THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF AGRICULTURE

TANZANIA INITIATIVE FOR PREVENTION OF AFLATOXIN CONTAMINATION (TANIPAC)

END OF PROJECT EVALUATION REPORT (EPER)

AUGUST 2025

FOREWORD

The completion of the Tanzania Initiative for Prevention of Aflatoxin Contamination (TANIPAC) project marks a significant milestone in Tanzania's pursuit of food security, improved public health, and agricultural trade competitiveness. This report serves as the comprehensive final evaluation, providing a meticulous assessment of the project's performance from its inception through to its completion. It is intended to inform national policy, guide future agricultural investments by the Government of Tanzania and its development partners, and secure the impressive gains achieved over the project lifecycle.

Tanzania's strategic development vision (TDV50) prioritizes agricultural transformation to propel the nation towards middle-income status –and the regional food-basket and among top-ten ranking food producers in the world. However, persistent challenges like high income poverty rates and the ever-present threat of aflatoxin contamination—a potent mycotoxin and economic disruptor—threatened this trajectory. TANIPAC was conceived as a multi-sectoral solution, deploying a strategy that integrated infrastructural development, high-level capacity building, on-farm knowledge transfer, and institutional reforms to tackle this systemic food safety issue head-on.

This evaluation is structured around an in-depth analysis of project outcomes and outputs against their initial targets. The key finding is the project's transformative success in achieving its highest-level objectives: food insecurity was drastically reduced, export value for maize and groundnuts soared, and public health enhanced through improved food safety. However, this success is balanced against several critical, structural constraints, notably the challenge to create a sustainable financing and investment model for farmers to adopt costly post-harvest management technologies and a significant shortfall in securing long-term technical expertise and institutional capacities for enhanced food safety in the Tanzanian food system.

The report details these successes and challenges across strategic interventions in infrastructure, knowledge transfer, institutional strengthening, and management effectiveness for prevention and control of aflatoxin – and enhanced food safety at large. Ultimately, this final document provides not only accountability for past performance but also a clear, actionable set of strategic recommendations. These recommendations focus on pivoting future efforts towards financial sustainability, addressing underlying production deficits in key crops, and completing the human capital development necessary to operate the state-of-the-art national assets—like the PHCoE, NBCU and CARL—for decades to come. Indeed, this document underscores lessons and recommendations for advancing the grain industry and other sector transformation initiatives.

Gerald Geofrey Mweli

Permanent Secretary

Ministry of Agriculture

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The Consultant, Prof. Khamaldin Daud Mutabazi, acknowledges first, the Ministry of Agriculture (MoA) of the United Republic of Tanzania for the trust accorded to him to carry out the outcomes' survey for the Tanzania Initiative for Preventing Aflatoxin Contamination (TANIPAC) Project.

Cordial thanks are extended to the TANIPAC Project Coordination Team (PCT) under the MoA for the active collaboration and cooperation unconditionally granted to the Consultant while undertaking the assignment. A wealth of invaluable information and data of the project were provided – underpinning impartial collaborative evaluation process.

Appreciation is also delivered to Mr. Sheu Mujuni of University of Dar es salaam who helped with supervision of data collection. Thanks are also extended cordially to the team of enumerators: Mr. Rajabu Hashim Tibahwa, Mr. Jummanne Placid Kabalo, Mr. Guntrum Gerald Chimtembo, Mr. Reginald Stanley Chami, Ms. Emmanuelina Philbert Joel and Ms. Gloria Adolf Rwiza. Warm appreciations go also to the two drivers – Mr. Alex Nguli and Mr. Duncan Chale, their driving enabled evaluation teams to move around safely.

Lastly, sincere appreciations are extended to all respondents and consulted stakeholders who dedicated their precious time and energy to exchange information for this evaluation study.

EXECUTIVE SUMMARY

Tanzania's agricultural sector, public health, and food security have long been hampered by widespread aflatoxin contamination in staple crops like maize and groundnuts. These mycotoxins present a dual crisis: they are a direct cause of severe health issues, including liver cancer and childhood stunting, and they create significant barriers to trade, limiting economic opportunities for smallholder farmers. The Tanzania Initiative for Prevention of Aflatoxin Contamination (TANIPAC) was strategically designed to address this multifaceted development challenge by tackling the root causes aflatoxin contamination.

The primary goal of TANIPAC was to minimize aflatoxin contamination across the maize and groundnuts food value chains to enhance food safety, improve public health, and boost the export trade and competitiveness respective grains. Overarching objectives of the TANIPAC project were to: create aflatoxin awareness to different key stakeholders an national, subnational and local levels – including farmers, value chain actors, extension staff, policy-makers, politicians and the general public; promote aflatoxin-smart pre- and post- harvest practices in the value chain; strengthen technical and testing capacities of food safety regulatory and agricultural R&D institutions; create enabling regulatory frameworks for prevention and control of aflatoxin contamination; and development of strategic food safety and post-harvest management infrastructure and facilities.

This evaluation utilized a comprehensive and mixed-methods approach. The data analytics process involved a thorough desk review of key project documentations, complemented by extensive primary data collection. Quantitative data was sourced from structured surveys with farmers; while qualitative insights were gathered through Key Informant Interviews (KIIs) with officials and partners, value chain actors, artisans; and Focus Group Discussions (FGDs) with farmer groups to understand the project's impacts on the ground.

The TANIPAC project achieved exceptional success, exceeding its primary objectives and delivering significant positive results towards its targets. Its outreach and capacity-building initiatives directly reached 198,212 beneficiaries, surpassing the target by 41%. A nationwide awareness campaign successfully educated an estimated 25 million Tanzanians on the dangers of aflatoxin and its prevention, leading to the enhanced adoption of improved agricultural and post-harvest practices.

Economically, the project empowered smallholder farmers and value chain actors through awareness creation, transfer of Good Agricultural Practices (GAPs) – that will lead to improving crop quality and safety, unlocking profitable market access. Institutionally, TANIPAC fortified the national capacity for aflatoxin control by upgrading laboratory facilities by supporting acquisition of critical equipment, establishing robust monitoring protocols, and supporting a conducive policy framework – that are altogether contributes to the transformation of the Tanzanian grain industry. Apparently, the TANIPAC was a successful and impactful initiative. Despite of meeting its objectives, the project has established a sustainable framework for long-term management of aflatoxin and other food safety hazards.

Based on the evidence presented in the report, the following strategic recommendations are proposed to build on the project's successes:

1. **Extending Promotion of PHM Technologies with Tailored Farmer Financing Model:** For smallholder farmers to ultimately access promoted PHM technologies there must a sustainable financing mechanism to support farmers in adopting and investing in post-harvest technologies.
2. **Addressing Yield Gap in Crop Agriculture:** To enhance food and nutrition security, despite of improvements in the use of productivity enhancing-inputs and mechanization in the agriculture value chain, yield gaps (realized vs. potential) are still wide in most crops including maize and groundnuts. Tailored strategies for yield gap closure, *inter alia*, include accelerating extension services delivery, financing and access to profitable markets.
3. **Promote Grain Trade Diplomacy:** As Tanzania is already producing surplus food grains and vowed to even expand grain export base in the region and beyond, it should actively engage in grain trade diplomacy through bilateral and regional agreements to expand market access for Tanzanian grains. The strategic food safety centric infrastructure developed under the TANIPAC, and other similar initiatives in advancing PHM should be the launcpad for the country to leverage a competitive regional grain export trade.
4. **Develop Food Safety Centric National Certification and Traceability System for Grains:** In order to improve market competitiveness of Tanzania's grains in the regional and international markets, it is recommended to the Government, in collaboration with stakeholders and development partners, to develop and implement a comprehensive food safety centric certification and traceability for grains. The very fabrics of a versatile grain certification and traceability system, *inter alia* – high-level political will, strategic laboratory facilities (incl. CARL) and other mega-investments in logistics and energy (incl. SGR, Modernized Dar Es Salaam Port, and Mwalimu Nyerere Hydro Power Station). Moreover, the endeavour would require development of appropriately equipped ISO-accredited food safety central laboratories – coupled with a network of satellite food safety testing facilities in-country and at the borders.
5. **Modernize Grain Commodity Trading System:** A part of its long-term ambition (2050), Tanzania has a reachable ambition of being a leading producer of food in Africa and among top 10 countries feeding the world. Strategically, this requires the country to modernize its food trading systems particularly grains. The PHCoE developed under the TANIPAC is a radical step walking this path. The Centre should can start adopting modern grain commodity exchange systems, including futures markets and advanced traceability systems. Moreover, a "One Stop Centre (OSC)" to facilitate domestic and export grain trade should be established at the PHCoE. The OSC is expected to streamline the grain trading process including coordinated food safety and standards, grading, value addition, testing, certification, and licensing.
6. **Accelerate Public-Private Partnerships (PPPs):** The food grain industry holds a niche attracting public and private investments as related social and economic returns on investment is commensurate. As the country's Vision 2050 prospects

to develop corporate-styled State Owned Enterprises (SOEs) – creating efficient SOEs and an opportunity space for PPP. The regulatory framework for PPP exists – and all such opportunities provide the critical conditions for plausible PPP investments in the grain industry. As the grain industry has an engrained 'public good' nature, the state take a more active role in grain sector planning and trade while fostering a conducive environment for private sector participation.

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LIST OF ACRONYMS AND ABBREVIATIONS

ADF	African Development Fund
AfDB	African Development Bank
AMs	Aide Memoires
AMP	Agricultural Master Plan
AU	African Union
CARL	Central Agricultural Research Laboratory
CESA	Cumulative Environmental and Social Assessment
D-Fund	Direct to Project Funding
EAC	East Africa Community
EPER	End of Project Evaluation Report
ESMPs	Environmental and Social Management Plans
FBOs	Farmer-Based Organizations
FGDs	Focus Group Discussions
FIES	Food Insecurity Experience Scale
FSSR	Food Self-Sufficiency Ratio
GAFSP	Global Agriculture, Food Security Program
GAI	GAPs Adoption Index
GAPs	Good Agricultural Practices
GDP	Gross Domestic Product
HCC	Hepatocellular Carcinoma
KIIs	Key Informant Interviews
KPIs	Key Performance Indicators
LGAs	Local Government Authorities
LOGS	List of Goods and Services
MDD	Minimum Dietary Diversification
MoA	Ministry of Agriculture
MoF	Ministry of Finance
NACS	National Aflatoxin Communication Strategy
NAfCS	National Aflatoxin Communication Strategy
NAOT	National Audit Office of Tanzania
NBCU	National Biocontrol Unit
OHS	Occupational Health and Safety
OSC	One Stop Centre
PAR	Project Appraisal Report
PCT	Project Coordination Team
PHCoE	Post-Harvest Centre of Excellence
PHM	Post-Harvest Management
PICS	Purdue Improved Crop Storage
PPPs	Public-Private Partnerships

PRBF	Project Results-based Logical Framework
PSM	Propensity Score Matching
RBLF	Results-Based Logical Framework
SGR	Standard Gauge Railway
SIDO	Small Industries Development Organization
SMEs	Small and Medium-sized Enterprises
SOEs	State Owned Enterprises
TANIPAC	Tanzania Initiative for Prevention of Aflatoxin Contamination
TBS	Tanzania Bureau of Standards
TDV50	Tanzania Development Vision 2050
ToC	Theory of Change
URT	United Republic of Tanzania
USD	United States Dollar
VCAs	Value Chain Actors
VEOs	Village Extension Officers
VETA	Vocational Education and Training Authority
WHO	World Health Organization
ZDV27	Zanzibar Development Vision 2027

PART ONE
STRATEGIC DEVELOPMENT CONTEXT AND PURPOSE OF EVALUATION

1

1.1 Strategic Development Context

Tanzania Development Vision 2050 (TDV50) and Zanzibar Development Vision 2050 (ZDV50[1]), place high priority on the agriculture sector transformation. Both long-term Visions aspire to propel the URT to a semi-industrialized upper middle-income country – with per capita income of USD 7,000, and reducing abject income poverty rate based on the international poverty line of US$ 2.15 from 43% (World Bank 2024[2]) to 5% by 2050 (URT 2025[3]). By 2050, Tanzanian population will be around 140 million people with more than half will residing in urban areas – and majority (over half) will be youth. The demand for food, which must be safe, nutrious and healthy, is estimated at to increase from the current 15 million tons to 20 and 34 million metric tons by 2030 and 2050, respectively (URT 2023[4]).

Equivocally, impressive socio-economic outcomes and growth sustained at 6-7 over the past decade have not translated into substantive gains in poverty reduction. Extreme poverty rate has modestly fallen from 36% in 2000 to 26% in 2022 (URT 2024[5]). Tanzania's growth elasticity to income poverty reduction remains the lowest globally. Expectedly, every percent increase in per capita GDP poverty declines by 2%. Between 2011 and 2018, Tanzania per capita GDP grew by 21%, whereas the overall national poverty rate declined by only 6.4% (World Bank 2024). An array of reasons for slow poverty reduction have include among others: low rates of decent jobs creation, and underdeveloped value addition in major employing sectors such as agriculture which has resulted into low value added per worker.

Agriculture and food systems transformation remains the lifeline of achieving higher national-level development aspirations – particularly reduction of income poverty, improved food and nutrition security, and enhanced public health. Foodborne illnesses resulting from compromised food safety accounts for 30% of global deaths. In Africa, consumption of unsafe food is associated with about 137,000 deaths and about 91 million cases of acute foodborne illnesses annually – the highest estimates worldwide (AU 2022[6]). Consumption of unsafe food remains a major threat to public health globally.

[1] RGoZ (2020). Zanzibar Development Vision 2050.
[2] World Bank (2024). Tanzania Economic Update. Issue 21.
[3] URT (2025). Dira ya Taifa ya Maendeleo: Tanzania Development Vision (TDV) 2050.
[4] URT (2023). Budget Speech 2023/24, Ministry of Agriculture. Dodoma.
[5] URT (2025). Dira ya Taifa ya Maendeleo 2050: Tanzania Development Vision (TDV) 2050.
[6] AU-Africa Union (2022). Food Safety Strategy for Africa 2022 - 2036

Globally, foodborne illness is estimated to be over 600 cases and associated 420,000 deaths annually (WHO 2015).

Food safety is the gateway for Tanzania to realize it vision of becoming a competitive agri-food trade hub in the region and Africa at large. As stipulated in its Agricultural Master Plan (AMP), Tanzania targets to realize a net agricultural exports valued at US$ 6 billion by 2030 and over US$ 20 by 2050 (from current US$ 1.2 billion). Indeed, this vision is being walked as Tanzania is a leading producer of grains in the East Africa Community (EAC) and among the three big producers in the Eastern and Southern Africa after Ethiopia and South Africa. The ambition of Tanzania feeding the continent and the world has been reiterated in the country's recent Development Vision 2050 (TDV 2050) with Tanzania intending to be the leading producer of food in Africa and among top 10 food producers in the world by 2050. Achieving such development ambitions requires Tanzania to address food safety concerns including aflatoxin.

