure stronger political commitment to the timely submission of official notifications of PFAs and ALPP. This could be achieved through setting clear timelines for notifications following receipt of scientific data.
- Support the sharing of best practice, including with other regions. Consider developing practical guidelines based on the project experience establishing PFAs and ALPP to add to the body of work and international guidelines available. Building on and broadening out the IAEA-sponsored sterile insect program[6], including sterilization techniques with area wide baiting/ monitoring program modelling based on climate was recommended.[7] This expansion would need firm government engagement given it would involve national laboratories.

[6] Which was rolled out in one of the target regions in South Africa.

[7] It was noted that rolling out a sterile insect program in other areas, especially the northern part of South Africa, will be challenging as five fruit fly species cause damage to fruit and need suppression.

2 PURPOSE & CONTEXT

20. As a component of the Evaluation of the STDF 2020-2024, the project evaluation team was tasked by The World Trade Organization (WTO) with the development of three project impact evaluations (PIEs). These were selected from 19 project grants (PGs) that were completed during the in-scope period and were confirmed with the Evaluation Steering Group.[8] The purpose of the PIEs is two-fold: (1) to provide evidence of impact at the PG level through detailed evaluation engagement, including in the field, and (2) to support the overall STDF evaluation by providing a base of evidence that included direct engagement with project implementors and beneficiaries.

2.1 SUMMARY OF THE SPS PROBLEM & SOLUTION IMPLEMENTED

21. The F3 project was designed to establish and develop a framework for the maintenance of PFAs and ALPPs of fruit fly pests in South Africa and Mozambique. The targeted fruit fly pests were Mediterranean fruit fly, C. *capitata*; melon fly, and Z. *cucurbitae*

22. At the time of design, fruit flies were a major constraint in horticulture in the region. Several major fruit fly pests had a large impact on fruit production and trade and, as such, they formed one of the main phytosanitary issues in Africa, including in the two participating countries.[9]

23. Establishing Pest Free Areas (PFAs) would help create early detection and exclusion measures for fruit fly pests. Additionally, implementing Area-wide Integrated Pest Management Programs (ALPPs) would create effective fruit fly management systems, particularly benefiting less susceptible fruit types.

24. In response to this need, a Project Preparation Grant (PPG) request (STDF/PPG/567) was submitted to the STDF by the Department of Agriculture, Land Reform and Rural Development (DALRRD) in 2016. The Royal Museum for Central Africa (RMCA) acted as contractor bringing together consortium partners, representatives from the fruit industries, National Plant Protection Organizations (NPPOs), research organizations and phytosanitary experts to discuss the development of PFAs and Areas of Low Pest Prevalence (ALPPs) for target regulated fruit fly pests in the region. Stakeholders were invited to participate in the development of the proposal.

25. A Project Grant (PG) application, STDF/PG/567 was subsequently submitted by the NPPOs (South Africa and Mozambique) and partners (South Africa: Agricultural Research Council (ARC), Citrus Research International (CRI), Stellenbosch University (SU); Belgium: RMCA; Mozambique: Eduardo Mondlane University (EMU)) and approved by the STDF Working Group in 2019.

[8] The evaluation steering group was drawn, on a volunteer basis, from the STDF Working Group and represented the Working Group's interests in guiding the evaluation.

[9] Four invasive fruit fly species of Asian origin have been introduced into Africa. Two of these exotic species, the Oriental fruit fly, *Bactrocera dorsalis* and melon fly, *Zeugodacus cucurbitae* are present in southern Africa. *Bactrocera dorsalis* is distributed throughout Mozambique but still has a restricted distribution in South Africa.

26. As per the Project Grant proposal the F3 project aligned with STDF objectives in terms of:

- Developing a regionally harmonized framework for development, implementation and recognition of Pest Free Areas (PFA) and Areas of Low Pest Prevalence (ALPP) for regulated fruit fly pests of commercial fruit commodities in southern Africa (i.e. South Africa and Mozambique) following the directives of the relevant International Standards for Phytosanitary Measures (ISPMs), as approved by the International Plant Protection Convention (IPPC);
- Addressing good practices in SPS, by safeguarding and improving at a regional scale, the production of a number of main horticultural commodities in the southern African countries involved, assuring them of continued or new market access by adherence to requirements for export of fruit free of fruit fly pests.

27. Expected results[10]: The expected results of the project were as follows:

Project goal: Improve market access, revenues and employment in South Africa and Mozambique with regard to export fruit markets where targeted fruit fly pests constitute risks.

Project objective: To facilitate fruit export in the main horticultural areas in South Africa and Mozambique.

28. Project Outputs:

- Established PFA areas in South Africa and Mozambique for target fruit fly species
- Scientifically based evidence for specified low fruit fly prevalence levels for target fruit fly pests
- Established ALPP areas in South Africa and Mozambique for target fruit fly species
- Operational database platform for determination of fruit fly status in different regions in South Africa and Mozambique
- Identification protocol and service for rapid and unambiguous recognition of target fruit fly pests and related taxa
- Financial model for maintenance of PFA and ALPP for target fruit fly pests

29. Activities were grouped in Work Packages (WP) with one overall coordination WP (WP1), four WPs dedicated to the specific outputs, and an overarching WP (WP6) dealing with information dissemination, public awareness and legislation.

[10] From the final project report.

TABLE 1: PROJECT WORK PACKAGES

Work Package	Objective	Lead	Partners
1. Project Management	To ensure the smooth running of the project.	ARC	DALRRD, CRI, DSV, EMU, FFA, RMCA and SU
2. Establishment of PFAs	To establish PFAs according to standards set out in ISPMs 4 and 26.	EMU (Mozambique) and DALRRD (South Africa)	ARC, CRI, DSV, RMCA, SU and contracting FFA
3. ALPP thresholds	To define ALPP thresholds for citrus, selected subtropical fruit (litchi, avocado) and pome fruit (apples & pears) in accordance with trading partners' requirements.	CRI	ARC, EMU and SU
4. Establishment of ALPPs	To characterize and establish ALPPs according to standards set out in Annex 1 of ISPM 35.	EMU (Mozambique) and DALRRD (South Africa)	
5. Identification and data basing services	To ensure that all records obtained through the characterization and establishment of PFAs and ALPPs for the target pests are properly identified and stored in a standardized manner, accessible to all parties concerned.	SU and RMCA	
6. Operational and Economic model	To develop an operational plan supported by an economic business model that will ensure the maintenance of the recognized PFAs and ALPPs.	SU	EMU and FFA

30. **Alignment with regional and international priorities and obligations**: The project aligned with the SPS strategy of DAFF and the plant health policy for South Africa which supports the establishment of pest free areas related to prioritized commodities, and harmonization of these SPS measures on a regional basis.

31. In Mozambique, it supported the **national SPS strategy** which aims to prevent introduction, establishment and spread of plant pests. It addresses the enhancement of sustainable agricultural productivity and export opportunities (Decreto n° 05/2009). The project addressed focus areas identified in the 2012 Phytosanitary Capacity Evaluation (PCE)[11] in which the inability of Mozambique to comply with SPS of importing countries was highlighted as a major factor undermining growth of the agricultural sector in the country. This related to NPPO pest diagnostic, control and surveillance and establishment of PFAs and ALPPs.

32. In addition, the project aimed to support the UN Sustainable Development Goals (SDGs) through a strengthened horticultural sector including SDG2 (zero hunger: end hunger, achieve food security and improved nutrition and promote sustainable agriculture) and SDG12 (responsible consumption and production: ensure sustainable consumption and production patterns).

[11] Ministry of Agriculture, Republic of Mozambique. 2012. Background information on the situation of phytosanitary capacity in Mozambique. 32 pp.

2.2 IMPLEMENTATION CONTEXT

33. South Africa ranked 15th in terms of world fruit production and 4th in the southern hemisphere.[12] The country is the leading fruit exporter in Africa and the second largest exporter of citrus in the world.[3] It is vital that it complies with international SPS regulations to maintain its position in the global market.