Aflatoxin contamination is a major challenge affecting food safety, public health, and agricultural trade in Tanzania. Key staple crops including maize and groundnuts are highly susceptible to aflatoxin contamination, which has been linked to severe health risks, including liver cancer, immune suppression, and stunted growth in children. Moreover, aflatoxin contamination limits Tanzania's ability to access regional and international markets due to strict food safety regulations, causing substantial economic losses estimated at USD 264 million annually.

Tanzania Initiative for Preventing Aflatoxin Contamination (TANIPAC) was a five-year project implemented since 2019/20, hence ending in 2023/24 – but was extended until end of December 2025. The project was co-financed through a Grant from the Global Agriculture, Food Security Program (GAFSP), a concessional loan from the African Development Fund (ADF) and the counterpart funds from the United Republic of Tanzania. The project was introduced following the Aflatoxicosis outbreak in the central zone regions of Dodoma and Manyara, in which 65 people were hospitalized resulting in 19 deaths. Maize and groundnuts are highly susceptible to aflatoxin contamination. Farming households and consumers are exposed to aflatoxins as most of the maize and groundnuts (over three quarters) are consumed directly in the producing areas where no formal testing is ever done.

Strategically and objectively, the TANIPAC project aimed at: rising awareness and building the capacity of farmers and other value chain actors, promoting adoption of aflatoxin mitigating technologies, developing post-harvest infrastructure, strengthening institutions and regulatory framework for aflatoxin control. Such interventions were expected to result into three major outcomes: 1) Increased quantity of aflatoxin-safe maize and groundnuts, and related products consumed and traded, 2) Improved adoption of aflatoxin smart pre- and post-harvest technologies, and 3) Enabling environment for aflatoxin control. Delivery of such outcomes was expected contribute to improved food and nutrition security, national income and public health. TANIPAC interventions were implemented in 18 districts from ten (10) regions of Tanzania Mainland and Zanzibar.

1.2 Purpose of Evaluation

The purpose of an independent external end-evaluation was to examine the performance of the TANIPAC project towards achieving intended results. Specifically, the end-line evaluation involved addressing the following objectives, *inter alia*, including:

i.) Provide an independent, systematic and objective evaluation of the project performance in terms of achievement of intended results and ascertain the processes along the impact pathway;
ii.) Assess whether the project's underlying assumptions were correct and whether the results framework describes the most effective paths toward expected results based on the project's Theory of Change;
iii.) Generate lessons learned and good practices in the design, execution and realization of intended results in the evaluation contexts of relevance, efficiency, effectiveness, economy, sustainability, and implementation arrangement; and
iv.) Provide evidence-backed and forward-looking recommendations to inform efficient delivery of on-going and future projects and programmes at the Ministry of Agriculture.

PART TWO
PROJECT DESCRIPTION

2

2.1 Project Development Objective

The main objective of the TANIPAC project was to minimize and control aflatoxin occurrence and contamination levels in the food system focussing on maize and groundnuts value chains. The project aimed at contributing to the overall impact of improving food safety and food security, hence improving the public health and nutrition at the same time advancing agricultural productivity and agri-food trade – and ultimately contribute to poverty reduction and economic growth at large.

2.2 Theory of Change

In practice, the end-evaluation is a systematic process guided by the project's Theory of Change (ToC). The ToC maps out the project's logic of intervention along the impact pathway – from activities upon which resources are spent to outputs, outcomes and ultimately impacts. The thrust of an evaluation is not only that the results have occurred but how such results can be attributed to the project's interventions.

Across its landscape of documentation, the TANIPAC project did not have schematically developed ToC. However, the project would have implicitly followed its own theory of change as depicted in Figure 1. TANIPAC project was motivated by a set of critical issues that led to design of strategic actions in terms of activities to address. Such activities resulted into outputs and then into outcomes and impacts.

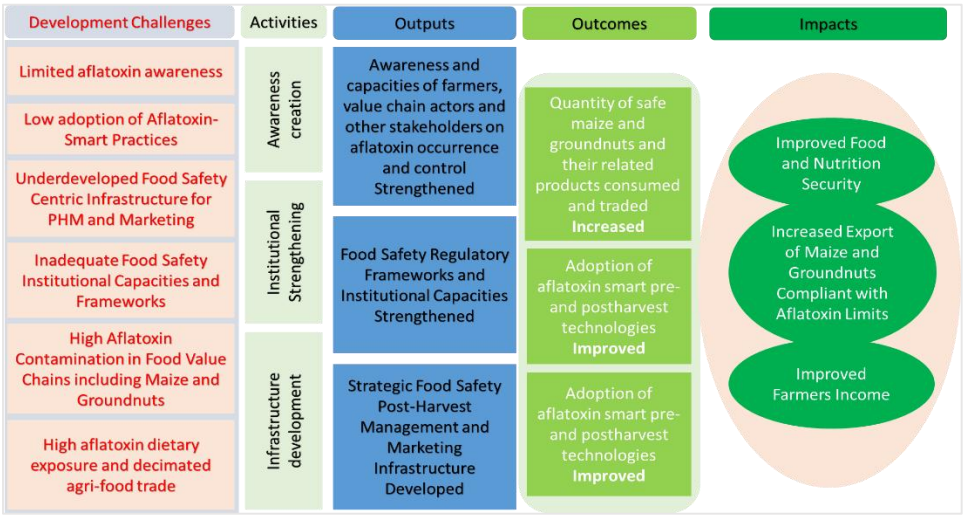


Figure 1: TANIPAC Project Theory of Change

2.3 Project Components

The project had three components as follows: i) Infrastructure development for prevention of pre- and post- harvest contamination; ii) Awareness creation and institutional strengthening; and iii) Project coordination and management.

The first component (Component 1) was focused on development of infrastructure for controlling aflatoxin contamination along the value chains of maize and groundnuts. It involves construction of quarantine facility at National Biological Control Unit (NBCU), establishment of Post-Harvest Centre of Excellence (PHCoE) for grains and Central Agricultural Reference Laboratory. Furthermore, the project has constructed fourteen (14) Storage Facilities, two (2) in Zanzibar and 12 in the Tanzania Mainland.

The second component (Component 2) was aimed at creating awareness and strengthening key food safety and agriculture R&D institutions in controlling and mitigating aflatoxin contamination. Under this component, the project also intended to create awareness of farmers, value chain actors and other stakeholders on aflatoxin occurrence, its effects on health and agri-food trade and control. The project also aimed at establishing partnership with the private sector at all segments of the value chains to support advocacy, development and transfer of appropriate technologies for aflatoxin mitigation and control.

The third component (Component 3) was designed to ensure efficient coordination and management of the project for achieving intended results. Major specific interventions envisaged under this component included management of day-to-day implementation of the project, financial management and monitoring and evaluation of results to inform adaptive management of the project.

2.5 Project cost and financing arrangements

Total project costs incurred during the five-year implementation period, including price and physical contingencies, but excluding duties and taxes, are estimated at US$ 35,016,000. The project was financed a blended financing arrangements by the Government of Tanzania, GAFSP, and the African Development Bank. GAFSP provided USD 20,000,000 on grant terms, while the AfDB provided a concessional loan of USD 12,696,000. The Government financed taxes, duties and in-kind contributions to the tune of USD 2,320,000.

2.6 Project's target area and beneficiaries

The project was implemented in ten (10) regions of maize and groundnut production in Mainland Tanzania and in Zanzibar. The 10 regions in Mainland Tanzania with intervention districts in brackets include: Dodoma (Bahi, Kondoa, Chemba, and Kongwa), Morogoro (Kilosa and Gairo), Mtwara (Nanyumbu and Newala), Ruvuma (Namtumbo), Tabora (Nzega and Urambo), Kigoma (Kibondo and Kasulu), Mwanza (Buchosa), Manyara (Babati and Kiteto), Simiyu (Itilima) and Geita (Bukombe). In Zanzibar, the two intervention districts include Kusini Unguja and Chakechake. The selected regions in Mainland Tanzania were either had incidences of aflatoxicosis outbreak in the past and/or had a higher likelihood of aflatoxin contamination. For example, Dodoma and Manyara regions had cases of human deaths associated with aflatoxicosis outbreak. Maize was produced in significant amount across the intervention regions, whereas leading groundnuts

producers were Tabora and Mtwara. In Zanzibar, production of maize and groundnuts are insignificant by growing over time.

The project targeted farmers, Value Chain Actors (VCAs) and other key stakeholders in the maize and groundnut value chains. Through targeted interventions, the project intended to directly reach and impact about 60,000 farmers; 5,000 VCAs; 120 extension and technical staff; and 400 youth. The ultimate beneficiaries of the project would be a much bigger domestic population consuming and trading Tanzanian aflatoxin-safe maize and groundnuts, including consumers in importing countries. The mitigation of aflatoxin contamination in staple foods would improve public health and promote agri-food export trade. Among the core values the project planned to embrace as to ensure inclusivity by targeting interventions tailored to impact the most vulnerable women and children through improved agriculture productivity, value addition, market access and food safety at large.

2.7 Project's Key Performance Indicators

The project's Key Performance Indicators (KPIs) for monitoring progress in achieving the Project objectives are summarized in the Results-based Logical Framework (RBLF) (Annex 1). The outcome level KPIs include: i) Percentage of aflatoxin-safe maize and groundnuts that comply with Maximum Tolerable Limit (MTL); ii) Percentage of agricultural production sold in the regional markets; iii) Percentage awareness rate on aflatoxin problem (disaggregated by sex); iv) Percentage awareness and knowledge on aflatoxin-smart pre- and post- harvest technologies and practices (disaggregated by gender); and v) Adoption rate of pre and post-harvest technologies and practices (disaggregated by gender).

Furthermore, the KPIs at output level include: i) Number of quarantine facility – National Bio-Control Unit (NBCU)– constructed and equipped; ii) Number of Post-Harvest Center of Excellence (PHCoE) constructed and equipped – entailing its centres for marketing, agro-processing and technology transfer; iii) Number of Central Agricultural Reference Laboratory (CARL) constructed and equipped; iv) Number of storage facilities constructed and equipped; v) Number of farmers reached (disaggregated by sex); vi) Number of trained extension workers from public and private institutions; vii) Number of tutors from public and private institutions trained and aflatoxin management modules developed; viii) Number youth artisans trained and incubated on metal silo fabrication business; ix) Number of hermetic bags distributed vulnerable farmers and metal silos fabricated and sold to farmers; xi) Number of regulatory frameworks developed and disseminated for aflatoxin management

Key output indicators include: i) Number of quarantine facility – National Bio-Control Unit (NBCU) constructed and equipped; ii) Number post-harvest center of excellence (PHCoE) – including it centres of marketing, agro-processing and technology transfer – constructed and equipped; iii) Number of central Agricultural Reference Laboratory (CARL) constructed and equipped, iv) Number of storage facilities constructed and equipped, v) Number of farmers reached, vi) Number of extension workers from public and private institutions, vii) Number of tutors from public and private institutions; viii) Number clusters of farmers established

Number of farmers' participation in Farmers field School or demo plots; ix) Number of youth metal artisans ; x), Number of hermetic storage bags technologies; xi) Number of

value chain actors (traders, transporters, processors and SMEs) trained; xii) Number of regulatory instruments developed and disseminated for aflatoxin management; xiii) Number of in-service staff trained/capacitated; xiv) Number of laboratory; xv), equipment procured and commissioned to regulatory and research institutions; xvi) Number of key stakeholders reached and sensitized on aflatoxin management; xvii) Number of national Aflatoxin; xvii) Communication Strategy developed and implemented; xviii) Number of awareness materials developed and distributed; xix) Number of people reached with aflatoxin messages; and xx) Number of M&E periodic reports

PART THREE
APPROACH AND METHODOLOGY

3

3.1 The Approach

End of project evaluation is basically an impact study. The impact evaluation measures the performance of the project regarding to what extent the interventions achieved intended results (outcomes and impacts). In the context of results-based M&E, the results entail outcomes and impacts that are derived from preceding inputs, activities and outputs – along the results chain (Figure 2).

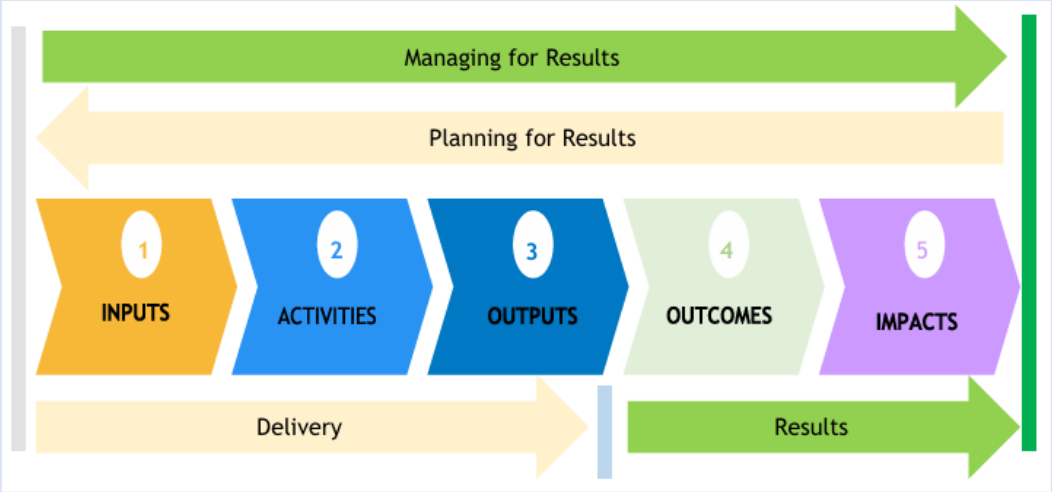


Figure 2: Impact pathway (Results Logic)

The end-line evaluation is expected to feed into the preparation of the Project Completion Report (PCR). Thus, the end-line evaluation and PCR process summarized in Figure 3.

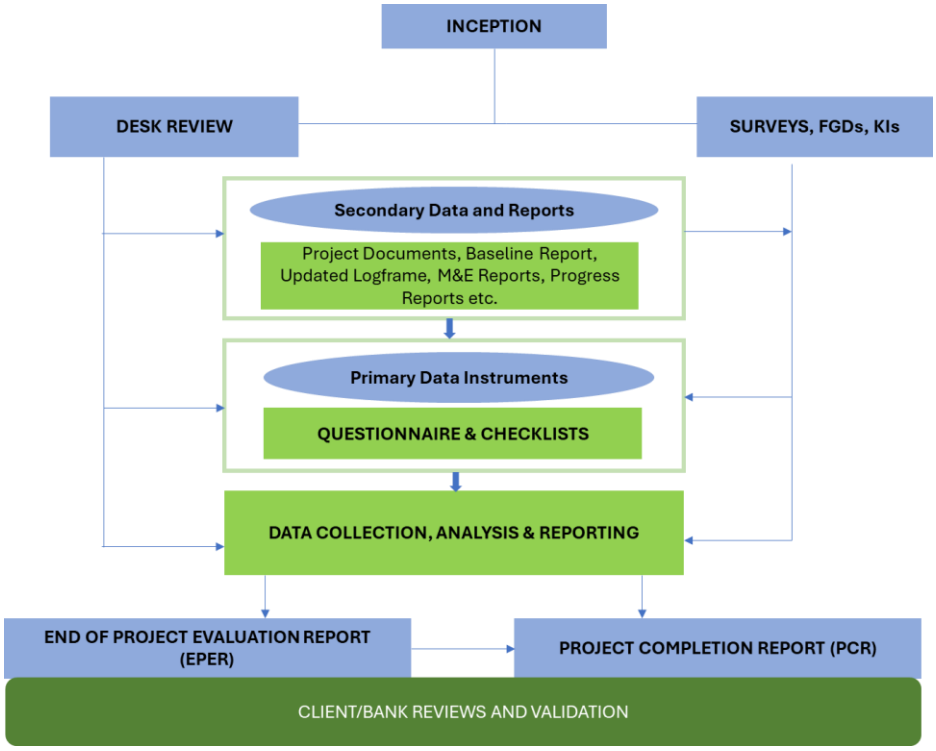


Figure 3: End of Project Evaluation and PCR Framework

The evaluation applied a mixed methods approach that integrated and triangulated three categories of qualitative and quantitative evaluations: 1) Systematic Review the Project Documents; 2) Qualitative Semi-Structured Focus Group Discussions (FGDs) and Key Informant Interviews (KIs), and 3) Quantitative Farmer Survey.