34. Agriculture represents 26% of Mozambique's GDP, involving over 70% of its population, with agricultural exports forming 25% of total exports. The country has a huge growth opportunity in fruit exports, with only 15% of arable land currently cultivated. However, meeting international SPS standards remains a challenge that hinders its export growth.

35. Sub-Saharan Africa has approximately 915 fruit fly species,[13] with some being native to the continent while others have been introduced through activities like agri-product trade and human movement. Those introduced species, known as invasive pests, pose a significant threat to agricultural productivity and farmer livelihoods in South Africa and Mozambique.

36. These pests cause substantial economic losses. Since the detection of Oriental Fruit Fly *Bactrocera dorsalis* in Mozambique, in 2007, both national and international quarantine measures were instituted. In September 2008, South Africa temporarily banned the importation of fresh fruits from Mozambique. Average yield and economic losses associated with fruit flies in the Manica Province of Mozambique totaled approximately 5.65t/ha and USD3428.97/ha, and a company in central Manica Mozambique reportedly lost about US$ 1.5 million due to quarantine restrictions induced by the presence of B. *invaders*.[14]

37. Given their invasive nature, fruit fly pests are widespread across South Africa and neighboring countries, with some species recognized as quarantine pests in many importing nations. To combat their spread and mitigate economic losses, pre and post-harvest measures have become standard practice in fresh fruit production systems. However, the effectiveness of these measures is often hindered by stringent residue level requirements imposed by importing countries.

38. Certifications such as FF-PFA (Fruit Fly Pest Free Areas) and FF-ALPP (Fruit Fly Area of Low Pest Prevalence) have emerged as solutions to facilitate market access for fruits from areas with reduced pest prevalence. Fruit flies of primary economic importance include the oriental fruit fly, Mediterranean fruit fly (Medfly), and melon fly. While Medfly is established in South Africa and Mozambique, its presence varies across

[12] Fruit South Africa. 2021/2022 Key Fruit Statistics.https://fruitsa.co.za/wp-content/uploads/2023/09/A5-Fruit-SA-Booklet_2023_Digital.pdf

[13]Ben Yazid et al.,: Key fruit flies species reported in Africa, Mor. J. Agri. Sci. 1(4): 201-214, July 2020

[14] Perception of fruit farmers on the occurrence of the oriental *Bactrocera dorsalis* (Diptera: Tephritidae) and its associated economic impact in Manica province, Mozambique - L. Canhanga, M. De Meyer, D. Cugala, M. Virgilio, L. Bota and M. Mwatawala

production areas. In regions with minimal Medfly presence, ALPP certification is possible, and can suppress its spread.

39. Similarly, the oriental fruit fly is established in some fruit-producing provinces of South Africa, while the melon fly has not yet become endemic. In areas where fruit fly pests are not yet established, there is an opportunity to develop PFA and ALPP systems to enable timely detection and eradication measures. Establishing these certifications in fruit production regions of South Africa and Mozambique not only creates an effective fruit fly management system but also facilitates the implementation of area-wide systems approaches to handle fruit fly threats in commercial fruit production systems.

2.3 IMPLEMENTING PARTNER AND INVENTORY OF OTHER STAKEHOLDERS

2.3.1 IMPLEMENTING PARTNER:

40. The ARC was responsible for overall project management, implementation and coordination of the project from 2016 to 2023. ARC is one of the principal agricultural research institutions in South Africa, which acts as the research branch of the DAFF. EMU assisted ARC with project management and implementation in Mozambique.

41. Given their impact, fruit fly activities in the region have enlisted and sustained a broad range of partnership from NPPOs and National Agricultural Research and Extension System (NARES).

42. The main project partners represented government, NPPOs, research organizations, and fruit growers' associations across the partner countries:

- Department of Agriculture, Land Reform and Rural Development, Directorate Plant Health, South Africa
- Royal Museum for Central Africa, Department of Biology, Belgium
- Citrus Research International, South Africa
- Stellenbosch University, Faculty of AgriSciences, Department of Conservation Ecology and Entomology, South Africa
- Stellenbosch University, Faculty of AgriSciences, Department of Agricultural Economics, South Africa
- Eduardo Mondlane University, Faculty of Agronomy and Forest Engineering, Mozambique
- Eduardo Mondlane University, Centre of Excellence in Agri-Food Systems and Nutrition, Mozambique.

- Ministry of Agriculture and Food Security, National Directorate of Agriculture and Silviculture, Department of Plant Protection, Mozambique

2.3.2 PROJECT BENEFICIARIES:

43. Targeted beneficiaries were the fruit industries including the fruit growers, as well the agricultural departments within the ministries (see above).

Image Credit: Roxane Burstow

2.3.3 GOVERNANCE STRUCTURE:

44. The project was overseen by two steering committees:

- **Project Steering Committee** composed of senior officers of the participating consortium partners to oversee delivery, acting as WP leaders to ensure smooth execution of the project's activities. The steering committee consisted of all the work package leaders and a representative from FFA. Dr Marc De Meyer (RMCA) served as an advisor to the committee. Steering committee meetings took place every six months with 2 in-person meetings during implementation.

- **Technical Advisory Committee** composed of scientific specialists, representatives of the fruit growing industry and other stakeholders to provide advice on the design of activities and technical aspects. This committee met quarterly to track project results at the laboratory level as well as budget.

45. The Steering Committee and Technical Advisory Committees jointly met at the start of the project (Year 1 and 2). Progress reports were supplemented with minutes of the Steering Committee and Technical Advisory Committee meetings over the course of delivery.

3 EVALUATION METHOD & APPROACH

46. The STDF/PG/567 - F3 project evaluation was conducted from January 2024 to March 2024. Evidence collection included: document review; key informant interviews (KII) – conducted both virtually and-in person; field visits to the two participating countries – South Africa and Mozambique; and a web-based survey. The evaluation framework provided questions to guide the conduct of semi-structured interviews with stakeholders.

47. Findings were inputted to an evaluation matrix aligned against the evaluation questions. The evaluation also included examination of impact in terms of the effects on trade and exports based on trade data collected from the UN and the World Bank.

48. The document review and interviews were mostly carried out in English by the Lead Evaluator. However, given that the project was partly implemented in Mozambique, some of the project stakeholders were more comfortable providing responses in Portuguese. The survey was also provided in both English and Portuguese. Interview transcriptions and the PIE report were drafted in English as per the evaluation contracting requirements.

3.1 DOCUMENT REVIEW

49. A review of all relevant documentation was completed. This included progress reports submitted to STDF during delivery (i.e. Project Grant proposal, five (5) bi-annual progress reports, final report) as well as a number of documents shared by ARC and project beneficiaries, including export data. A full list is provided in Annex A.

3.2 KEY INFORMANT INTERVIEWS (KII)

50. Two KIIs were completed virtually with the implementing partner ARC and the STDF team ahead of the field visits. These were aimed at discussing main project achievements and constraints, as well as mission logistics.

51. The field mission took place in South Africa (Stellenbosch) and Mozambique (Maputo, Manica Province) in order to complete in-person KIIs with key beneficiaries, and visit three (3) participating fruit production sites involved in the project.

52. ARC and EMU supported in the identification of key stakeholders to interview for the field mission. Visits to fruit growers took place in the Manica province in Mozambique. This province was selected given it is the location of some of the largest exporting farms in the country facing the most restrictions linked to the prevalence of fruit flies.

53. The field missions took place on:

- South Africa: 29th February – 4th March 2024
- Mozambique: 5th – 8th March 2024

54. A total of 17 KIIs were completed during the field visits (see Annex B). Given limited time for the field mission, virtual interviews were set up with respondents based in Pretoria who could not be visited in-person.