3.2 Detailed Mixed Methods Evaluations

3.2.1 Systematic Review of Project Documents

The project end-line performance evaluation involved the in-depth review of the internal documentations. The project documents reviewed were clustered into four thematic areas addressed: 1) Design and Planning, 2) Implementation Progress Monitoring, 3) Performance Evaluative Assessments, 4) Outreach Interventions, 5) Exit and Sustainability Strategy.

Project Design and Planning Reports: This entailed documents underpinning the design and planning of the project. Under this category the key documents reviewed included: 1) Project Appraisal Report (PAR), 2) Project technical background studies, 3) Project baseline report and 4) Project implementation and management guiding documents.

Project Implementation Progress Monitoring Reports: The TANIPAC project generated a wealth of reports on the implementation of project activities and tracking of progress. Thus, the key documents reviewed under this category include: 1) Project's Results-Based Logical Framework (RBLF) and List of Goods and Services (LOGS), 2) Internal activities and progress reports, and 3) Aide Memoires from the AfDB-URT Joint Supervision Missions.

Project Implementation Progress Monitoring Reports: The TANIPAC project generated a wealth of reports on the implementation of project activities and tracking of progress.

Thus, the key documents reviewed under this category include: 1) Project's Results-Based Logical Framework (RBLF) and List of Goods and Services (LOGS), 2) Internal activities and progress reports, and 3) Aide Memoires from the AfDB-URT Joint Supervision Missions.

Project Performance Evaluative Assessment Reports: Internally, the project implemented a number of systematically designed evaluative studies that produced reports reviewed under this evaluation. Such major internal evaluation reports that were reviewed under this evaluation covered include: 1) joint supervision missions culminating into Aide Memoires (2019-2024); 2) Audit reports by NAOT were reviewed to evaluate the performance of the project against achievement of planned results, public finance compliances and management of project assets as to underpin the public value for money (2020-2024); 3) *ex post* evaluation of the performance of youth artisans in the business of manufacturing of metal silos after being trained and incubated by VETA and SIDO (2024).

Project Outreach Interventions Reports: The review covered the development and implementation of the National Aflatoxin Communication Strategy (NACCS) and other public outreach strategies.

Review of Project Exit Strategy Reports: In this case, the review involved documents that tried to establish the project exit and sustainability of the strategic infrastructure developed under the project.

3.2.2 Qualitative Semi-Structured Surveys

The qualitative surveys entailed consultations and interviews covering representative officials and key informants across the selected locations in Mainland Tanzania and Zanzibar. The total consulted official and respondent key informants (165) included: Regional Secretariats (7), the District Council Management Committees (34); Farmer's Focus Group Discussions (52), project extension staff (4), trained and incubated artisans (33), and Value Chain Actors (35).

3.2.3 Quantitative Farmer Survey

The very first step in any survey is to identify the enumeration areas – representative project intervention districts. The one of the major outcomes the project intended to achieve was to improve public health through reduction of dietary exposure in the local communities. From early to mid-2024, the Tanzania Bureau of Standards (TBS) conducted a cross-sectional survey on food consumption pattern, aflatoxin contamination and dietary exposure in the project areas. The study collected and tested 1,926 samples of maize and groundnuts, and their products from 1,816 households including those trained and not trained by the project.

Based on the prevalence of aflatoxin contamination in terms of detected samples, all districts were ranked in descending order (Table 1). While ensuring representation of all the clusters, 5 districts where purposively selected taking into account variability in prevalence of aflatoxin in terms of percentage detected samples (%) and median exposure from consumption of *Ugali* (ng/KG bw/day).

The districts could be categorized into three clusters – with relatively high, medium and low aflatoxin prevalence – in terms of percentage of detectable contamination of maize

and maize products. Alongside, the median dietary exposure from the widely consumed maize product (*Ugali*) was presented. Itilima and Kilosa were selected from the cluster of districts with highest aflatoxin prevalence. From the cluster with medium prevalence, Nanyumbu and Chemba districts were chosen – whereas Kibondo represented the districts with least aflatoxin contamination rates.

Table 1: Aflatoxin Contamination in Maize and Maize Products

Districts	Samples (#)	Detected (%)	% Samples > AFB1	% Samples > AFT	Median Exp. From Ugali (ng/KG bw/day)
Itilima	101	96.04	65.35	65.35	66.70
Kilosa	90	93.33	62.22	55.56	17.30
Urambo	100	84.00	42.00	43.00	27.50
Bahi	73	82.19	31.51	21.92	5.50
Kongwa	99	76.77	19.19	12.12	3.40
Nzega	100	72.00	25.00	23.00	5.10
Newala	81	67.90	40.74	45.68	40.00
Kiteto	108	54.63	17.59	16.67	3.70
Buchosa	98	54.08	22.45	21.43	8.50
Nanyumbu	90	48.89	31.11	28.89	42.00
Chemba	96	47.92	9.38	8.33	2.40
Bukombe	99	44.44	16.16	20.20	26.60
Kasulu	100	34.00	5.00	7.00	4.10
Gairo	99	32.32	9.09	9.09	9.20
Babati	101	30.69	8.91	7.92	3.90
Kondoa	98	24.49	9.18	9.18	4.20
Namtumbo	103	16.50	1.94	1.94	3.40
Kibondo	99	8.08	0.00	1.01	13.30
Overall	1737	52.96	22.57	21.65	10.80
Trained	893	51.62	20.60	19.82	8.90
Untrained	842	54.51	24.70	23.63	13.00

Source: URT (2024)

Under each intervention district, the project worked in 10 villages. From each of the five sampled districts, one village was randomly selected. The farmer survey had a pre-determined intended sample of about 1,200 farmers – equally split into project and non-project farmers. The more or less similar baseline sample size was enough to provide for detectable statistical effects. Project category entails farmers that were enrolled in the on-farm Farmer Field Schools (FFS) and those trained by FFS lead farmers through the project's Farmer-to-Farmer (F2F) outreach model. Non-project farmers were those in same village that were anyhow not directly reached by the project. For project farmers, the entry point was to identify the FFS lead farmers that afterward led enumerators to other farmers they reached through the F2F extension. It was a challenge for the FFS lead farmers to present all farmers – nine per lead farmer - they earlier claimed and presented to the project to have reached. In Zanzibar, maize and groundnuts are not widely grown – and very few grow the crops at a substance scale and harvest maize while grain for home

consumption. At the end, the evaluation reached 69% of the overall target sample, including 53% and 85% for project and non-project sample respondents, respectively (Table 2).

Table 2: Farmers Sampling Planning and Achievement

District	Planned Sample			Achieved Sample		
	End-line Sample	Project	Non-Project	End-line Sample	Project	Non-Project
Kibondo	224	112	112	202	79	123
Itilima	259	130	130	184	70	114
Chemba	210	105	105	174	56	118
Kilosa	381	191	191	152	84	68
Nanyumbu	126	63	63	118	29	89
Total	**1,200**	**601**	**601**	**830**	**318**	**512**

Source: End of Project Evaluation

Expectedly, the pertinent farm-level impact of the project would be through the effect of interventions on the adoption of aflatoxin-smart pre- and post- harvest Good Agricultural Practices (GAPs). The project's baseline survey (2020) established a design framework for counterfactual evaluation by earmarking treatment and control villages across the intervention districts. This framework was not harnessed during the implementation of the project as the project interventions were scaled into villages initially identified as control. Also, the project embarked on mass media as its public outreach strategy, hence leading to contamination in the neighbouring control (non-treatment) villages. In this context, the only left option for counterfactual analysis was to apply econometric approach of propensity score matching technique on cross-sectional evaluation data from the farmer survey.

First, the GAPs Adoption Index (GAI) was developed as a composite measure of uptake of various practices. Across each of an array of GAPs, a respondent farmer was asked whether he never applies the practice (0), and if he does, is it rare (1) or often (2). For each farmer, the cardinal sum of scores of each GAP cannot exceed a maximum of 3. This will measure the intensity and cardinal measure of adoption of GAPs. Then, through Propensity Score Matching (PSM) the level adoption measured through GAI was compared between project and non-project farmers – hence ironing out the effect of training on adoption of GAPs. Statistically, the PSM matches farmers between two categories "treated" and "untreated" based on pre-adoption covariates. Following propensity score matching, a linear regression was conducted to estimate the effect of treatment on the outcome variable, GAI.

PART FOUR
KEY FINDINGS AND SYNTHESIS FROM REVIEW OF PROJECT DOCUMENTS

4

4.0 An Overview

The project end-line performance evaluation involved the in-depth review of the internal documentations. The project documents reviewed were clustered into four thematic areas addressed: 1) Design and Planning, 2) Implementation Progress Monitoring, 3) Performance Evaluative Assessments, 4) Outreach Interventions, 5) Exit and Sustainability Strategy.

4.1 Project Design and Planning Reports

This entailed documents underpinning the design and planning of the project. Under this category the key documents reviewed included: 1) Project Appraisal Report (PAR), 2) Project technical background studies, 3) Project baseline report and 4) Project implementation and management guiding documents. The content reviews and syntheses of the project's internal documentary landscape are hereunder presented

4.1.1 Project Appraisal Report (PAR)

The PAR[7] underscored the development rationale of the TANIPAC project that aligned with the country's development priorities with agriculture as the key growth sector ensuring: 1) food and nutrition security, 2) income generation and 3) increased agricultural exports. The project also aligned with the AfDB's CSP 2016-2020 in the development transformation areas of infrastructure development and strengthening institutions and governance of the economy including the growth sectors such as agriculture. The project's development premise underscored the urgency of addressing aflatoxin problem as to enhance food and nutrition security, promote competitive agri-food export trade and safeguard public health.

During its implementation, the project sustained the initial ideas addressed in the PAR. Changes made during the implementation, mainly at output level, was part of adaptive management as were still in line with delivery of the intended results. For instance, planned intervention to support crop and weather monitoring and early warning system was dropped. However, some outputs would have been relevant to retain but were dropped or not explicitly addressed during implementation. Such outputs include establishing database systems for collecting, analysing and reporting on post-harvest

[7] PAR (2017). Tanzania Initiative for Preventing Aflatoxin Contamination (TANIPAC). Project Appraisal Report (PAR), September 2017.

losses, and strong engagement with private sector for aflatoxin monitoring, control and reporting – and backward and forward linkages in the target food value chains. The changes effected were agreed upon between the Executing Agency (EA), and the Bank.

4.1.2 Project Technical Background Studies

An empirical evidence base is critical to inform an effective design and implementation of any project. Two situation analyses reports (Kimanya et al. 2016[8] and RoGZ 2021[9]) and the baseline survey report (URT 2020[10]) formed the evidence base for TANIPAC project. Such reports informed the development problem and rationale, and provided baseline information as the basis of defining and setting targets, and key performance indicators for benchmarking project performance.

The study by Kimanya et al. (2016) provided an empirical evidence base that informed the project development objective and rationale. The study entailed assessment of the level of aflatoxin contamination, knowledge and awareness, and control of aflatoxin in maize and groundnuts value chains. Kimanya et al. (2016) established that awareness on aflatoxin and control measures were low (20%). The knowledge and adoption of aflatoxin smart GAPs were limited involving only around a third of respondents. The health impacts due to aflatoxin was estimated at about 3,334 cases of hepatocellular carcinoma (HCC) resulting with 95% mortality (3,167 persons) per year. Dietary exposures from consumption of maize and groundnuts based foods ranged from 5.0 – 10,926 ng/kg-bw/day – whatsoever, exceeding the minimum tolerable limit of 0.04 ng/kg-bw/day. Apparently, over 80% of infants and young children in Iringa, Kilimanjaro and Tabora were found to have aflatoxin in their blood. Adverse health impacts related with dietary aflatoxin exposure was estimated at Disability Adjusted Life Years of about 96,686 DALYs. Such aflatoxin related economic impacts related with illness and loss of life was estimated in the range of USD 6 to USD 264 million per year.

The situation analysis of aflatoxin problem in Zanzibar was commissioned to the consultant in 2021 (RGoZ 2021[11]) - two years after the TANIPAC project started. It was realized that the project cannot be fully realized in Zanzibar without a clear knowledge of the aflatoxin situation in the archipelago and formulation of interventions based on the local context. Arguably, while it provided basic information on the situation on the aflatoxin problem in Zanzibar, it was not timely to radically shape strategic interventions tailored to the Zanzibar situation. Zanzibar is a net importer of grains including maize and groundnuts. It is estimated that only 15% and 24% of maize and groundnuts samples tested for aflatoxin are sourced from local production. With an exception of boarding schools and public military camps, maize is not a major staple food in Zanzibar.

The situation analysis in Zanzibar found that aflatoxin contamination was prevalent in spices particularly black pepper, turmeric, ginger and chilli. For instance, black pepper indicated high level of aflatoxin contamination detected in 88% of the samples with median concentration of 17.3 ppb. Seemingly, after two years of project implementation, there was a limited possibility to accommodate spices in the project interventions. The

[8] Kimanya et al. 2016. Country and Economic Assessment for Aflatoxin Contamination and Control in Tanzania: A supplement to the 2012 Report. URT & African Union Commission – PACA.
[9] RGoZ (2021). Situation Analysis of Aflatoxin Problem in Zanzibar. TANIPAC
[10] URT 2020. Baseline Survey Report. TANIPAC.
[11] RGoZ (2021). Situation Analysis of Aflatoxin Problem in Zanzibar. TANIPAC

study found that awareness on aflatoxin problem among farmers and other stakeholders was low – estimated at only 25% being aware of the problem. However, the study established that majority of food business operators were already undertaking good practices such as sorting and discarding moulded grains – but not intentionally to mitigate aflatoxin contamination. Due to limited knowledge of the aflatoxin problem and its health effects in the food and feed chains, moulded maize grains and bran were still widely used as poultry feeds.

Despite of the local contexts on reliance on importation and low but steadily growing consumption of maize and groundnuts, dietary aflatoxin exposure in Zanzibar was apparent. On average, Zanzibaris were likely to be exposed to aflatoxins at 93.95 ng/kg-bw/day. Such level of exposure posed a serious health with economic implications through adverse impacts of illness and mortality. The situation analysis established that, there are about 45 new cases of aflatoxin-induced hepatocellular carcinoma (HCC) in Zanzibar associated with 95% probable mortality rate (43 deaths) – resulting into a loss of 1,698 Disability-Adjusted Life Years (DALYs). The overall economic health impact of aflatoxin contamination of, mainly imported maize and groundnuts, was estimated to exceed TZS 33 billion. This is the money currently spent on importation of maize and groundnuts that can save annually, if the aflatoxin problem is effectively mitigated.

4.1.3 Project Baseline Study

The baseline survey (URT 2020[12]) covered 4,137 households from 18 and 2 districts in Tanzania Mainland and Zanzibar, respectively. The baseline survey established empirical baseline information across all key results-based performance indicators – at impact, outcomes and outputs. At the impact level, baselines for three indicators were established, with 2019 as a performance benchmarking reference year: 1) Export value of aflatoxin standards compliant maize (USD 32.3 million) and groundnuts (4.7 million); 2) Food Self-Sufficiency Ratio (FSSR) relating the domestic food production to the requirement (124); 3) Cases of aflatoxin-related Hepatocellular Carcinoma (HCC) liver cancer (3,334). Moreover, the baseline information at outcomes and outputs indicators were accordingly modified as interventions leading to such results were adaptively adjusted during the implementation.

In the course of project implementation, the impact-level KPIs on exports of aflatoxin safety compliant of the target value chains and FSSR were maintained, but with slight changes and inclusion of additional indicators. However, the impact indicator on aflatoxin related illness (liver cancer cases) was not addressed. It was acknowledged from the baseline survey report itself that the capacity to assess the exposure and effects of aflatoxins in humans using biomarker assays was not available at health facilities and food safety regulatory institutions in Tanzania.

The biomarker-based exposure estimation is preferred to food-based because, the former offers more robust epidemiological interpretations of individual exposure levels from all possible food sources of aflatoxins. Even to date, despite of having the expertise, the TBS still lacks the equipment needed to undertake the aflatoxins biomarker analysis. In this regard, the PCT did not manage to design a clinical/epidemiological study to

[12] URT 2020. Baseline Survey Report. TANIPAC.

monitor liver cancer in some designated health facilities particularly in the project intervention areas.

4.1.4 Project Implementation and Management Guiding Documents

To facilitate and guide its implementation, the TANIPAC project developed a number of key guiding documents and frameworks – including Project Results-based Logical Framework (PRBF), undated LOGS, the implementation and accounting manuals, Environmental and Social Management Plans (ESMPs) of developed infrastructure, national gender mainstreaming guideline, and National Aflatoxin Communication Strategy (NACS). Apart from the PRBF and LOGS that were developed from the very beginning of the project implementation, most of other guiding documents were a bit delayed – between 2021 and 2023. For example, the gender mainstreaming guideline was developed in August 2023. Besides the roles implications, isolated studies show that more women and children are affected by eating food contaminated with aflatoxin (URT 2023)[13]. Such delays were persistently reckoned in the aide memoires of the joint missions. Having such guiding documents ready for use from the very start of the project interventions was indispensable. However, the project management and coordination were run effectively and efficiently afterwards as the PCT acclimatized with the project.

4.2 Project Implementation Progress Monitoring Reports

The TANIPAC project generated a wealth of reports on the implementation of project activities and tracking of progress. Thus, the key documents reviewed under this category include: 1) Project's Results-Based Logical Framework (RBLF) and List of Goods and Services (LOGS), 2) Internal activities and progress reports, and 3) Aide Memoires from the AfDB-URT Joint Supervision Missions

4.2.1 Results-Based Logical Framework and List of Goods and Services

The Results-Based Logical Framework (RBLF) and the List of Goods and Services (LOGS) very foundational documents guiding the objectively verifiable rollout of project activities and tracking progress and investments. Operationally, the LOGS is actually the financial input into the results chain. The RBLF is the basic framework for an effective planning and managing projects for results. The RBLF that was part of the PAR was improved overtime in the course of project implementation. The costed activities, goods and services as inputs into the delivery of outputs were envisaged in updated List of Goods and Services (LOGS). The major revision of the activities and services was done and approved by the Bank in February 2021 after the joint progress review mission. The revisions of LOGS and budget reallocations were approved by the Bank.

4.2.2 Internal Activities and Progress Monitoring Reports

Project Progress Reporting: An Overview

The systematic internal progress monitoring reporting was done quarterly and bi-annually in fulfilment of the Bank's and GAFSP's reporting frameworks, respectively. However, the project have had *ad hoc* monitoring and reporting on the planning, implementation and outputs of specific activities. Such comprehensive reporting system provides a richer landscape of activities and progress monitoring documents that

[13] URT (2023). National gender mainstreaming guideline for aflatoxin control in food value chain. TANIPAC Report, August, 2023.

informed this end-line evaluation and the project performance in general. In the quest to keep the review of such richer landscape of information concise and non-repetitive, this end-line evaluation was focused on the review bi-annual progress reports – under the auspices of the GAFSP reporting framework - that integrate progress made across the four quarters each year. The holding assumption was that information from other intermittent reports from monitoring of activities and quarterly progress were already integrated bi-annual reports. The quarterly reports were submitted and approved by the AfDB as the project supervision entity.

The GAFSP bi-annual reporting template included some other higher-level assessment of the impacts of the project such as nutrition, climate change and job creation. With respect such high-level results, the review addressed an overview on implementation progress made and results achieved; contribution and implications of the interventions on nutrition; climate smart agriculture and job creation; and overall rating of the project performance.

Contribution to Nutrition: The human nutrition aspects of interest stipulated in the reporting template that were relevant in the context of TANIPAC entailed: bio-fortification, promotion of nutrient dense foods, and nutrition education. The reporting of the progress did not contemplate any direct nutritional impacts and implications of the project interventions. However, mitigation and control of aflatoxin enhances food safety which contribute to positive nutritional and health outcomes. For example, chronic dietary exposure to aflatoxin is reported to cause undesirable nutritional outcomes such as child stunting. Both maize and groundnuts that are prone to aflatoxin contamination are major ingredients in the manufacturing of compounded infant nutritious flours.

Contribution to Climate Action: The context of climate change and CSA was not explicitly articulated in the project monitoring and reporting system. However, the project would have objectively underlined climate change smartness in the pre- and post- harvest GAPs promoted to control aflatoxin contamination. These would have included, among others, the promotion of climate resilient seeds, promote the use of agro-climate data and weather forecasts information, soil-water conservation, use of cover crop and mulch, and abatement of high-emission practices such as slash-burn practices and burning of crop residues after harvest.

Contribution to Job Creation: Some interventions under the TANIPAC project created primary and secondary jobs. During the construction of the infrastructure, youth and women were directly employed at the construction sites. The NFRA as a frontline operator of the community-level storage facilities and PHCoE is creating seasonal jobs to youth and women undertaking activities of drying, cleaning, bagging and staking of grains. Another project's pathway for job creation was through the vocational training to 420 youth artisans on fabrication of metal silos for grain storage that was undertaken in collaboration with VETA and SIDO. After manufacturing training, the youth artisans were incubated on metal silos fabrication, agribusiness entrepreneurship and each of them was equipped with a starter-pack of welding machinery tools.

Review of the Project Bi-Annual Progress in 2019 - 2025

The review of bi-annual progress reports provides evidential insights into the gradual performance of the project in relation to planned and ad hoc interventions across the project components.

Project Management and Coordination

Throughout the entire period of project implementation (2019-2025), the project managed to successfully pursue routine, periodic and *ad hoc* management and coordination activities: administration; preparation of guiding documents (manuals and plans); execution of planned interventions; *ad hoc* and periodic monitoring and reporting on implementation progress; financial management and reporting; and managing procurement of services and supplies contracts.

Throughout the project implementation, the PCU sustained engagements and collaboration with stakeholders, particularly partner implementing organizations in both Mainland Tanzania and Zanzibar. Among other administrative tasks, administration of contracts, performance progress monitoring and reporting were fulfilled.

Reviewed progress reports that were approved by the supervising Bank (AfDB) and audit reports by the CAG through the NAOT indicate that financial management – of both project finances and assets – was up to acceptable standards. The audit quarries by the CAG were addressed.

Towards the finishing line, the project is effecting procurement of a variety of laboratory equipment, furniture and consultancy services towards completion end of the project in May 2025. The PCT continued to oversee the management and coordination of the project. The PCT was optimistic of managing to fully accomplish planned interventions by end of the project. The second bi-annual reporting of 2024 indicates that the overall performance of the project stood at 96.4%. According to the expenditure plan, over 99% of the total project funds was allocated. As of February 2025, the implementation of the project reached at an average of 98.5%. Implementation of activities under component two on awareness creation and Institutional Strengthening has been completed to 99.9%.

Apparently, in addressing the delivery lags in the development of strategic infrastructure, by February 2025 the project has managed to hit the an impressive level of delivery (98.7%) – with 20 contracts for works completed and the remaining two contracts advancing to completion by March 2025. The component for project coordination and management is satisfactorily implemented as planned gauged at 97.1% completion.

Awareness Creation and Institutional Strengthening

This was the most comprehensive part of the project results area. Thus, for the sake of organizing a wealth of reviewed information into a rather concise and readable set up, the discussion is organized into two levels – 1) National level Interventions, and 2) Sub-national and Local Level Interventions.

National Level Interventions

The very entry point to creating public awareness on the aflatoxin problem started with engagements with national level stakeholders – policy-makers, political members of parliament representing various constituencies and international development organizations in the global food systems. The launch of the project in March 2019 was attended by representative Members of Parliament (MPs), international organizations with vested interest in addressing aflatoxin in Africa – FAO, WFP and the then Partnership for Aflatoxin Control in Africa (PACA) of the AU. Awareness of the project by the MPs

facilitated project's policy outreach and advocacy for change across constituencies in the country.

From the its launch until the second year (2020), the project concentrated on introducing the project and creating awareness to different stakeholders on the aflatoxin problem regarding its occurrence, and negative effects on human health and agri-food trade. From second half 2020 until end of 2022, the project's awareness creation interventions were halted by the outbreak of COVID-19 pandemic. This was due to restrictions on public gatherings aimed at curbing the spread of the virus. As the nation continued to acclimatize with COVID-19 pandemic and taking protective measures such as wearing masks and sanitizing hands, the project continued to implement interventions aimed at creating awareness on aflatoxin. In the second half of 2021, the project already surpassed the targeted number of policy-makers to reach by 119%, by reaching a cumulative total of 1,388 policy-makers, politicians and leaders. These included members of parliament, national leaders, councillors and members of the House of Representative in Zanzibar.

Over the years of project implementation (2019-2025), the project participated in national level outreach events – *NaneNane* and World Food Day – to enhance public awareness on aflatoxin, showcase project initiatives for prevention and control of aflatoxin, and disseminate outreach material (e.g., brochures, fliers, leaflets, banners, and T-shirts). While in the Mainland Tanzania, women comprise around half of the visitors to the project pavilion, in Zanzibar less than a quarter of the visitors were women. In Zanzibar, the religious culture may limit involvement of women in open public events. The scope of public awareness was expanded in the first half 2020 after the project embarked on public mass outreach through radios and TV programs. In order to widen the public outreach on aflatoxin, the project trained 217 journalists from different media houses from Mainland Tanzania (117) and Zanzibar (100). Female journalists trained accounted for 44% of the trained journalists. The training of journalists involved creating awareness on aflatoxin occurrence, effects and control for informed public messaging.

On the perspective of institutional strengthening, the project fostered technical and human capacities of public food safety regulatory and R&D institutions in the Mainland Tanzania and Zanzibar. Such institutions included the Tanzania Bureau of Standards; Tanzania Agriculture Research Institute (TARI); Zanzibar Bureau of Standards (ZBS); Zanzibar Food and Drug Authority (ZFDA) and Zanzibar Agriculture Research Institute (ZARI). The project strengthened the laboratory testing capacities through provision of modern equipment for testing aflatoxin and a range of other food safety parameters. TARI received 2 investigator machines; ZARI received an Investigator Machine; TBS received HPLC and LC-MS/MS and ZFDA was given HPLC. The deployment of equipment was effected alongside training of the laboratory technicians and technical experts at recipient institutions on developing aflatoxin testing protocols and operating the equipment. A total of 42 technicians and experts (45% female personnel) were trained on the use of the supplied equipment.

The project built the human capacities within the Ministries responsible for agriculture in the Mainland and Zanzibar by running short and long training courses for staff. Thematic training workshops and short courses were aimed at updating and retooling extension staff on Aflatoxin and its control measures. The project also rolled out a post-graduate scholarship that mainly enrolled early carrier scientists from the public R&D and some

fresh graduates to pursue Masters and PhDs through the project support. A range of broader research topics on aflatoxin were advertised in tandem with the scholarships and candidates in the first place were required to apply on those topics.

In the second half of 2020, the project accomplished the process of selecting 30 post-graduate candidates (22 Masters and 8 PhDs) for an award of the TANIPAC scholarships. By the end of 2021, the project awarded 30 post-graduate scholarships (26% female) for Masters (22) and PhDs (8). Of the 30 candidates, 18 were registered during the 2020/2021 academic year, 10 were enrolled in the 2021/2022 academic year and 2 postponed studies due to different reasons. In the financial year 2024/2025 the project continued to support 21 on-going students pursuing PhD (5) and Masters (16) at Local Universities. As of February 2025, seven (7) students have graduated. The remaining students are anticipated to graduate before the closure of the project in May 2025.

During the second half of 2019 to first half of 2020, the project supported the development and integration of aflatoxin modules in the curricula of the tertiary agriculture (MATIs) and livestock (LITA) training institutes. These instates train agriculture and livestock extension graduates at certificate and diploma levels. This initiative involved aflatoxin awareness rising and training to tutors from those institutes.

Furthermore, the project supported strengthening of regulatory frameworks for aflatoxin control and enforcing food safety in general – including by-laws for 18 LGAs, development of 2 regulations for aflatoxin control in Zanzibar and formulation of standards and codes of practices for maize and groundnuts at the TBS in Mainland Tanzania. Moreover, for ensuring sustainability and inclusivity, the project supported development gender mainstreaming guideline for the agriculture sector during the second half of 2022.

Through its adaptive management approach, the project also addressed pertinent institutional support issues that emerged over the course of project implementation. During the second reporting half of 2022, stakeholders requested the project to support border posts with aflatoxin screening kits. After approval by the Bank, the project procured the equipment – 25 kits for 11 Plant Health Services (PHS) border posts and 11 storage facilities. During the second half of 2023, the project trained a total of 73 participants from 25 JKT/JKU military camps extension officers and enrolled volunteer youth aflatoxin-smart GAPs. JKT in Mainland Tanzania and JKU in Zanzibar are the national services facilities involved in agriculture and also enrolled youth.