3.3 SURVEY

55. A survey was developed using the survey monkey on-line platform to gather information from stakeholders who could not be interviewed in person. Respondents were able to submit responses in English or Portuguese. The survey included 15 questions. Data collated was in the form of comments. In total 7 responses were received.[15]

3.4 DATA LIMITATIONS

56. The main limitations are as follows:

- The PIE took place in a limited timeframe given the F3 project replaced another STDF project initially selected several months into the STDF program evaluation.
- Staff turnover over the course of, and since completion of, the project led to some respondents not having a full view of project implementation.
- Logistical challenges and distances between farms in the Manica province, Mozambique restricted the number of farms visited.
- The farm owners interviewed had little knowledge of the STDF program beyond the monitoring aspect carried out by the project technician.
- The small number of days for the field visit meant that travel had to be limited to Stellenbosch in South Africa. Virtual interviews were carried out for Pretoria-based stakeholders.

[15] The survey response rate was 13% (7/55).

- Difficulty in correlating/ quantifying impact of PFA and ALPP in terms of increased trade. Most of the interviewees stated that establishing these areas was important in terms of keeping markets open which in turn positively impacted trade, but they were largely unable to quantify the extent of positive impact in terms of empirical data/evidence.
- The e-survey received limited responses from stakeholders, however the responses that were submitted provided rich and useful data.
- The Portuguese language challenge was mitigated by the Lead Evaluator's functional understanding of Portuguese.

4 MAIN FINDINGS

4.1 RELEVANCE

The project was deemed to be relevant, with evidence of alignment to regional and national strategies and the stated priorities of beneficiaries in both countries. These highlighted fruit flies as a priority given its impact on production of main horticultural commodities. Establishing PFAs and ALPPs, with associated buffer zones, according to ISPMs standards was therefore highly relevant. The project was developed through a Project Preparation Grant (PPG) in broad consultation with government, NPPOs, research organizations, and fruit growers' associations, including DAFF and DSV, the regulatory bodies in plant health. Priority issues, pests and target regions were agreed collectively.

57. Overall, the project objectives and activities aligned with regional and national strategies – including the SPS strategy/ plant health policy for South Africa, and the SPS national strategy for Mozambique - and the stated priorities of beneficiaries in both countries. The presence of fruit flies was consistently highlighted as the primary phytosanitary problem affecting the production of main horticultural commodities (deciduous, citrus and subtropical fruit) in southern Africa by evaluation respondents.

58. Fruit flies are recognized as pests of quarantine importance, with detection leading to export restrictions. Mozambique reportedly faces phytosanitary barriers to trade linked to the presence of certain types of fruit flies - often without scientific basis. At the time of project design, there were PFAs in the Northern Cape, the Eastern Cape, the Western Cape and the Free State in South Africa. However, the pest free status of these fruit production areas was under threat due to the build-up of Oriental fruit fly populations, notably in neighboring countries such as Mozambique, with potentially serious market impacts. The project's focus on establishing PFAs and ALPPs, with associated buffer zones, according to ISPMs[16] standards was therefore highly relevant for maintaining and expanding market access.

[16] Specifically following ISPM 26, Establishment of pest free areas for fruit flies (*Tephritidae*), ISPM 35, Systems approach for pest risk management of fruit flies (*Tephritidae*), Annexure 1, Establishment of areas of low pest prevalence for fruit flies, ISPM 29, Recognition of pest free areas and areas of low pest prevalence, and ISPM 37, Determination of host status of fruit-to-fruit flies (*Tephritidae*). Other general standards would also be followed as

59. The project was designed in consultation with a broad range of stakeholders representing government, NPPOs, research organizations, and fruit growers' associations through the Project Preparation Grant (STDF/PPG/567). As such the proposed approach received support across a wide range of key industry actors with priority issues, pests and target regions agreed collectively. DAFF and DSV, the regulatory bodies in plant health in South Africa and Mozambique respectively, were involved in project implementation and played a critical role in terms of notification of PFAs and ALLPs and associated legislation.

60. The project selected three fruit fly pests, the Oriental fruit fly *Bactrocera dorsalis* (present throughout Mozambique but with a restricted distribution in South Africa), as well as the melon fly *Zeugodacus cucurbitae* and Medfly *C. capitata* (present across Southern Africa) given their impact on fruit production and export market loss. The latter is the subject of the only Sterile Insect Technique (SIT) program in Africa based in the Western Cape (which produces approx. 60 – 70% of South Africa's fruit) attesting to its importance.

61. According to all participating NPPOs, the provision of technical assistance and training (including identification tools and online training modules), as well as trapping equipment and associated supplies was seen as highly relevant for pest monitoring purposes. In addition, a database was developed to capture all trap information and catches to facilitate monitoring, regional mapping, and identify and address risk areas. While development of this database was flagged as relevant and useful, issues were raised in terms of duplication of similar tracking tools, and the limited accessibility of the tool (notably to growers).

62. The project remained relevant over time with ongoing monitoring actively maintained in both countries since the project ended (see sustainability section) to ensure continued market access. However, repeated delays in official notifications to enact approval legislations from the authorities has impacted results.

4.2 COHERENCE

The project was highlighted as a first in terms of its approach establishing PFAs and ALPPs over such a wide region. However, limiting the project to South Africa and Mozambique was consistently flagged as a shortcoming given the cross-border impact of the pests, and need for a coordinated approach across Southern Africa.[17] A broader systems approach was also recommended. Synergies with partners were consistently and effectively leveraged, with evidence of the project complementing other fruit fly initiatives

a result such as, ISPM4, Requirements for the establishment of Pest Free Areas, ISPM 6, Surveillance, ISPM 8, Pest status, and ISPM 9, Eradication.

[17] It was noted that STDF's projects are demand-driven so for this project to cover more countries, it would have required countries to jointly request for the project with South Africa and Mozambique and would have required financial contributions from these countries given that for this project, 75% of total budget came from beneficiary countries themselves.

by STDF partners, as well as working on other pests (many of which are also ending). The presence of other databases monitoring pest prevalence could result in duplication of efforts.[18]

63. The evidence collected suggests that the project was internally and externally coherent, adding value to partner countries and aligning with other SPS interventions in the region. The project was a first in terms of its approach establishing PFAs and ALPPs over such a wide region. South Africa and Mozambique made a joint request because of their geographical closeness, extensive horticultural trade, and common ecological areas that allow pests to spread naturally. Mozambique's agriculture, mainly small and lacking in pest management, increases the risk of pest introductions. Additionally, the countries have collaborated on surveillance and research efforts in the past, providing a good basis for a joint pest control program.

64. However, limiting the project to South Africa and Mozambique was consistently flagged as a shortcoming given the cross-border impact of the pests, and need for a coordinated approach across the region. For instance, South Africa noted that collaboration should have been extended to other countries, notably in terms of melon fly which has an unknown status in many neighboring countries, to guarantee PFAs in-country.[19] This would also help build confidence in other produce exported from the region e.g. Eswatini, Kenya, Namibia, Tanzania, Zimbabwe.

65. Another area where the project could have been better scaled is in adopting a broader systems approach.[20] It was noted that the initial proposed scope had to be revised given the high budget of the original proposal (submitted ahead of the PPG). This resulted in some components of a systems approach being removed.[21] The scope was redirected to defining PFAs and ALPPs and working on more practical applied components. Complementarities and synergies

66. Given the importance of fruit flies, multiple actors have provided support in this space since the detection of fruit flies in Southern Africa in 2007. STDF therefore built on lessons learnt from the implementation of those programs, leveraging available research, and worked with experts who had been involved in their execution. There is evidence of the project complementing initiatives by STDF partners (e.g., Food and

[18] The implementing organization was aware of these other databases but noted that the database developed by the project focused on fruit flies specifically and could do large scale mapping, vs other databases that monitored a wider range of pests.

[19] However, given the existing research relationship between the two project countries and the prioritization of the spread of melon fly from Northern Mozambique, the scope was limited to these two countries with no outreach to others at the PPG stage.

[20] As clarified by ARC, South Africa aims to integrate various measures to meet phytosanitary import requirements. A systems approach requires the integration of different risk management measures, at least two which act independently, and which cumulatively achieve the appropriate level of phytosanitary protection (as per ISPM 14 of the IPPC).

[21] The following was removed from the first proposal: validate operational plan to maintain ALPPs for *B. dorsalis* and *C. capitata* in South Africa and Mozambique through case studies in selected regions under selected cropping systems. The host status testing was also removed before submission of the first PG in light of the limited budget.

Agriculture Organization (FAO), donors (Belgium Development Agency, EU, USAID), and agencies such as the International Atomic Agency (IAEA)). This extended to other research initiatives, and some of the project partners provided inputs on the parallel RMCA managed DISPEST program to complement research efforts.

67. There was also coordination with programs tackling other pests such as BananaMoz (Technoserve, USAID) tackling the Panama Disease Tropical Race 4 (TR4) and Banana Bunch Top Virus (BBTV) which is threatening commercial banana plantations and smallholder production. Given that the scope of the F3 project was largely focused on commercial growers, the Mozambique partners coordinated with the Farmer-led smallholder irrigation (FASIMO) project (funded through various sources including IDRC and Belgium Development Agency) which complemented its pest awareness work. The collaboration with the FASIMO project facilitated communication on pest management with smallholder farmers, and was reported as an important missing link given the ongoing spread of pests from smallholder farmers and households to commercial farms.[22]

68. Many active projects working on agriculture/ pest management have recently ended or are in the process of closing down. This was flagged as a risk for continued sustainability of results (see sustainability section).

69. Knowledge sharing with the STDF Secretariat was highlighted by stakeholders as beneficial with bi-annual meetings held throughout the duration of the project to discuss challenges experienced and share best practice examples from other STDF programs.

70. While there was limited evidence of duplication of efforts between projects, a notable risk to efficiency related to the proliferation of databases monitoring pest data (see effectiveness section).

4.3 EFFICIENCY

Despite delayed activities given the impact of COVID-19, implementation was efficient overall with the majority of the budget disbursed by project close. The project implementors optimized resources, with funds reallocated to address logistical hurdles in Mozambique. Resources were supplemented by in-kind and financial contributions from some of the project partners. Project and reporting deadlines were largely well-respected, with strong and consistent coordination through the implementing partner, ARC.

71. The F3 project broadly made efficient use of time and resources. Project start was delayed by several months as a result of the COVID-19 pandemic. While it was supposed to kick off in April 2020, the WTO

[22] FASIMO trained more than 400 smallholder farmers and 137 extension officers on improved crop management practices, including land preparation, optimum crop density, pest control and adoption of water-efficient innovations.

and the ARC eventually signed an agreement on 28 August 2020 and the project started on 1 September 2020.

72. Initially, it was suggested that DAFF act as the implementing organization. However, as a government agency, their administrative and financial regulations were considered too onerous for it take on the administrative and financial co-ordination of the project. It was, therefore, decided that the ARC, which is the research branch of the DAFF, should oversee project management[23] to ensure a more efficient delivery.

73. The budget requested from STDF was US$ 721 584. The total project value was US$ 2 925 941 with an in-kind contribution of US$ 1 031 551 from across the consortium and a financial contribution of US$ 1 172 806 coming from Fruit Fly Africa and DALRRD.[24] Funds remaining in the project are US$ 39 262.

Table 2 Partner In-kind contributions

Partner	Contribution (USD)	Contribution (%)
ARC	30,792	3
CRI	35,882	3.5
Crop Watch	12,600	1.2
DALRRD	252,514	24.5
EMU	54,858	5.3
FFA	539,951	52.3
RMCA	53,772	5.2
SU	47,759	4.6
Subtrop	3,423	0.3
DSV	N/A	N/A
Total	1,031,551	

74. One budget revision was carried out and US$ 20 000 was reallocated from Work Package 1 (Project Management) to Work Package 2 (Establishment of PFAs) and the funds were disbursed to EMU. The

[23] The Agricultural Research Council is a public entity established under the Agricultural Research Act, 1990 (Act No. 86 of 1990, as amended). It is a schedule 3A public entity in terms of the Public Finance Management Act, 1999 (Act No. 1 of 1999, as amended). As such it acts as the research branch of the DAFF.

[24] The financial contribution was USD 1,152,037 resulting from an MoU between Fruit Fly Africa and DALRRD (representing 30% of contribution). There was also a financial contribution of USD 20,769 from funds left after a fruit fly conference organized by SU and donated to the project.

initial end date was 31 August 2023, but a no-cost extension of 4 months was granted by STDF until December 2023 to account for the delayed start.

75. Respondents consistently highlighted that there were very few delays in the disbursement of funds and that time and resources were used effectively. These resources were supplemented by in-kind contributions from some of the project partners. It was noted that in-kind contributions were generally higher from South African partners, with a more modest contribution from the Ministry of Agriculture in Mozambique to cover some monitoring and equipment costs.

76. Resource constraints were flagged in the Mozambique part of the project. For instance, the project encountered logistical hurdles, such as securing transport for fieldwork given the remote locations of project sites. This was on some occasions resolved by sharing resources with other projects (e.g. Fruit Fly IPM), but it was flagged that having a project vehicle available would have significantly facilitated monitoring operations at the province level.

77. Additionally, the Government of Mozambique introduced a new rate of Daily Subsistence Allowance during implementation (representing a 3-fold increase) which led to an unexpected increase of costs related to fieldwork. A reallocation of funds to Work Package 2 and EMU was carried out to address this (as above).

4.4 EFFECTIVENESS

The project formalized PFA and ALPP definitions, a process for monitoring surveillance data, and allowed mapping of "hot-spot" corridors, with results largely achieved against initial targets. All targeted regions were monitored effectively with data shared to formalize PFAs and ALPPs, however delays in notification of pest areas by participating authorities impacted full completion of outputs. The main challenges faced for setting up PFAs and ALPPs related to procurement of control materials, security risks, climatic factors, and most importantly political risks (e.g. delays in notification of PFAs and ALPPs). Research was largely carried out effectively, although establishing ALPP thresholds was complicated by limited data, and the relationship between trap catches and fruit fly infestation could only be tested for two crops. Online monitoring tools and protocols were developed by the project. With regards to the tools, the proliferation of databases monitoring pest data was an issue. The quality and timing of reporting was largely adequate.

4.4.1 ESTABLISHING PFAS AND ALPPS (OUTPUTS 1, 3)

78. The project objective was to facilitate fruit export in the main horticultural areas in South Africa and Mozambique which was addressed through establishing PFAs and ALPPs including through the development of online tracking tools to monitor. Despite the difficulties faced, the project was commended by respondents as being the first in the region to define levels of pest prevalence. It formalized PFA and ALPP definitions, a process for monitoring surveillance data, and allowed mapping of "hot-spot" corridors.

79. The project successfully **established PFAs (Output 1)** and **ALPPs (Output 3)** in both countries which was consistently highlighted as the project's main achievement. In South Africa a surveillance programme was put in place (301 traps) for the melon fly, which allowed the whole of South Africa to be established as PFA. An action plan was developed to retain this status. For the oriental fruit fly, at the start of the project, PFAs were established for the Free State, Western Cape, Eastern Cape, Northern Cape. Isolated incursions into these areas during delivery were reportedly successfully eradicated by cooperation between the public and private sectors. At the project close the status changed in one area in the Eastern Cape, the Sunday River Valley from PFA to ALPP.

80. For Mozambique, a surveillance program was set up in all 8 provinces (214 traps) for the melon fly. This resulted in the Southern part established as a PFA (Maputo, Gaza and Inhambane). A buffer zone was created in the central part of the country and an action plan developed, notably to avoid a progressive invasion spreading from the north.