Sub-national and Local Level Interventions

Major interventions on awareness creation at the subnational and local level started from first half of 2020. However, prior engagements with LGAs that involved entering into mutual agreements through MoUs created a collaborative environment for smoother project interventions. With farmers, the project started awareness creation and training on post-harvest management for aflatoxin control. Pre-harvest interventions required the project to have accomplished training and retooling extension staff and establishment of Farmer Field Schools (FFS) for on-farm demonstration of aflatoxin-smart GAPs.

During the first half of 2020, the project trained 1,400 farmers in the project districts on aflatoxin occurrence, associated health effects and best Post-Harvest Management

(PHM) for controlling the problem. Training of farmers on PHM practices involved demonstration of the use and deployment of technologies – drying tarpaulins, dry-cards for moisture testing and hermetic storage bags. Parallel to the trainings, some post-harvest management technologies, inputs and 36,221 knowledge communication products were promoted and distributed to farmers (Figure 4): Aflasafe (317 two-KG packs), dry-cards for moisture check (4,142), drying tarpaulin (438), hermetic bags (4,317), hand maize shellers (3,417), posters (22,745) and simplified training guides (781). Alongside PHM technologies, the use of aflasafe bio-control technology was also introduced and promoted – including distribution of free starter packs. Training of farmers Awareness creation and training of farmers on post-harvest involved other stakeholders – including 61 extension workers, and students and teachers from 10 secondary school students. The project also reached out the general public through nation-wide and local FM radios and TV stations.

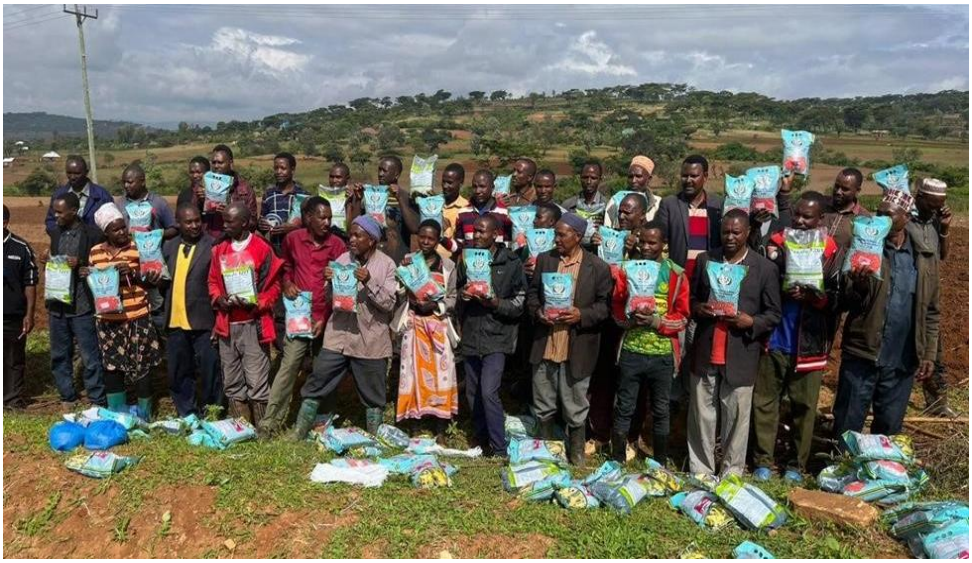


Figure 4: Farmers after receiving agro-inputs in Ololimo Village, Kondoa DC

Source: Courtesy, TANIPAC Project

Towards end of 2020, the project carried out the assessment on the use of promoted aflasafe technology. Despite of free hand-out of the aflasafe technology to entice its use, the technology was not used in 39% of recipient LGAs mainly due to delayed delivery, while 50% did not use the technology due drought. Availability of aflasafe technology has remained problematic and the manufacturer has not scaled production and last mile distribution. The farm-level benefit of aflasafe can be optimized with bundling the technology with GAPs. The manufacturer (Agro-Z) felt that sensitization by the Government has not created and effective demand for the technology at the farm-level. Increased farm-level investment in aflatoxin-smart technologies such as aflasafe might require innovative and tailored certification and traceability of aflatoxin safe food produce in the market.

Under the project institutional collaborative arrangements, TBS was mandated to train business actors in the maize and groundnuts value chains. During the second half of

2020, the TBS conducted a survey of VCAs to establish level of aflatoxin awareness, knowledge and capacity gaps for designing a tailored training programme URT 2020[14]). The study found out that majority of the respondent VCAs (86%) were not aware and knowledgeable of the problem or have just heard about the aflatoxin problem. Of those who were aware of aflatoxin 49% knew about negative health effects associated with aflatoxin. Only 32% of the VCAs disposed mouldy grains, but more than half (68%) handled faulted grains still in unsafe ways by either feeding to animals (30%), de-hulling for human consumption (20%), local brewing (19%), or selling at a discounted price (17%).

Following the training needs assessment, during the second half of 2021, the TBS trained a total of 600 VCAs (54% women) in four districts (Kiteto, Kongwa, Gairo and Kilosa) were trained on aflatoxin occurrence, effects and control. Trained VCAs by category included 414 traders (69%), 90 processors (15%), 47 transporters (7.8%) and 9 SMEs (1.5%). In Zanzibar, 100 of the same categories of VCAs were trained – with women accounting for 40% of all trained agri-preneurs. This was equivalent to the 14% project performance against the project target of training 5,000 VCAs. In the first half of 2022, a total of 4,400 VCAs were trained on aflatoxin mitigation measures in Tanzania Mainland (4,300) and Zanzibar (100). In addition to the 600 VCAs trained previously, the overall target of training 5,000 VCAs was reached.

Under the institutional arrangements within the project, VETA and SIDO were mandated to train and incubate youth artisans from the project intervention districts – on the manufacturing business of metal grain storage mini-silos for grains. This endeavour was aimed at making the metal silo technology available and accessible to farmers, including also creating jobs to youth while supporting transformation of the food system. Towards end of 2021, VETA carried out a study (URT 2021[15]) covering a range of 961 stakeholders in the grain industry – including youth artisans already in metal works welding business, farmers, extension staff and stockists. The study was intended to assess the level of awareness, understanding and usage of metal silos and determine skill gaps and mismatch on metal silos fabrication in Tanzania Mainland and Zanzibar. The study found that more than a quarter of respondent youth artisans (76%) had practical skills on metal works mainly gained through apprenticeships – only 24% got skills through formal training in colleges. Farmers produced between 10 and 100 bags, with only 4% using improved metal silos for grain storage. In the first half of 2022, VETA in collaboration with VTA in Zanzibar, enrolled a total of 420 artisans for vocational training on metal silos fabrication technology. Of the enrolled artisans, only three were women.

From the second half of 2021 onwards until 2024, the project embarked on scaling of aflatoxin mitigation and control practices at farm/household level. Training of farmers on pre-harvest aflatoxin-smart GAPs was preceded with training of extension staff in the districts. In the second half of 2021, the project trained 491 extension staff, making a cumulative total of staff trained until then far 1,351 – which is 201% of the overall target. By end of 2021, the project engaged with 18 LGAs through signed MoUs for training of 60,000 farmers (3000 per district) during the upcoming year (2022).

[14] URT (2020). Assessment of post-harvest knowledge gap and training needs for management of aflatoxin in maize and groundnuts in Tanzania mainland. TANIPAC Report.
[15] VETA (2021). Training need assessment report on metal silo fabrication. TANIPAC Project, July 2021.

During the second half of 2022, in collaboration with LGAs and its extension system, the project established 180 FFS for training farmers on best pre-harvest for aflatoxin control (Figure 4). Through established FFS, the project trained 5,400 lead farmers on GAPs including aflasafe bio-control technology (see Figure 5). Out of the total number of farmers trained, 2,018 (38%) were women. The project outreach strategy to reach the target of 60,000 involved each of the lead farmer trained through FFS to reach other 9 farmers through farmer-to-farmer outreach. Towards the end of 2022, project reported to have trained 54,000 farmers (99% of the target) including lead farmers and farmers reached through the farmer-to-farmer outreach.

Figure 4: Farmers Applying Aflasafe at one of the FFS plot in the project Area

Courtesy: TANIPAC Project

The project continued to train farmers on PHM for aflatoxin control. From mid towards end of 2022, the project trained 56,440 farmers on best practices in PHM – of which 500 farmers were from Zanzibar. This increased a cumulative total number of farmers trained by end of 2022 to 61,910 farmers were trained on best post-harvest practices for aflatoxin control. Women and youth accounted for 39 and 60% of the farmers trained, respectively.

Towards the end of 2024, the project undertook a comprehensive farmers' field training program from 3rd – 17 December 2023 and 25th -31st January 2024 (URT 2024[16]). During the training, 180 villages were covered with 5,403 beneficiaries reached, equivalent to 100.1% of the targeted 5,400 farmers. In terms of gender, about 3,329 farmers were males (62%) and 2,074 (38%) were females. Age-wise, 1,786 farmers (33%) were adults between 18 – 39 years, whereas 2,870 (53%) were adults between 40 – 55 years, and 739 (14%) were elderly people above 56years. Each famer was facilitated with agro-inputs

[16] URT (2024). Training on aflatoxin smart gap for aflatoxin management to 180 farmer's cluster through demonstration plots, TANIPAC Project, Feb 2024

(improved seed, aflasafe and pesticide) for using on their own demo-plot (baby-plot) for self-practice and to use the same to train other fellow 10 famers not involved in the cluster training, expecting to reach 3000 famers in each LGAs. Each LGAs had 10 clusters consisting of 30 farmers selected from the chosen village, making the total number to be 300 per district council. One the lessons drawn by the project was that demonstration needed to be provided at least for three seasons at a specific location instead of once – as farmers tends to learn slowly and adopting the practices and technologies as they see and feel the benefit of participation over time.

Apart from awareness creation and training on pre- and post- harvesting good practices for aflatoxin control among farmers and value chain actors, it was imperative to strengthen the regulatory frameworks through creation and institutionalization of by-laws. From second half of 2021 to first half of 2022, the project supported by-laws development and institutionalization process for 18 LGAs in the Mainland Tanzania.

Development of strategic infrastructure and facilities

During the second half of 2019, only the procurement process of contractors for design and construction of infrastructure and facilities was initiated. In 2020, the project continued to advance the plans made and activities started in the preceding year. In the first half of 2020, the development infrastructure was still at the design stage – with accomplishment ranging between 15-85% for 14 storage, quarantine and PHCoE facilities. The design stage is followed by another procurement process of contractors for the actual construction.

During the second half of 2020, the project was already advancing in procurement process of engaging civil contractors for the quarantine and warehouse, achieving delivery by 60 and 30%, respectively. The design of the PHCoE and CARL was achieved by 50%. The Environmental Impact Assessment (EIA) for infrastructures development was conducted and reports were submitted to the National Environmental Management Council (NEMC) for approval.

Regarding the development of infrastructure, the construction of the quarantine facility reached 52%. Construction of 14 storage facilities ranged between 16% and 55%. The evaluation of bidding contractors for construction of the PHCoE and CARL was completed and the reports have been submitted to the Ministerial Tender Board and y the Bank for review and approval.

In the reporting first half of 2022, the project made significant progress in the development of infrastructure with accomplished construction of 14 warehouses averaging at 71%, and that of quarantine facility reaching 80%. The PHCoE construction was only attained by 9% which is below the planned target of 12% that was expected by that time. Procurement of a contractor for the CARL was being finalized through the approval process by the URT and the Bank.

During the second half of 2022, the project finalized ESIA for all 17 infrastructures. A total of 15 construction projects were registered with NEMC and two with ZEMA. The project trained 80 stakeholders on the Environmental, Social, Health and Safety (ESH&S) issues related to the development and operations of project infrastructure. The stakeholders trained include the Project Support Officers (PSO), District Environmental Officers

(DEMO), and Consultants and Contractors. The project conducted monthly ESH&S monitoring visits to the sites with on-going construction works.

During the second half of 2022, the project advanced in the construction of infrastructure attaining an average of 85% for 14 storage warehouses, 95% for the quarantine facility, and 45% for the PHCoE.

Between January and June 2023, the project made tangible cumulative progress in the construction of strategic infrastructure. Construction works for 20 infrastructures 11 have been completed and construction works of 9 facilities were at different stages: quarantine facility (99%), 14 storage facilities (90%), and PHCoE (75%). In the second half of 2022, construction and renovation of 16 out of 20 facilities was attained by 100%. Progress in the construction of the CARL which was at 20% in the first half improved to 50% towards the end of 2022.

Lessons Learnt in the Delivery of Project Components

The awareness creation and outreach involved strategic engagements with multiple stakeholders at national, subnational and local grassroots levels. The spectrum of stakeholders engaged at the national level included policy-makers; management and technocrats in key agriculture sector line Ministries, Departments and Agencies (MDAs); and politicians. From the official launch to initial awareness creation interventions, the project seems to have had started with the right footing and momentum by engaging with high-level policy-makers, international organizations and the general public. From the beginning the project formed the collaborative action alliance with the right public organizations for bringing about intended changes.

The successful implementation of banked on collaboration with various public institutions, particularly TBS, VETA and SIDO. The VETA and SIDO collaborated closely with their counterpart VTA and SMIDA in the planning and execution of the youth artisan training and incubation program. However, collaboration between TBS and its counterpart ZBS and ZBS in Zanzibar was inadequate. Stronger joint planning and implementation of project activities between the food safety and standards regulators on both sides of the URT would have enhanced the effectiveness of the project. Such cooperation would have been explicitly stipulated in the MoU.

Apparently, progress pace of designing and procuring of contractors for construction of infrastructure was generally sluggish. This was due to a number of reasons, particularly, increased lead time of up to three months, for accessing funds due to an introduction of a new D-fund management system by the MoF. The outbreak of COVID-19 pandemic affected the implementation of the project, particularly interventions on awareness creation. However, the project, adjusted by capitalizing on the use of media and virtual technology to carry on implementation. Overtime the project adjusted by lodging applications for funds ahead of time and making close follow-ups to fast-track funding approvals in the government system.

At the subnational level, the project engaged and worked closely with the Regional Secretariats (RSs), LGAs and private sector particularly VCAs in the secondary markets and service providers such as artisans in manufacturing. At the local grassroots level the project engaged with the very beneficiary of the project – the farmers, community leaders and VCAs in the primary markets. The project also engaged with the media and influential

artists for effective and inclusive communication and outreach. Such broad-based strategic engagements are pertinent to bring intended changes in behaviour and practice that are needed to address aflatoxin and food safety at large.

The first half of 2021 was grappled by the disruptive COVID-19 pandemic. However, during the pandemic, the PCT continued to manage but at halted pace. However, awareness creation activities that required public mass gatherings were stopped during the peak of COVID-19. Since the second bi-annual report of 2020, no meaningful progress was reported by end of first have of 2021. However, an accelerated pace of project implementation resumed as the spread of the virus slowed and public protective measures were widely taken.