81. In South Africa, 9 ALPPs were identified in the Richmond area of the KwaZulu-Natal province for the oriental fruit fly. In the Western and Eastern Cape, monitoring data for the Mediterranean fruit fly (Hexrivier, Warm Bokkeveld, Elgin/Grabouw, Vyeboom, Langkloof) mostly didn't exceed 1 FTD, and a further 2 ALPP were established. In Mozambique 32 ALPP fruit production areas were established in Maputo, Inhambane and Manica for the oriental fruit fly, and a corrective plan was put in place to address the Mediterranean fly.

TABLE 3 RESULTS OUTPUT 2 & 3

Country	Melon fly (Z. cucurbitae)	Mediterranean fly (C. capitata)	Oriental Fruit Fly (B. dorsalis)
South Africa	- PFA: Whole of country - Action plan developed	2 ALPPs in Western Cape	PFA: Western Cape and parts of the Eastern Cape, Northern Cape and Free State 9 ALPPs
Mozambique	- PFA: 1 - ALPP: 32 - Action plan developed	No data collected	4 ALPPs

82. Training initiatives on pest management[25] focused on technicians carrying out monitoring activities, however these were at times extended to the broader local community across multiple provinces as

[25] Totaling 90 individuals for the public sector, and 12 for the private sector.

reported in Mozambique. Through field-based demonstrations, small scale farmers/ households were educated on Integrated Pest Management (IPM) techniques and provided with essential materials to implement control measures effectively. This was highlighted as an important initiative given the significant risk of infestation from small households; however its reach was limited.

83. A number of risks were reported during the establishment of the PFAs and ALPPs, most notably in Mozambique. For instance, procurement challenges were faced as lures for fruit fly management were not locally available and had to be bought from South Africa. Security risks related to insurgent activities in Northern Cabo Delgado significantly impacted survey work, and fieldwork had to be redirected to central and southern districts. It has not been possible to carry out monitoring in the northern part of the country for several years due to the security situation which represents a significant risk for sustainability of ALPPs. Climatic factors (floods and cyclones) also impacted the country making some monitoring sites inaccessible. There were reports of recurring thefts of traps in the Limpopo region in South Africa. The above risks all impacted activities and led to delays, however this did not significantly affect overall outcomes.

84. Political risks had a major impact on achievement of outputs. Obtaining ministry support, notably for actions like notifying the International Plant Protection Convention (IPPC) of pest status, required ongoing engagement and collaboration. Long delays were reported between scientific evidence being made available and official notifications to confirm PFAs and ALPPs. This resulted in outputs (1, 3) being only partially achieved. In the case of Mozambique, the establishment of border zones and domestic quarantine (whereby food from Northern and Central parts could not be moved to Southern areas) was reportedly seen as politically driven by growers which complicated formalizing the areas.

4.4.2 RESEARCH STUDIES (OUTPUTS 2, 6)

85. Challenges were faced in terms of **establishing ALPP thresholds (Output 2)** due to the complexity of correlating trap catch with infestations, requiring extensive sampling efforts. Historically there were no significant correlations between catches of males and females of the target pests at different time periods. Data was only obtained for citrus, avocado and litchi (for citrus this was limited to the Medfly). Information received from Mozambique consisted of only trap catches without any association with fruit fly infestation which further complicated the task.

86. To establish thresholds, surveys were conducted on fruit crops in South Africa: mandarin, orange, deciduous fruit (plum, nectarine, peach and apple), avocado, litchi and mango; and Mozambique: avocado, litchi and mango to determine trap threshold levels. Fruit fly infestation was only recorded, albeit at low levels, on mandarin, litchi and mango.

87. The historical information available limited the data sets obtained. It was noted that for most of the crops in this study, the fruit infestation rates were either nil or very low, which made it difficult to find a suitable model to determine the relationship between fruit infestation and trap catches. Ultimately, the

significance of the relationship between trap catches and fruit fly infestation could only be tested for two of the crops: mandarin and litchi and the output was not fully achieved.

88. The project successfully developed two (2) **operational and economic models** to ensure 1). maintenance of PFAs and 2). ALPPs **(Output 6)** albeit with some research delays due to COVID-19 restrictions.

4.4.3 ONLINE MONITORING TOOLS AND PROTOCOLS (OUTPUTS 4, 5)

89. The project developed technological tools for monitoring of fruit fly data. This included an **operational database platform for determination of fruit fly status (Output 4).** The database was established with the ongoing purpose of expanding on data points and adding fruit fly data through various projects and institutions. However, issues were flagged in terms of its effectiveness given the proliferation of databases monitoring pest data. According to interview data, in South Africa there are 50 companies approx. offering such databases to the agricultural industry, which negatively impacts a consolidated approach to monitoring efforts. There is no integrated database available.

90. An **identification protocol service for recognition of targeted fruit fly pests and related pests (Output 5)** was also set up with mobile applications for larvae and adult pests. This included a decision tree and protocols for identification of fruit flies and preservation of fruit flies. Training courses in-person and online[26] were established and rolled-out, largely aimed at technicians conducting inspections. However, feedback on the effectiveness of these training sessions varied among stakeholders.

91. It was highlighted that, while there were some shortcomings in the systems developed, the technology and processes established were beneficial in terms of their wider application. In this way fruit flies served as a useful model, building capacity in the two countries to address other pests in the region and fruit infestation more generally.

TABLE 4: PROJECT MONITORING DATA

Output	Indicators	Level of Completion[27]	Outstanding
1. Establishment of PFAs	**Indicator 1:** 12 PFAs established and reported to trading partners in accordance with ISPMs, of which 7 for Oriental fruit fly in South Africa and 2 for melon fly (whole of South Africa and southern and central part of Mozambique) **Indicator 2:** Action plan for melon fly developed	Indicator 1: 90% Indicator 2: 100%	Official notification by NPPOs outstanding (Mozambique)

[26] Seven YouTube videos. Morphology of the Tephritidae; Sorting and identification of Tephritidae; Preservation of fruit flies (*Tephritidae*); Main Tephritidae pest species, *Tephritidae genera*, Preparation of fruit fly larval mandibles, and Introduction to the Tephritidae.

[27] At project end as per Logframe submitted with final completion report.

Output	Indicators	Level of Completion[27]	Outstanding
2. ALPP thresholds	**Indicator 1:** Analysis of historic information by M12 **Indicator 2:** Relationship established between trapping data and infestation rate	Indicator 1: 100% Indicator 2: 90%	Models to determine the relationship between trapping data/ infestation rate only tested for two target crops: citrus and litchi.
3. Establishment of ALPPs	**Indicator 1:** 10 ALPPs established and reported to trading partners in accordance with ISPMs (4 areas for Mediterranean fruit fly and 2 for Oriental fruit fly in South Africa; 6 for Oriental fruit fly in Mozambique) **Indicator 2:** 13 possible ALPPs acting as buffer zones surrounding PFAs in accordance with ISPMs 26 and 30 **Indicator 3:** Action plan for maintenance of ALPPs	Indicator 1: 90% Indicator 2: 90% Indicator 3: 100%	The legislative adjustments will be made after completion, which will also indicate buffer zones for ALPPs. (South Africa)
4. Identification and data basing services	**Indicator 1:** Online database available, operational and used	Indicator 1: 100%	
5. Operational and Economic model	**Indicator 1:** Larval and adult identification tools publicly available for target pests and congeneric species **Indicator 2:** Provide online training resources in use of online identification tools	Indicator 1: 100% Indicator 2: 100%	

4.4.4 ADAPTING OPERATIONS AND DELIVERY IN RESPONSE TO COVID-19

92. Delays linked to the COVID-19 pandemic presented some challenges for the project, affecting the project start date, as well as both training and the development of models for pest-free areas. Travel restrictions meant that key experts were unable to travel to project sites. This delayed some of the research work, including the economic model to ensure the maintenance of PFAs and ALPPs. In South Africa, despite some agricultural fieldwork continuing with special permits, universities were shut down, preventing access to labs and interrupting academic research and training programs. Planned training courses on fruit fly identification had to be postponed due to travel restrictions. Delays were addressed through a no-cost extension, and training videos were made available on YouTube to replace in-person training sessions. A COVID-19 risk review was submitted alongside the inception report.

93. Additionally, COVID-19 restrictions disrupted trade flows and led to waste when local markets could not absorb the surplus produce.[28]

4.4.5 MONITORING AND EVALUATION

94. All consortium partners reported according to milestones and submitted updates collated into bi-annual reports by the implementing partner ARC, including updates in terms of the work plan and logframe indicators.

95. The quality of monitoring data was variable in the progress reports, and there was a lack of data on progress against indicators at the goal and objective level (impacts and outcomes), with no quantitative data reported (for instance on market access or exports).

96. The project was not evaluated at regular stages (e.g. annual, mid-term) apart from the final completion report. No internal final evaluation has been conducted. [29]

4.5 IMPACT

The evidence suggests a positive correlation in terms of retained market access through defining low-risk areas for fruit trade, notably to main markets such as the EU which have strict regulations related to the target pests. However, NPPOs still need to request recognition of the PFAs and ALPPs by importing countries. The impact on market access will therefore only be seen following this official recognition. Nevertheless, there are already indications of maintained and enhanced trade between Mozambique and South Africa, as a result of collaboration on the project. The presence of other diseases and pests, and the limited geographical reach of the project could mean that markets are lost regardless of project outcomes. Positive environmental outcomes were recorded related to reduced reliance on pesticides.

97. While quantitative data was largely unavailable, interviews and sample notifications of pest detection shared highlighted a positive correlation in terms of retained market access through defining low-risk areas for fruit trade. The importance of established PFAs was seen as critical, particularly for the European market which represents 60% of exports for South Africa, given strict regulations regarding fruit pests. Regular inspections and data collection are conducted to ensure compliance with export requirements, particularly for organic certification.[30]

[28] For example, Jacaranda Farm 1500hc used to export 900 containers of banana produce per week, but exports stopped when COVID started, this resulted in significant waste

[29] It was noted that it is not customary for STDF's project to conduct mid-term evaluation - perhaps because projects are quite short in length. There was a provision for an end-of-project assessment but given this project started before the STDF's MEL framework was established, the allocated budget was quite small. Ways to increase that budget to conduct the end-of-PG assessment were considered, but given that it was going to be covered by the programme evaluation, a decision was made to avoid duplication of efforts.

[30] The certification process, including Global Gap and Smith certifications, is crucial for retaining market access.

98. While PFAs should be dependent on the absence of certain species of fruit fly, any fruit fly species found result in all exports being cancelled.[31] EU Fruits of *Citrus L.*, *Fortunella Swingle*, *Poncirus Raf.*, and their hybrids, *Mangifera L.* and *Prunus L.* must be free of non- European fruit flies. In South Africa no areas are free of all non-European fruit fly species. Although some areas are free of Oriental fruit fly, *C. quilicii* is also present. Systems approaches are used to mitigate the risk, and the identification work (including protocols, mobile apps and training resources provided by STDF) remains important.

99. It was noted that the NPPOs of South Africa and Mozambique still need to request recognition of the PFAs and ALPPs by importing countries. Therefore, the impact on market access, revenues, and employment will only be seen at a later date following this official recognition.[32]

100. Nevertheless, there are positive indications suggesting trade has been maintained and may have been enhanced between the two implementing countries Mozambique and South Africa, given both country NPPOs' were involved in the project. Surveillance reports detailing fruit fly trap catches are always required by trading partners for import to South Africa or when South African ports are used to export to other areas. South Africa reportedly stopped the import of the following from Mozambique due to Oriental fruit fly presence: 1 *cucumis spp*. (Cucumber and Melon); 2 *Cucurbita spp*. (Pumpkin Squash) in 2008.[33] However, as a result of the project, DALRRD has been able to ensure proper mitigation options are put in place to increase export opportunities from Mozambique to South Africa.[34]

101. Throughout the project, South Africa assessed the risk of Oriental fruit fly on a commodity-based process. The first commodities for which suitable mitigation options could be agreed with the NPPO of Mozambique were major fruit crops such as Bananas, Mango, Avocado and Lichee. These were imported mainly from the southern provinces of Mozambique. Data shows a marginal increase in produce exports for: bananas (Maputo) from 36,122 tons (2021) to 42,589 tons (2023) from 3,6122 tons to 42,589 tons; and mangoes (Maputo and Manica) from 770 tons (2021) to 1,296 tons (2023).[35] Although this is not solely attributable to project outcomes, a positive correlation can be seen.

102. Clear distribution patterns have also now been detected for the Melon fruit fly as a result of the project. Once PFAs are declared by NPPO of Mozambique no additional trade restrictions will be necessary for

[31] For instance, Cape Fly and Natal Fly are indigenous to Africa, but Med fly is all over Europe and America. Exports should still go through in the case of Med fly, but the flies are extremely similar, in the same genus, so this differentiation is rarely made.
[32] This is likely to be a matter of time, given the need to trap for 24 months (two full year cycles) in order to have a reliable idea of the presence or absence and distribution of a particular species, followed up with exact demarcation, and testing on thresholds for ALPP, among other issues.
[33] When the Oriental fruit fly was detected in Mozambique around 2008 importation from Mozambique stopped (n.b. of *Cucumis* and *cucurbita*) and later certain commodities were allowed under certain import conditions.
[34] These include PFA's that can be declared for *Cucurbits* and ALPP for Oriental fruit fly. Mozambique however still needs to officially declare these areas.
[35] Export data, MoA Mozambique, provided in the context of the PIE.

produce from the southern provinces determined free from Melon fruit fly. This is expected to have a highly positive impact for trading between the countries.

103. However, while PFA and ALPPs reduce the risk of market access restrictions, other diseases and pests are present in the Southern African region, which means that markets could be lost regardless of the project outcomes, given the project only focused on specific fruit flies and products. For instance, a moth issue reportedly closed the Taiwan market for bone fruit (in the Western Cape & Eastern Cape) in May 2023 due to interception of fruit moth in one of the shipments. It is therefore difficult to make a direct correlation between the establishment of PFAs and ALPPs and an increase in trade. A broader regional management programme integrating other phytosanitary aspects would allow the SPS risks to be addressed more efficiently.

104. While the impact on poverty and food security was not a project metric, the initial detection of the Oriental Fruit Fly led to a serious impact on Mozambique's fresh fruit market (notably mangoes) affecting food security and livelihoods. This raised awareness of the importance of invasive fruit flies. However other invasives e.g. fall army worm were noted as now posing a higher threat to food security.

4.5.1 GENDER

105. Gender was mentioned in reporting documents (e.g. the proposal and final report) in terms of contextual information, the assumption being that "Female small-scale farmers and women employed along the value chain of the horticultural sector in southern Africa will benefit from growth in the horticultural sector, and it will provide a more stable financial and resource framework." However, the project did not integrate gender in the application, design, expected results (logframe) or project activities. Growers interviewed in Manica, Mozambique confirmed that more women are hired during fruit harvesting seasons, however the majority of long-term farm workers – including those servicing the traps – were men.

4.5.2 ENVIRONMENT

106. Environmental issues were referenced in reporting documents (e.g. the proposal and final report) in terms of contextual information, however this was not integrated into the application, design, expected results (logframe) and project activities. Nevertheless, project activities did have a positive environmental impact as reported in the KIIs. The emphasis on monitoring fruit flies and establishing PFAs helped to reduce reliance on pesticides, as well as reducing the need for disinfestation treatments when exporting. However, despite the presence of traps, spraying is still part of the pest control strategy, notably in ALPPs and in hosts prone to infestation (e.g. mango).

107. As fruit flies are spread from small households which act as breeding sites, it is necessary to apply area-wide control. The sterile insect technique currently being trialed by Fruit Fly Africa (sponsored by IAEA) would provide a non-toxic way to address the problem. It is expected that the response to climate change

will likely increase research in these areas, and the data produced will open other avenues for environmentally friendly pest management approaches.