During the second half of 2021, the project reported on the challenge in the flow of funds following the new funding modality. The flow of funds to the project was also slowed as the government entities including the PCT under the MoA was acclimatising with a new Direct to Project Funding (D-Fund) system instituted by the URT through its MoF. D-Fund system is one of the financing instruments that can be used by development cooperation partners to leverage development support to the Government. However, as the D-Fund system is integrated in the E-Government, the efficiency in financing approval process is expected to improve. The project engages leaders at Ministry of Agriculture and Ministry of Finance to improve the internal clearance processes to minimize the lead time to a maximum of 15 days.

4.3 Project Outreach Interventions Reports

For any project to have expected outcomes and impacts at a scale, it must, inter alia, have an effective communication and outreach strategy. The process of development and approval of the National Aflatoxin Communication Strategy (NCCS) was not accomplished until 2023. The NCCS highlighted, among others, critical communication issues on aflatoxin, target audiences and implementation arrangements and roles of key stakeholders. Nevertheless, the review evidence indicates that from the beginning, the project have had strategic outreach interventions across the planning scales – national, subnational and local.

The primary project beneficiaries to who planned changes were expected to happen – were farmers and actors in the maize and groundnuts value chain. The project used a range outreach communication channels that were in the first place investigated in terms of efficacy as perceived by the target beneficiaries. For example, the study by TBS (URT 2020) indicated media – radio, television, newspapers and social platform – as widely used means through which VCAs received educative information on aflatoxin.

The project capitalized on the use of media to reach out the general public with message on aflatoxin. The media used by the project in its outreach included: 3 print media (Daily News, Mwananchi and the Citizens); 1 local FM Radio (Mashujaa FM); 4 electronic media (TBC1, ITV, Channel 10 and Star TV); and 3 social media platforms (Michuzi blog, Millard Ayo and Global TV). The project was pragmatic on using a variety of means of outreach at the grassroots including –Farmer Field Schools (FFS), seminars/workshops and public campaigns. The project also used influential artists (Figure 5) to attract and convey aflatoxin awareness message.

Figure 5: TANIPAC's Public Awareness Campaign through a Renowned Artist

Courtesy: TANIPAC Project, 2023

Furthermore, over the years of project implementation, the project participated in the national outreach events – the *NaneNane* shows and World Food Days (Figure 6). At these events the project created public awareness on aflatoxin through physical education and dissemination of knowledge sharing products. During the 2020 *NaneNane* shows, a total of 1,093 (334 females and 759 males) people visited the project's pavilions at *NaneNane* shows conducted in three regions of Tabora, Morogoro and Simiyu. During the *NaneNane* shows in 2023, the project educated and disseminated aflatoxin knowledge and Knowledge Sharing Products (KSPs) to 1,200 (612 females and 588 males): Mbeya (614: 351 females and 263 males), Lindi (488: 267 males and 221 females) and Zanzibar (98: 40 were females and 58 were males). The KSPs disseminated included 3,000 fliers and 6,000 posters.

Figure 6: Public visitors to the project pavilion during national Level Outreach Events in Tanzania mainland and Zanzibar

Courtesy: TANIPAC Project

Based on the review of internal reports on national outreach events the following lessons are drawn:

- There is a need for sustained and widespread public awareness creation on aflatoxin occurrence and its effects on human health and agri-food trade. The public aflatoxin awareness remains limited particularly in areas beyond the project intervention.
- While aflatoxin-smart PHM technologies - such as hermetics (metal silo and bags), moisture meters and driers - are in existence, the critical issue remain on how to make them readily available, accessible and affordable to resource-constrained farmers and VCAs.
- The outreach scope for Zanzibar as net importer of food grains should put more emphasis on creating awareness, deployment of control measures and enforcement of food quality and safety standards in the agri-food trade particularly importation and processing in the archipelago.
- There is a need to extend awareness creation outreach to consumers on health implications of aflatoxin and how to identify safe food products before purchase, and safe handling and preparation before consumption at home.

- Aflatoxin outreach should also target youth, and school-going students and children to make them aware of aflatoxin contamination and related health effects – first as the most exposed to consumption of unsafe foods – and second the ambassadors to their families. This is an upfront investment in the generation of food safety conscious citizens. Apart from safeguarding from consumption of unsafe food, youth and children are also food producers and traders of today and tomorrow.

Apparently, towards the end of 2024 since the project launch, the project produced and disseminated 36,145 various awareness materials with educative messages 33,045 printing materials, 4 documentaries, 15 TV program, 63 radio program, 1,000 calendars, 2,000 T-shirt and shirts and 19 banners (126% of the target). Moreover, the deployment of media houses including TBC Television, Voice of Agriculture, Kasibante radio, FADECO radio, TBC online and Dar 24 enabled the project to reach over 24 Million Tanzanians and educate them on aflatoxin problem and mitigation measures.

4.4 Project Performance Evaluative Assessment Reports

Internally, the project implemented a number of systematically designed evaluative studies that produced reports reviewed under this evaluation. Such major internal evaluation reports that were reviewed under this evaluation covered include: 1) joint supervision missions culminating into Aide Memoires (2019-2024); 2) Audit reports by NAOT were reviewed to evaluate the performance of the project against achievement of planned results, public finance compliances and management of project assets as to underpin the public value for money (2020-2024); 3) *ex post* evaluation of the performance of youth artisans in the business of manufacturing of metal silos after being trained and incubated by VETA and SIDO (2024).

4.4.1 Review of Joint Supervision Missions: Aide Memoires

Every joint supervision mission culminated into an Aide Memoire (AM). The Aide Memoire as the reporting product of the joint mission, presents implementation progress against planned results, and identifying constraints and challenges and recommendations on the best ways to address them as to keep the project on-track towards intended results.

The Aide Memoire from the first joint supervision mission indicated that the funding from the AfDB' ADF was delayed for over 6 months since official inception of the report in February 2019. The first disbursement from GAFSP was relatively timely. However, the counterpart funds from the URT was not flowing in harmony with other external finances, hence affecting planning and financing of activities.

The 2020 joint supervision mission of November 2020 found that, the disbursement was only 3.45% after almost 2 years of implementation – rendering the project red-flagged according the Bank's protocol as disbursement was still below 10%. By April 2021, the disbursement still stood at 5.21% of the overall project budget. Between December 2022 and May 2024, the disbursement improved from 35% to 72%. And by December 2024, disbursement from both ADF and GAFSP increased to 83.26% of the overall project funds. Furthermore, by March 2025, all the entire project funds were already allocated for spending until the end of the project.

Generally, the joint supervision missions during the tenure of the project commended the project's accounting system as robust its accounting operations and competences

of staff in the accounts section. Accounting reports were done and reported timely on quarterly basis. Some critical issues underscored from the review of Aide Memoires (2019-2024) are summarized in Table 3.

Table 3: Critical Project Performance Issues from Reviewed Aide Memoirs

SN	Critical Issue	Evaluation Remark
1	Inadequate engagements, particularly in the first two years of (2019-2020), with subnational and local stakeholders at region, LGA and local levels	Sub-national and local engagements improved along the way. But more would have been done and achieved as discussed above.
2	Delayed development and promotion of the National Aflatoxin Communication Strategy (NACS) not widely done at sub-national and local levels	Widely promoted at national and sub-national levels, contrary to local level to communities. No evidence that it was downscaled to the community level.
3	Low burning rates	Lengthy procedures for acquisition and titling of land needed for construction of infrastructure
4	Disruptions that affected efficiency and effectiveness of the project performance – the COVID-19 that limited implementation of activities involving gathering people, and escalation of global prices of imported construction material and equipment due Russian war in Ukraine.	At the peak of COVID-19 spread between 2020 and 2021, the project continued to implement activities that did involve gatherings, and capitalized on using virtual means of communications and engagements. With easing COVID-19 pandemic, the project increased the pace of project implementation to catch up from hiccups caused by the pandemic.
5	Delays in disbursements at the start of the project and lengthy process of approval of funds through the D-Fund system under the Ministry of Finance	The delay was due to newly introduced D-FUND and internal process within the government. The counterpart funds from the URT was not flowing in harmony with other external finances, hence affecting planning and financing of activities.
6	Poor performance of contractors, especially in the construction of the infrastructure.	The poor performance ranged from poor workmanships to some abandoning the construction sites. The Ministry should keep an inventory of capable and reliable contractors that can be contracted in the future.

4.4.2 Review of Audit Reports by NAOT

Imperatively, financial management is of great interest for internal and external evaluation. Financial audits are an effective means of evaluating financial performance. The quest of public auditing to verify value for money of public projects. The public audits are conducted by the National Audit Office (NAOT) under the Controller and Audit General (CAG).

In this evaluation, four audit reports (2020 – 2024) conducted by the NAOT were reviewed. NAOT's audit reports declared the project financial performance entailing procurement of goods, works, and consultancy and non-consultancy services to be in line with International Public Sector Accounting Standards (IPSAS), and in accordance of accounting and in the manner required by the public Financial Act, 2001 (revised in 2004). That audit reports underscored a number of issues that needed improvements. However, the critical audit queries – minor but pertinent addressing – are discussed as follows.

Critical Audit Issues During the First Audit, 30th – June 2020

The flow of counterpart funds (URT) was not always in time, hence affecting financial planning of the project. For the financial year 2019/20, until June 2020 when the project was audited, no funds were remitted from the URT's total contribution of TZS 1.08 billion. As revealed in the first audit, the transfer of funds to the project was inadequate, only 15% of the funds budgeted for in 2019/20 was received. Likewise, by the time auditing in June 2020, unspent funds accounted for 35% of released funds. The outbreak of COVID-19 halted the implementation of awareness creation that involved gatherings of people. The budget line on awareness creation retained much unspent funds (57%). At the start, the project did not use an Integrated Financial Management System (IFMS) in generating financial statement. This was due to delay in installation of accounting system due to changes from Epicor to MUSE accounting systems.

Critical Audit Issues During the First Audit, 30th – June 2021

Five out seven (71%) of previous audit recommendations under implementation were implemented and 2 (29%) were reiterated. The implementation of previous recommendations was rated satisfactory. The audit found that, the implementation of activities for infrastructure development was time-lagging. The pace of awareness creation was slow according to the target. The project continued to face inadequate release of funds. Of the annual budget approved of TZS 21.9 billion only TZS 2.1 billion (10%) was released by end of the 2020/21 financial year. The project's burning rate of released funds was overly slow, with only 16% of released funds spent in the respective financial year. This was due to planning oversights and delays in procurement of contractors. The NAOT also recommended strengthening SPS border stations with aflatoxin testing equipment to facilitate export of aflatoxin safe produce.

Critical Audit Issues During the First Audit, 30th – June 2022

The procurement of goods, works and services of the TANIPAC was generally in compliance with the requirements of the Public Procurement laws, and budget Act and guidelines. The rate of addressing previous audit recommendations was 72% - that is, 10 out of 14 were implemented. The implementation of previous recommendations was rated satisfactory. The NAOT observed delays in the construction of the infrastructure. Such delays were mainly due to non-adherence to programmes of works by the contractors.

Critical Audit Issues During the First Audit, 30th – June 2023

The project implemented 10 of 11 (91%) recommendations made in the previous audit. Thus, the implementation of recommendations was satisfactory. The project was not yet developed the operation and maintenance manual. Some of the infrastructure and

outdoor facilities had construction defects. Such construction defects were associated with inadequate internal control over management of contracts, delays in paying contractors, delays in processing tax exemptions, inadequate internal control over safety issues and service provides, and lack of building codes for some facilities such as offices and conference halls.

Critical Audit Issues During the First Audit, 30th – June 2024

Ten out of nineteen recommendations made, 53% have been implemented, 7 w under implementation (37%), and 2 were reiterated (10%). Funds sent to Zanzibar for capacity building was not utilized. This was due to inadequate planning and over budgeting, and some activities were not done. The NAOT audit noted some irregularities in the management of assets of the project that was associated with inadequate internal controls. Some assets were transferred without completing the authorized transfer forms. The project purchased goods that were not yet recorded in the asset registry. The audit reported defects were reported in some of the infrastructure. The project carried out internal performance for the financial year 2024/25 and procurement plan as of November 2024. The major activities for the terminal project implementation year 2024/25 include: 1) complete construction of infrastructures, 2) preparation activities for project closing, and 3) dissemination of information and knowledge communication materials through outreach activities.

Evaluation of Farm-Level Performance of GAPs and Aflasafe

Towards the end of 2023, the project carried out a study to monitor and evaluate performance of the farmers training on GAPs and use of aflasafe technology (URT 2023[17]). The study covered a sample of 488 farmers including FFS farmers and those reached through farmer-to-farm outreach. The study indicated that about 89.5% of farmers were aware on aflatoxin. However, 64% were able to correctly describe aflatoxin as toxins resulting from fungal infestation in crops. A notable disparity between males and females was observed, with women exhibiting lower levels of awareness (37%) than men (63%). Despite of the good awareness on aflasafe among the farmers, its adoption rate is still low (18.2%). The reasons for low adoption as reported by farmers includes lack of incentive for application of aflasafe (54.9%), high cost (42.2%), lack of training (37.5%) and unavailability at farmer's locality (20.1%). However, the results indicated that the participation of males in FFS was higher (69.3percent) compared to females (30.7%). This highlights a major gender gap in FFS participation therefore more awareness is needed to bridge the gender gap. Based on the information obtained in the survey, it was indicated that most of farmers (79.9%) stated that the training was useful in enhancing the awareness and adoption of GAPs.

However, productivity of maize has stagnated at the same level as the 2020 baseline yield of 3 Mt/Ha. However, productivity of groundnuts improved three-fold from 2020 baseline of 0.5 Mt/Ha to 1.5 Mt/Ha. Factors that contribute to low productivities that have constantly plagued Tanzanian smallholder agriculture include among others: inadequate use of productivity-enhancing inputs, limited access to extension services,

[17] URT (2023). Monitoring and Evaluation Report for Performance of farmers training on Aflatoxin prevention through GAPs and Aflasafe. TANIPAC Report, 1st November 2023.

dominance of rainfed farming system in the face of climate change and variability that aggravates yield risk, and low investment in technology such as mechanization.

The study drawn a number of lessons: some improvements in the quality and safety of grains were achieved; farmers felt that FFS was a useful and effective approach to promote adoption and diffusion of GAPs; and farmers' awareness on aflatoxin improved with majority of trained farmers undertaking pre- and post- harvest measures to mitigate and control aflatoxin, including proper disposal of faulted grains. However, more would have been done and achieved by running on-farm demonstrations for at least three seasons; and strengthening including close monitoring of farmer-to-farmer outreach.

Performance of Youth-led Metal Silo Manufacturing Agribusiness

The project's overall objective of the youth artisan training program on hermetic metal silo manufacturing was to promote local availability of grain storage technology to farmers for mitigating the risk of aflatoxin contamination and improve food safety. The program was designed as an efficient and cost effective way of deploying affordable metal silo grain technology to farmers. Under this youth program, VETA in Mainland Tanzania in collaboration with VTA in Zanzibar embarked enrolling youth for training on metal works and skillsets needed in the manufacturing of hermetic metal silo technology. Youth trained at VETA were further incubated at the SIDO centres through extended technical training and entrepreneurship in agribusiness. The eligible target group - young Tanzanian artisans aged 18-45 years with basic skills and at least 1-year experience in metal fabrication works. The course – welding and fabrication of metal silos. Other material include the manual.