4.6 SUSTAINABILITY

Sustainability was considered during project design with commitment obtained from NPPOs from both countries to project outcomes. While monitoring has continued since project close, this has largely been funded by larger-scale growers and associations in both countries, with government contributions for this purpose flagged as insufficient (notably given monitoring covers other fruit flies and pests). A notable risk to continued status of PFAs and ALPPs relates to financial constraints of smaller-scale farmers for ongoing pest control, as well as spread through small households which requires continued awareness raising. The fact that the database cannot be integrated with other systems raises concerns about its continued use and sustainability of its data.

108. In the initial design, sustainability considerations were acknowledged as vital, with efforts made to involve NPPOs from both countries in project activities to ensure sustainability post-project. Letters supporting the project were duly signed by the competent authorities, but written agreement could have been obtained from Government to commit to appropriate levels of continued funding and monitoring of PFAs and ALPPs after the project ended, and this was not the case.

109. While the project provided scientific data to enact approval legislation for the management of pests, there were long lag times between data submission and political action, and official notifications of PFAs and ALPPs have been slow (see effectiveness section). This has threatened to hamper results and continued trade. There is a need for the established PFAs and ALPPs to be officially recognized by trading partners in order to become fully sustained. Continuous surveying will be required for export markets to be maintained.

110. In the project aftermath, there has been a reported lack of a coherent strategic plan to address monitoring going forward, with no clear budget line item(s) to continue activities. In South Africa, government funding has been made available, but funds were flagged as insufficient given the limited budget available also covers other fruit flies and pests across the country.

111. Budget limitations have been even more stark in Mozambique. It was noted that funds to purchase materials for a year after project close were factored into the budget. According to evaluation respondents, these funds and co-financing from other projects will allow results achieved to be maintained for a year. However, other sources of funding will be required to move towards long-term management of fruit flies. The risk to sustaining the results relates to the lack of funding from both government and private institutions/agencies. This is all the more problematic as many other donor-funded projects working on related issues have also recently ended or are in the process of shutting down. A break in monitoring activities would have serious implications for continuation of the established PFAs and ALPPs, and status could potentially be revoked before any impacts of the projects have been seen.

112. In many cases, given the vital importance of pest-free status for exporting, monitoring is continuing through growers and/ or fruit associations[36] in the absence of sufficient government funding. All NPPOs interviewed confirmed this. While this is possible for larger-scale commercial farms (albeit more challenging in the Mozambican context where growers have more limited funds), a notable risk relates to the financial constraints of smaller-scale farmers and their inability to purchase control materials. There are several reported instances of farmers approaching the project team about this in Mozambique since the project has ended. This has raised serious questions about the sustainability of pest management efforts to date. Another marked risk relates to spread through households which requires continued awareness raising in IPM techniques for effective mitigation.

113. Continued market access is threatened by other pests (e.g. Panama disease which is spreading rapidly in Northern parts of Mozambique), as well as the unknown status of fruit flies in other neighboring countries. An integrated regional and pest management plan is vital for continued trade. However, economic challenges, political unrest, and security risks in these countries (notably in Zimbabwe, Tanzania, and North Mozambique) all pose significant barriers to developing a coordinated approach. The sustainability of the developed tools such as the database will depend on the availability of data and continued incentives for technicians and growers to use it. However, the availability of multiple databases, and the lack of awareness amongst growers about the app which has largely been targeted at inspection technicians, mean that other tools are being used for this purpose. Some of these tools reportedly do not provide correct historic information or spatial analysis, and most are costly to subscribe to. While the initial ambition was to integrate the database with the Government of South Africa application, this proved too costly. The aim is to standardize the data and make it interoperable with other databases and systems in future, but this has not been achieved within the remit of the project.

114. Future initiatives for the database include modularizing data and expanding efforts to survey other invasive pests (2 additional pests are currently being surveyed), alongside collaboration with industry stakeholders to address pest management needs in a more holistic way. The aim is for the app to be directly funded by the industry. This would allow more integrated research and response to market access threats. It would also include data on impact of interceptions to allow government to see the immediate benefits.

115. Low availability of experts working in this area in the Southern African region represents another risk to ongoing monitoring and research efforts, as well as identifying experts for any future initiatives. For instance, there are only three trained entomologists in Mozambique, with qualified experts reportedly often seeking employment opportunities abroad.

[36] In the South African citrus industry, CRI has a biosecurity division that continues to monitor and mitigate risk (e.g. melon fly) support retention of PFAs, and they are looking to further apply the processes and procedures for area of low pest prevalence to other pests.

4.7 OTHER

116. Support was repeatedly flagged as required for certification and associated training. This was both at the national level in Mozambique where the government is currently migrating to an electronic phytosanitary (e-phyto) certification system; as well as for growers requiring certification support (notably for organic certification) to access export markets.

5 LESSONS

117. The current project focused on two countries i.e. Mozambique and South Africa.[37] The collaboration was positive allowing for a joint approach to the surveillance and response to invasive fruit fly species, notably on the Northern Mozambique border, with the identification of PFAs and ALPPs ultimately helping to facilitate trade between the two countries.

118. However, given the cross-border nature of pest management, the geographical scope was too limited. Establishing a more integrated regional management program would have meant other phytosanitary aspects could have been dealt with more efficiently and coherently.[38]

119. The partners were a diverse mix of private and public sector actors. The role of the private sector was especially important given their close links to growers. This ensured they were able to respond rapidly to fruit fly detections, as was evidenced in the Western Cape in South Africa.

120. The co-financing format of the project (75% from project partners) was essential for overall commitment, however there were some challenges and delays getting all contracts agreed at the outset. The role of the implementing partner and the first work package focusing on program management helped to mitigate consortium challenges.

121. The broader systems approach initially proposed in the PPG had to be scaled down given budget constraints. The project was therefore more narrowly focused on defining PFAs and ALPPs and working on more practical applied components. While this represented a good entry point/ baseline to tackle pest management, the research was consequently more limited in scope than originally planned.

122. One key lesson for the establishment of PFAs and ALPPs was the importance of streamlining trapping data. A major challenge was that trapping data was recorded in different formats across partners. This meant that all historical data had to be manually uploaded into the database in the correct format. As a result of

[37] The two countries and research partners on the project had a long history of collaboration prior to the project. It was noted that the framework developed for the recognition of PFAs and ALPPS could potentially be extended to other countries.

[38] For instance, working with the SADC Secretariat on actioning its regional strategy (building on regionally focused initiatives such as the EU funded project (Strengthening Pest and Disease Management in the SADC Region) implemented by CABI which developed a harmonized regional strategy for MLN disease) was proposed as a viable way forward.

the project, the partners have aligned their data collection methods, and the systems in place now allow for large scale mapping of PFAs and ALPPs specifically for fruit flies.

123. The project focused on large commercial farms, given these are the primary exporters and the project goal was to enhance market access and increase revenue. While some efforts were made to raise awareness of fruit fly management amongst other groups such as small-scale producers and household growers during delivery through sensitization, training and, in the case of Mozambique, collaboration with partner programs, the reach of these activities was limited. A more integrated approach would have been beneficial, as smaller-scale producers often lack resources and knowledge about pest control, yet they contribute significantly to agricultural outputs, and pose a critical risk to the spread of pests.

124. While the database was beneficial to streamline trapping data from project partners and allow for area-wide mapping specifically targeted at fruit flies, it was noted that the proliferation of mobile app technologies and the fact that growers use multiple apps[39] for surveillance purposes posed risks to efficiency and data collection. Making the project database accessible to growers (not just inspection technicians) through a mobile based app would have allowed them to access necessary data to combat pests effectively in real time.