Almost all youths (419 out of 420) identified for enrolment in the metal silo fabrication training program at 14 VETA and VTA training centres turned-up (VETA 2022[18]). Only three female youth artisans (0.7%) were enrolled in the program. This is due to limited participation of girls in technical/engineering vocational training and education. Technically, the youth artisans were trained on workshop safety, machineries and tools; welding; drawings; bench and metal works; painting; and fabrication of the metal silos according to the technical drawing (Figure 7).

[18] VETA (2022). Report of training 420 youth on metal silo fabrication held at various Vocational Education and Training Centre in Tanzania Mainland and Zanzibar. TANIPAC Project. July, 2022.

Figure 7: Youth Artisans Undergoing Hands-on Trainings and Finished Products

Courtesy: VETA/SIDO

Moreover, enrolled youth artisans were also trained on life skills and entrepreneurship. Apart from the core trainings on safety at work, welding and metal works, and painting – the training covered support subjects on entrepreneurship and life skills. The preliminary entrepreneurship training at VETA was further extended when the same youth enrolled with SIDO for agribusiness incubation.

Ensuring sustainability, the project collaborated with VETA/VTA to review and integrate a special module on welding and fabrication of metal silos into its curriculum (VETA

2021[19]). In order to meet rapid technological and socio-economic changes, VETA/VTA adopted competency-based curricula which are in a modular format and individually-paced with flexible entry and exit, skills and knowledge being broad-based to specialization.

During the incubation process, SIDO interviewed the incubatees on what transpired after finishing training at VETA. The youth artisans did not start any manufacturing after VETA training due to lack of capital. SIDO found that the youth incubatees still had limited exposure to key workshop machines and facilities, including those critical for metal silo fabrication.

SIDO incubated a total number of 387 youth artisans: 347 were incubated at 6 SIDO Technology Development Centres (TDCs) in Tanzania mainland and 40 at two VTA centres in Zanzibar. At each centre, the incubation program was divided into three intakes, with each one lasting for two weeks between February and May 2024. The fourteen (14) days training for each intake focused on practical training on metal silo fabrication the objective being to couch artisans improve the quality of silos as well as imparting business skills and exposing them to business environment which will trigger their entrepreneurial ability the aspect which is very crucial for commercialization of this technology in the home districts.

After the incubation, the youth artisans themselves posed requests including: 1) keeping linkages with SIDO for support in technology and business training for growth of their business, 2) accessing to affordable small loans and grants to finance their metal silos fabrication business, and 3) receiving more training from the MoA on post-harvest management and grain storage silos, food safety and value addition on grains.

Interestingly, the SIDO also carried out an acceptability and willingness to pay study (SIDO 2024[20]) of potential customers of the metal silos technology, particular smallholder farmers. Over three quarters (79%) of farmers rated the metal silos to be useful – and 38% rated the technology very useful. However, more than half of respondent farmers (60%) did not know about metal silo technology, and only 6% were using metal silo technology. Over half of respondent farmers (63%) were willing to adopt the metal silos technologies, but only 36% were willing to pay in cash by instalments. Moreover, a quarter of farmers (27%) proposed for subsidization of the metal silos technology by the government to make the technology affordable. More than half (67%) of the respondent farmers were willing to buy a 10-20 bag (1-2 Mt) capacity silo for TZS 500,000-750,000. The 10-bag silo was the most preferred capacity by farmers in the lowest income category.

Furthermore, in the mid-2024, the project carried out an internal evaluation study (URT 2024[21]) of the performance youth agri-preneurs in the metal silo manufacturing business after being trained and incubated under the metal silos manufacturing program. The study found that three quarters (75%) of respondent youth artisans were highly satisfied

[19] VETA (2021). Repackaged curriculum for welding and fabrication for metal silo. TANIPAC Project Report, May 2021.
[20] SIDO (2024). Assessment of farmers' willingness, acceptability and adoption of metal silos technology in Tanzania. TANIPAC Project, 2024.
[21] URT (2024). Report on evaluation of metal silo fabrication technology to support grains storage at the household level. TANIPAC Report.

and felt positively impacted by the program in terms of technical and business skills – with 95% recommending scaling the initiative country-wide. However, 25% whose expectations were not fully met highlighted areas for enhancement including intensive training on specific technical metal works design and fabrication skills, access to capital and post-training coaching and guidance.

As part of the program, youth artisans were encouraged to formalize their businesses as a way of accessing formal support in terms of further capacity-building and financing opportunities. The program evaluation study found that only less than a quarter (22%) of artisans registered to formalize their businesses. Nearly a half of the respondent artisans (49%) were optimistic on potential growth prospects in their metal silos fabrication business. The youth artisans applied the technical and business skillsets other lines of their metal works beyond metal silos fabrication: 57% anticipated growth prospects, 29%) engaged in market promotion, 34% noted increased sales and 37% managed to forge loyalty with customers. In market promotion of their metal works, mainly through the word of mouth (54%) and social media (34%) – others were displays at the business premises, participation exhibition events such as 88 shows and in social events. However, majority of the artisans (52%) did not monitor and evaluate the effectiveness of their market promotion strategies that would have provided a space for learning and adjustment.

In terms of ultimate business outcome, within just a year in business after the training and incubation program, at least 8% of the youth artisans managed to manufacture silos that were purchased by customers. The market development and promotion of a new product or technology is a slow-paced process as customers seek information and evaluate the utility of the product or technology. The metal silos fabrication is currently a small part of the business portfolio of metal works undertaken by the artisans. The respondent youths acknowledged that acquired technical and business skills, and granted equipment, improved the overall technical efficiency of their operations. As a result, 49% of the artisans noted improvement in their overall incomes, and 14% reported to have realized growth of their business.

Notably, a range of advanced equipment that youth artisans were trained on for metal silo fabrication such as rolling machine are not locally accessible. For example, artisan in Nanyumbu district had to travel over 200 km to the SIDO regional centre workshop in Mtwara to access rolling services with travel and service charges costing him around TZS 250,000 – estimated at one-third of the overall cost manufacturing the one 10-bag silo capacity. Such high costs of accessing specialized machinery services add up to the manufacturing costs, hence making the technology unaffordable to farmers. Given his manufacturing costs structure, the artisan in Nanyumbu set the sale price of a 10-bag silo inclusive of the profit margin at not less than TZS 1,000,000. This already twice as much expensive compared to the minimum of TZS 500,000 that majority of farmers were willing to pay for the metal silo of that capacity (URT 2024[22]). Thus, limited access to specialized machinery and tools for metal works would restrict growth of metal silos fabrication business and rise manufacturing costs – ultimately making the technology expensive for smallholder farmers.

[22] URT (2024). Report on evaluation of metal silo fabrication technology to support grains storage at the household level. TANIPAC Report.

Furthermore, more than half of the artisans (63%) reported to have remained networked with their peer artisans and technical tutors at the both VETA and SIDO. Such networking among youth artisans provides opportunities for collaborative learning and exchange of ideas that are critical for business transformations and growth.

The project's youth artisan program, is an exemplary initiative of advancing the jobs that youth are already doing to solve pressing problems in the agriculture sector and food system at large – like metal silos manufacturing for improved PHM. The same initiatives can be planned in other areas of PHM such as manufacturing of driers and other farm equipment and tools. This a much broader scope that can be considered under the BBT program for promoting youth engagement in agribusiness to create decent jobs for solutions. The lessons learned from youth artisan metal silo manufacturing program, inter alia, include:

- Continuous learning and skills development is required to ensure youth artisans are continuously learning to improve their skills and remain updated and relevant with the industry's best practices and emerging trends. Strategic hands-on trainings and self-studies to advance the technical and business skills of youth artisans are pertinent. For example, some youth artisans reported to have not gained technical proficiency in the technical calculations of angles and cycles needed in the design of the cone and cylinder diameters. As found in the internal evaluation study of the program, such technical defaults in the design, as it happened to one youth artisan, rendered a manufactured silo faulted by not being airtight at the joint between the cylinder and cone, hence allowing entrance of air and moisture into the silo. However, as of now, the support of LGAs in both technical, financial and human capacity of artisans groups remain inadequate (URT 2024[23]).
- Establishment and maintenance of collaboration and networking should be encouraged to establish and maintain networks with fellow trainees, industry experts, and professionals. The trained youth artisans can form a platform for them to constantly engage and share their experiences, challenges, success stories, and collectively envision their enterprise futures.
- Trained youth artisans can be bridges of knowledge to farmers to enhance food safety through improved PHM technologies. This should involve encouraging the trained youth artisans apply and promote the knowledge gained on aflatoxin contamination and control among their potential customers and the general public. While promoting their fabrication business, underline to customers the food safety merits and environmental friendliness of the hermetic metal silo storage technology by avoiding the use of hazardous chemical pesticides.
- The youth artisan metal works can be supported to develop and growth into Post-Harvest Management Technologies (PHMT) start-ups. Food safety centric PHM is critical in the transformation of the agri-food sector in Tanzania. The gateway to cost-effective and inclusive PHM would be to scale household-level access to affordable hermetic technologies including bags and metal silos. As a launcpad, the youth artisans trained and incubated under the project can be supported in

[23] URT (2024). Report on evaluation of metal silo fabrication technology to support grains storage at the household level. TANIPAC Report.

terms of formalization, capital investment, technology transfer, and business development skills to transform into clusters of youth-led start-ups focused on advancing food safety centric PHM technologies. Global convergence and affordability of digital technologies, including AI, which youth have affinity to, create an opportunity space for youth-led PHMT start-ups.

- Supportive mechanisms are needed to keep the costs of PHMT such as hermetics (metal silos and bags) affordable to farmers. Based on the study by SIDO that evaluated technology acceptability, majority of farmers (79%) perceived the metal silo technology useful and were willing to buy. However, farmers insisted on the need ensure the technology is affordable and purchasing should be on credit with payment made in instalments. Some supportive mechanisms that can increase affordability of PHMTs, among others, include introduction of tailored technology subsidy, import tax waiver on imported food-grade metal sheets, grant-based financing of costly technology such as rolling machines, direct selling price subsidy for youth artisan manufacturers to lower the selling price; and purchase credit to farmers arranged through AMCOS.
- In collaboration with LGAs and SIDO, the MoA through its department of mechanization and value addition can maintain monitoring, evaluation and learning system of the youth program. Trained youth artisan involved in the metal silo manufacturing groups can register either with LGAs or SIDO that can continue to monitor and evaluate performance, and leverage development support. This can help identify areas for improvement and measure the effectiveness of the training program, and sustain and scale positive impacts. Insights from M&E can the basis for the youth artisan groups supported to increase the PHMT manufacturing business scope.

Evaluation of Consumption, Aflatoxin Contamination and Human Exposure

In the mid of 2024, the TBS in collaboration with the project conducted a study (TBS 2024[24]) in the project intervention areas – covering all 18 districts in Mainland Tanzania – to evaluate the state of food consumption pattern, aflatoxin contamination and human exposure among trained and no-trained farmers and traders. This study covered a sample of 1,816 comprised both farmers (93%) and value chain actors (6%) – traders, processors, transporters and artisans.

The sample covered two categories of respondents – the direct beneficiary farmers and value chains actors that were trained by the project on aflatoxin contamination and control (52%) and untrained (48%). The key results areas reviewed comparatively among the two groups of respondents entailed: 1) awareness and knowledge on aflatoxin, 2) knowledge and aflatoxin control measures during food preparation for consumption at the household, and 3) aflatoxin contamination levels in maize and groundnuts samples and dietary exposures.

Over half of the respondent farmers and value chain actors (59.4%) were aware and knowledgeable on aflatoxin contamination and control. This means, awareness on aflatoxin problem in the project intervention areas has improved overtime from around 30% observed during the baseline survey to around 60%. More than three quarters (84%)

[24] TBS (2024). Report on assessment of stakeholder's food consumption pattern, aflatoxin contamination and exposure in the TANIPAC Project areas. June 2024.

of trained respondents (farmers and VCAs) were aware and knowledgeable on aflatoxin contamination and control – in contrast to the remaining 14% of untrained respondents with such awareness.

Sorting out mouldy grains was the most widely practiced aflatoxin mitigation measure – used 75% and 68% of trained and untrained respondents, respectively. Cereals, particularly maize, were the most consumed food by majority of respondents (97%) – at an average of two meals per day for both adults and children in the households. Groundnuts were consumed at an average of three days per week, with one meal a day. Thus, high frequency of consumption of maize based foods increases the risk of dietary exposure, particularly among women and children in the households. The prevalence of aflatoxin contamination was detected in maize samples collected from 53% households. This means, more than half of the consumer households were exposed to aflatoxin.

Furthermore, percentages of samples with detectable level of aflatoxin exceeding the regulatory limits for AFB1 (5 µg/kg) and AFT (10 µg/kg) were 23% and 22% for maize and groundnuts, respectively. The median contamination levels for maize and its flour product were below the maximum allowable limits for AFB1 and AFT levels of 5 and 10 µg/kg, respectively. Notably, as maize is frequently consumed, chronic dietary exposure to low aflatoxin doses, still has a cumulative negative health effect. For groundnuts samples tested, the median aflatoxin contamination levels were 5.25 and 11.99 µg/kg for AFB1 and AFT – exceeding allowable limits. While there has been improvement in reduction of aflatoxin contamination in maize, aflatoxin remains widespread and persistent in the groundnuts value chain.

Metrically, the exposure to aflatoxin from maize and groundnuts for adults and children was above the set limit of 0.04 ng/Kg-Bw/Day due to high consumption of contaminated maize and groundnuts. More than half (52.1%) of the adults who consumed *ugali* (maize flour) were exposed – at a median exposure of 10.8 ng/Kg-Bw/Day - beyond the tolerable exposure threshold (0.04 ng/Kg-Bw/Day). Apparently, all the respondent households whose maize samples were detected with aflatoxin contamination exceeded the exposure limit. Despite of improvement in reducing aflatoxin contamination in maize, given both high dietary intake and frequency, the risk of exposure persists from intake of contaminated maize-based foods over time.

Despite that groundnuts had high detectable level levels of aflatoxin contamination, dietary exposures among adults were limited far below the limit – but with an exception of only Nanyumbu, Bahi and Chemba that are major groundnuts producing and consuming districts. The median exposures for adults from the sample households in Nanyumbu, Bahi and Chemba were estimated at 0.34, 56.1 and 304.03 ng/Kg-Bw/Day, respectively.

Furthermore, a total of 578 children were observed to have consumed ugali (maize flour) in the past 24 hrs. And half of children (49.8%) consumed *ugali* with detectable levels of aflatoxin. The median aflatoxin exposure of children from both consumption of maize-based foods – *ugali* and porridge – was at the same level of 25.6 ng/Kg-Bw/Day. All children who from households whose maize samples had detectable levels of aflatoxin had exposure levels exceeding the tolerable threshold.