6 RECOMMENDATIONS

#	Action	Timing	Responsible Party
1	Adopt a more integrated approach for future projects, in terms of geographical reach, with broader-based actors across the fruit industry (e.g. smaller scale farmers and households), as well as a wider-based monitoring of other pests beyond fruit flies, to ensure results are sustained and market access is maintained. This could potentially be achieved through a multi-donor collaboration, and in coordination with SADC.	Potential Future Phase	STDF
2	Ensure a robust sustainability plan is in place for continued monitoring activities beyond the project end date. Notably, work with beneficiaries (e.g. Gov. Mozambique) to review options and solutions in place for continued purchase of control equipment once the year-long STDF funding extension ends.	Within 6 months/ Potential Future Phase	Participating Countries/ STDF

[39] Including one of the project partners Fruit Fly Africa which has subsequently created their own database as per a KII.

3	Ensure stronger political commitment to the timely submission official notifications of PFAs and ALPP. This could be achieved through setting clear timelines for notifications following receipt of scientific data.	Potential Future Phase	STDF
4	Support awareness raising of online monitoring tools (database and identification protocol) to relevant actors to promote their continued use	Within 6 months	ARC/SU/ STDF
5	Support the sharing of best practice, including with other regions. Consider developing practical guidelines based on the project experience establishing PFAs and ALPP to add to the body of work and international guidelines available.	Medium term	ARC/ Participating Countries/ STDF
6	Building on and broadening out the IAEA-sponsored sterile insect program,[40] including sterilization techniques with area wide baiting/ monitoring program modelling based on climate was recommended.[41] This expansion would need firm government engagement given it would involve national laboratories.	Medium term/ Potential Future Phase	STDF

[40] Which was rolled out in one of the target regions in South Africa.

[41] It was noted that rolling out a sterile insect program in other areas, especially the northern part of South Africa, will be challenging as five fruit fly species cause damage to fruit and need suppression.

7 ANNEX A: DOCUMENT LIST

#	Document Title
Project Documents	
2	Project Grant Application
3	End of PG Assessment
4	FF Reporting Schedule
5	P-IMA Ethiopia Project Reports
6	Inception Report
7	Progress Reports 1 – 5
8	Final Report
9	Contracts & Amendments
Other	
10	CABI. (2021-2022). Strengthening Pest and Disease Management in the SADC Region. Support towards operationalization of the SADC Regional Agricultural Policy (STOSAR).
11	Canhanga, L., De Meyer, M., Cugala, D., Massimiliano, V., & Maulid, M. (2020). Economic injury level of the Oriental fruit fly, Bactrocera dorsalis (Diptera: Tephritidae), on commercial mango farms in Manica Province, Mozambique. African Entomology, 28(2).
12	Canhanga, L., De Meyer, M., Cugala, D., Virgilio, M., Bota, L., & Mwatawala, M. (2021). Perception of fruit farmers on the occurrence of the oriental Bactrocera dorsalis (Diptera: Tephritidae) and its associated economic impact in Manica province, Mozambique. ISHS, 76(6).
13	Dados de Produtos Exportados No Ambito de Projecto STDF (Mozambique Export data, 2019 – 2023)
14	DARLDD - Final Phytosanitary workplan for the importation of Persea spp. (Hass, Pinkerton and Fuerte varieties of avocado) fresh fruit from Tanzania to South Africa (2021)
15	DARLDD - Notification on the Detection of Bactrocera Dorsalis in the Eastern Cape Province (Sunday's River Valley), South Africa (2021)
16	Ekesi, S., & Mohamed, S. A., De Meyer, M. (Eds.). (2016). Fruit Fly Research and Development in Africa: Towards a Sustainable Management Strategy to Improve Horticulture. Springer International Publishing Switzerland.
17	Ekesi, S., et al. Combating Fruit Flies in Eastern and Southern Africa (COFESA): Elements of a Strategy and Action Plan for a Regional Cooperation Program. International Centre of Insect Physiology and Ecology (icipe), The World Bank.
18	FAO. (2022). Support Towards the Operationalization of the SADC Regional Agriculture Policy (STOSAR) bulletin. 2nd Edition. Rome.
19	Faculdade de Agronomia e Engenharia Florestal. (2022). Avaliação do impacto socioeconómico da mosca da fruta (Diptera: Tephritidae) na produção das cucurbitáceas na província de Maputo e Manica. Licenciatura em Engenharia Agronómica. Departamento de Proteção Vegetal. Curso de licenciatura em engenharia agronómica. Maputo.
20	Fruit South Africa. 2021/2022 Key Fruit Statistics. https://fruitsa.co.za/wp-content/uploads/2023/09/A5-Fruit-SA-Booklet_2023_Digital.pdf
21	República de Moçambique. Ministério de Agricultura. (2012). Background information on the Situation of Phytosanitary Capacity in Mozambique.

22	Yazid,B et al.,: Key fruit flies species reported in Africa, Mor. J. Agri. Sci. 1(4): 201-214, July 2020

8 ANNEX B: STAKEHOLDER LIST

#	Name, role, department, organization	Country
1	Dr Tertia Grove, ARC TSC	South Africa
2	Ms Elma Carstens, CRI	South Africa
3	Mr Vaughan Hattingh, CRI	South Africa
5	Dr Aruna Manrakhan, CRI	South Africa
6	Ms Julie Mokwele, DALRRD	South Africa
7	Mr JanHendrik Venter, DALRRD	South Africa
6	Dr Laura Canhangan, EMU	Mozambique
7	Prof Domingos Cugala, EMU	Mozambique
8	Mr Gian Dutoit, Fruit Fly Africa	South Africa
9	Mr Matthew Addison, HortGro	South Africa
10	Mr Dalilo Ambasse, MoA Mozambique	Mozambique
11	Mr Luis Bota, MoA Mozambique	Mozambique
12	Mr Alegrias Elias, MoA Mozambique	Mozambique
13	Prof Pia Addisson, Stellenbosch University (SU), Department of Conservation Ecology and Entomology, Faculty of AgriSciences	South Africa
14	Willem Hoffman, Stellenbosch University (SU), Department of Conservation Ecology and Entomology, Faculty of AgriSciences	South Africa
15	Pedro Paulino, Agropecuária Frutas do Revue, Vanduzi	Mozambique

#	Name, role, department, organization	Country
16	Ibrahim Domingos Uerenganhe, Gan El, Sussundenga	Mozambique
17	Hugo Botha, General Manager, Gan El, Sussundenga	Mozambique
18	Azarias Francisco, Companhia de Vanduzi	Mozambique
19	Maquival Joaquim, Companhia de Vanduzi	Mozambique
20	Craig Peter Bailey, General Manager, Companhia de Vanduzi	Mozambique
21	Mr. Domingos Jequessene, Local Technician MoA, Manica Province	Mozambique

9 ANNEX C: GRANT APPLICATION (EXTRACT)

Beneficiaries

Mozambique

South Africa

Project number and title

STDF/PG/567

F^3: FRUIT FLY FREE

ESTABLISHMENT AND MAINTENANCE OF FRUIT PRODUCTION AREAS FREE AND UNDER LOW PREVALENCE OF FRUIT FLY PESTS IN SOUTHERN AFRICA

Budget

Total project value: US$ 2 925 941

Approved STDF contribution: US$ 721 584

Disbursed STDF contribution (95%): US$ 685 505

Period of implementation

1 September 2020 to 31 December 2023

Implementing Agency

Agricultural Research Council, South Africa

Partners

Department of Agriculture, Land Reform and Rural Development, Directorate Plant Health, South Africa

Royal Museum for Central Africa, Department of Biology, Belgium

Citrus Research International, South Africa

Stellenbosch University, Faculty of AgriSciences, Department of Conservation Ecology and Entomology, South Africa

Stellenbosch University, Faculty of AgriSciences, Department of Agricultural Economics, South Africa

Eduardo Mondlane University, Faculty of Agronomy and Forest Engineering, Mozambique

Eduardo Mondlane University, Centre of Excellence in Agri-Food Systems and Nutrition, Mozambique.

Ministry of Agriculture and Food Security, National Directorate of Agriculture and Silviculture, Department of Plant Protection, Mozambique