Out of 18 project districts in Mainland Tanzania, Itilima, Urambo and Kilosa appeared to be aflatoxin exposure hotspots – with more than 80% of the adults and children exposed to aflatoxin (AFT) beyond the allowable limit, mainly from the consumption of *ugali*. Spatial differences in the dietary exposures is a function of the levels of aflatoxin contamination and consumption intake. For example, despite of lower consumption intake of maize, households in Kilosa were still highly exposed as their maize had highest levels of aflatoxin contamination. Kilosa is district which is closer to coastal area (from Indian Ocean) falls in the sub-humid climate characterized by elevated humidity and ambient temperature that favour moulds infestation in grains.

4.4.3 Evaluation of Outcomes, Environmental and Social Impacts

Project Outcome Evaluation Survey

Towards end of 2023, the project commissioned an external evaluation survey (URT 2023[25]) for assessing the project performance towards expected outcomes. Rather than discussing the outcomes per se – that will be anyway covered under the end-lined evaluation – of much interest from the outcome survey is on ascertaining outcome pathways achieved by the project. The core project outcome was to effectively reduce aflatoxin contamination in the maize and groundnuts value chain. The very pathway of realizing this outcome is vested in farmers' adoption of aflatoxin-smart pre- and post-harvest technologies and practices. It is an aim of any results-based evaluation of the project performance to underpin the extent with which the project contributed to the change.

The outcome survey asked to what extent farmers associated adoption of different aflatoxin-smart technologies to the initiatives by various change agents including the TANIPAC project. The pre-harvest aflatoxin-smart technologies whose adoption was associated with TANIPAC by at least half of respondent farmers included: use of aflasafe (100%), proper handling of produce at harvest (82%), improved drying surface (62%), and improved weeding (55%). Likewise, aflatoxin-smart post-harvest technologies whose adoption was linked to TANIPAC by at least half of the respondents included: proper disposal of moulded grains (92%) and traders' decision to reject moulded grains (69%). The outcome survey found that on average about 56% of respondent farmers attributed adoption of pre- and post-harvest aflatoxin-smart technologies and practices to the interventions made by the TANIPAC. Generally, based on farmers perceptions as TANIPAC has contributed significantly to the adoption of aflatoxin-smart technologies at the farm-level.

Completion and Environmental and Social Audit Report

In April 2025, the project commissioned out an independent Completion and Environmental and Social Audit (CESA). The primary objective of the CESA was to independently evaluate project's E&S performance for 17 infrastructure – the 14 community warehouses, PHCoE, CARL and NBCU – developed under the TANIPAC project.

According to CESA, the E&S Operating Safeguards according to national environmental law and Banks standards were met. The project undertook ESIA for each construction project in compliance to the national environmental regulatory frameworks – and the

[25] URT (2023). Outcomes and Indicators Survey

Bank's E&S operating standards and safeguards. The construction projects have had positive socio-economic and environmental impacts. Apparently, the project demonstrated a strong commitment to environmental and socio-economic stewardship.

The construction of 14 community warehouses was implemented by local consultant and contractor companies. The three mega-construction projects of the PHCoE, CARL and NBCU that requires sophisticated civil technology were contracted to international contractors. Labourers and other skilled workers employed, mainly women and youth, were mainly localities where the projects were implemented. The CESA did not report any incidence of child labour.

During construction, it is estimated the total of 1,260 jobs were created with an average of 90 per construction site. Female labor participation ranged from 10% in early phases to 20% during finishing stages of the construction process. Post-construction operational phase of the infrastructure, particularly the warehouses, is estimated to be offering a total of 360 temporary jobs during grain handling and trading.

The CESA confirmed that significant progress has been made in establishing foundational Occupational Health and Safety (OHS) systems across all 14 TANIPAC warehouse and outdoor facilities.

The CESA found that, the project complied by ensuring each of construction projects had all required permits. The permits always come with conditions to be complied with, including environmental impact assessment certificates.

However, there were some post-construction environmental concerns as reported by the CESA. Some contractors left debris, remnants, and did not demobilize temporary facilities installed during construction.

There was also a need to further strengthen stakeholder relations at the operating phase of the infrastructure, particularly the community-level warehouse facilities. The CESA recommended collaboration among the NFRA as a frontline operator and the LGAs and communities around the warehouse facilities. The engagement involve collaborative adoption of the Warehouse Management Guidelines at the district and village levels. This can be achieved through roundtable meetings and orientation sessions to delineate roles, responsibilities, and expectations under the post-handover management structure.

The design of 17 infrastructure, including the CARL, PHCoE and NBCU, was inclusive, particularly through accessible toilets and disability-compliant sanitation infrastructure. These reflect adherence to national disability laws and AfDB's OS2 on labour and working conditions. Such compliance features demonstrate the project's commitment to universal access.

The major non-compliances appears to be post-construction after the project has handled the facilities to the frontline operator. Effective management and maintenance of developed facilities is essential for long-term environmental and socio-economic sustainability. For the modern infrastructure facilities to extend expected socio-economic benefits while ensuring ecological integrity, a well-coordinated and professional management is pertinent.

4.5 Review of Project Exit Strategy Reports

4.5.1 Evaluation of the Capacity of FBOs to Manage Constructed Warehouses

In May 2023, the project undertook an internal assessment (URT 2023[26]) of the capacity of FBOs and alternative business model to manage the 14 community-level storage facilities. The intent of such assessment was to reaffirm the initial idea in the PAR that stipulated hand-over management of the community storage facilities to Farmer Based Organizations (FBOs). The study interviewed a sample of representative leaders of 54 FBOs and 270 member farmers – and consulted 18 private warehouse operators and 18 warehouse operators under PPP arrangement.

More than half of warehouse operators (55.6%) owned the facilities they operated – 44% of the FBOs operated the storage facilities rented from village government or private owners. Major services that FBOs offered to its members included aggregation and storage of crops (59%), input supplies arrangements (29%), supporting production (7%) and value addition (4%). Out of 54 FBOs, 74% had active Bank accounts and 26% had inactive (dormant) bank accounts. Maintaining an active Bank account is an indication of sustained financial transactions.

During this survey, it was observed that out of 54 FBOs visited 74.1% have active bank account while 25.9% have dormant bank accounts. Bank Account is preferred as it ensures financial control, and access to credit/loan. More than a quarter of the FBOs (44%) did not submit their annual financial audit reports as they were not audited by the cooperatives registrar or COASCO.

Over three quarters (83%) of the FBOs operated with low-level technologies undertaking both administrative and provision of services to their members: inadequate storage facilities, lack of value addition and limited use of digital technologies including use of computers to administer inventories. For example, some private warehouse operators were already using CCTV cameras to maintain security around their warehouse facilities. Due to liquidity problem – as only 24% had diversified sources of income – most of the FBOs were unable to maintain as keep the storage facilities efficiently operational.

Private owned and operated warehouse facilities were in good storage condition and operated professionally. About 43% of private owned and operated warehouses were run by managers with professional background on warehouse operations. The private warehouse owners and operators consulted advised the following to be done to improve the performance of public warehouses: capacity-building of FBOs on warehouses operations (47%); ensuring profitable market linkages to farmers (77%), integrating value addition operations (97%), input supply including credit (67%), integrate inclusive financing (97%), and improve infrastructure including maintenance (77%).

Moreover, the FBOs have stringent weaknesses in the areas of management and leadership, infrastructure, financial management, and access to technologies including those addressing the aflatoxin problem and food safety at large. If strengthened, the FBO's managed community storage warehouses as hubs leveraging services to their members, including collective access to farm inputs and equipment, access to credit through mechanisms such as Warehouse Receipt System (WRS), aggregation, storage,

[26] URT (2023). Assessment of farmer's organizations capacity and alternative business models for management of storage facilities.

processing and marketing. Apparently, the capacity building efforts may hardly transform FPOs into entrepreneurially competent business entities as the face stringent challenges including limited managerial, leadership and financial capacities, member conflicts and political interference. In this regard, the project decided to transfer the 14 community-level storage facilities to the NFRA.

4.5.2 Alternative Operational Modalities of PHCoE, CARL and NBCU

Between June and August 2024, the project formed a Technical Working Team (TWT) to impartially evaluate alternative operational modalities for the three strategic infrastructure – PHCoE, CARL and NBCU facilities. The TWT was comprised of members from Ministry of Agriculture (MoA), and one expert on food system investment planning from Sokoine University of Agriculture (SUA). The TWT made rounds of consultations with key public institutions and other stakeholders in the private sector, and NGOs.

There were no challenges associated with the initial idea of the project in transferring CARL and NBCU facilities to TARI and TPHPA. The CARL will be handled over to TARI as frontline operator. The CARL laboratory facilities will be also utilized by other public institutions such as Tanzania Official Seed Certification Institute (TOSCI), Tanzania Plant Health and Pesticides Authority (TPHPA) and Cereals and Other Produce Regulatory Authority (COPRA). The laboratory services at the CARL will also be made available to the private sector stakeholders. Within the legal mandates of the TPHPA, NBCU will be involved in advancing bio-control technology including technologies to combat toxigenic fungi and bio-pesticides for crop protection as to ensure food safety and ecological integrity of the environment. CARL laboratory facilities will be accessible by public and private sector R&D stakeholders in the bio-technology industry. Some of the biotechnologies such as bio-pesticides provide an industrial commercialisation opportunity.

The stakeholders consulted by the ministerial TWT envisioned PHCoE is an exemplary investment with a great potential of transforming the Tanzanian grain industry. It was suggested that, the PHCoE must have a clear goal, strategic objectives and clear action plan with targets and progress markers to achieve the goal – and how the its three units (technology transfer, agro-processing and marketing) are operationally integrated. The report produced by the TWT indicate that, one corporate miller was ready to invest in a modern maize milling plant around the centre. Such partnerships with private sector need to be explored and capitalized upon.

Based on his experience, the consulted director of Trade Policy and Country Manager at Eastern Africa Grain Council (EAGC) suggested that the PHCoE should have a one stop centre for services pertaining regional grain trade including testing of mycotoxins, aggregation, mechanised cleaning, trading, processing, certification for safety and quality standards, licensing and issuance of export permits. The director at the EAGC was also excited that the technology transfer centre with sumptuous accommodation for corporate executives will facilitate running executive courses on post-harvest management and grain trade for corporate business owners at both country and regional level. Training of corporate executives with authority on the grain business including food safety issues would influence decisions such as changing corporate policies. As Tanzania aspires to become the regional grain hub, having such a facility was viewed by stakeholders as a gateway for transformation in the Tanzanian grain industry. Some of

the recommendation the TWT drew from stakeholder consultations in terms of what needs to be achieved through the PHCoE:

- The URT should pursue increased role of the State in grain planning and trade while ensuring continued participation of the private sector
- Tanzania becoming a regional hub for a competitive grain trade is a realisable vision, hence efforts to enhance production, quality and safety standards, marketing and trade infrastructure and enabling environment should continue to be implemented at a scale.
- The URT should enhance the grain trade diplomacy and relationships through bilateral regional and international agreements
- The Ministry of Agriculture should request the Government to set up a dedicated One-Stop Centre that will facilitate grain export trade
- Development Comprehensive Certification, Traceability and Logistics Networks for Marketing and Trading of Grains
- The Centre should adopt innovative world-class grain commodity exchange systems at the Centre, including commodity and stock exchanges, futures markets and traceability
- The Centre should attract strategic PPP investments on existing assets and new ones on undeveloped part of the property, as provided by institutional and legal frameworks for PPP arrangements.

PART FIVE
QUALITATIVE EVALUATION SURVEY

5

5.1 Sub-National Qualitative Survey

5.1.1 State of Food Safety and Aflatoxin Control

Before TANIPAC, aflatoxin and food safety issues at large were largely neglected. The project triggered significant improvements — reduced presence and sale of moulded grains in the markets, improved public awareness, and adoption of hygienic drying practices using tarpaulins. Traders now reject visibly contaminated grains, and some products are being safely disposed by burning or burying. However, food and feed testing capacity remains limited at the district level due to lack of laboratories, and feeds are rarely tested.

Despite of some improvements in PHM, some farmers are still practicing poor post-harvest handling such shelling by beating maize cobs and poorly-constructed private grain warehouses that continue to expose grains to aflatoxin contamination risks. Climatic variability, including erratic rainfall patterns, also contributes to heightened aflatoxin risks – as crops get stressed and weak.

5.1.2 Impacts of TANIPAC Interventions

TANIPAC introduced awareness campaigns, farmer field schools (FFS), community warehouses, and promoted aflatoxin-smart practices. The CMT in Kilosa reported a 70% adoption of good agricultural practices (GAPs) attributable to the project. Public sensitization through local leaders, FFS, and media contributed to improved awareness and knowledge on aflatoxin and PHM for prevention and control the problem.

Hermetic storage adoption (PICS bags) increased (approx. 40% at household level), though affordability limits scale. The project strengthened institutional capacity through by-laws and created M&E linkages with the district councils in the project intervention areas to track the progress of the project. Aflasafe was the only novel technology introduced, but its adoption remains low due to limited availability.

5.1.3 Development and Enforcement of By-laws for Control of Aflatoxin

The 18 planned by-laws were developed in the intervention districts to enforce aflatoxin-smart practices in the food value chain – they have been approved by responsible Ministry (PO-RALG). However, the evaluation noted a slower pace of further promotion of the by-laws in all villages beyond the 10 project villages mainly due to budget constraints that districts are facing. Despite this, by-laws are a key institutional tool supporting food safety governance.

5.1.4 Adoption of Pre- and Post-Harvest Aflatoxin-Smart Practices

Adoption of improved drying on tarpaulins, sorting, hermetic storage bags, and good agronomic practices has increased. Use of hermetic PICS bags is notable, though cost limits wider uptake. Metal silos adoption is constrained by high production costs. In Nanyumbu, GAPs adoption is estimated between 30–50%. Farmers in Kigoma still rely on traditional shelling and poor storage, which elevate aflatoxin contamination risk. Mechanized drying and cleaning are increasingly demanded in order to supply quality grains. Erratic rainfall patterns challenge timely harvesting and drying.

5.2 Village Extension Assessment

As part of the evaluation, the public village extension officers (VEOs) operating in the representative villages in the five sample districts involved in the evaluation were interviewed as Key Informants (KIs). Unfortunately, the extension staff for Ombiri village in Chemba district was not available during the entire one-week period when the evaluation team was in the field. So, a total of 4 interviews with VEOs were achieved. The qualitative analysis of the 4 VEO transcripts of interviews' responses was structure under four themes: awareness and knowledge on aflatoxin, training and retooling of extension staff on aflatoxin, assessment of farmer adoption of pre- and post- harvest aflatoxin-smart practices, and recommendations for scaled adoption of aflatoxin-smart practices. The thematic analysis and synthesis is presented hereunder.

2.2.1 Awareness and Knowledge on Aflatoxin

Respective qualitative thematic analytics in indicate that four VEOs demonstrated strong aflatoxin awareness and knowledge – by consistently identifying aflatoxin as a fungal toxin caused by poor drying, moisture or dampness, and poor storage practices. They identified crops prone to aflatoxin contamination to include maize, groundnuts, and other crops particularly grains. In terms of health effects, the respondent extension staff cited consumption of aflatoxin contamination to associated diseases like cancer, child stunting and negative animal health impact – and economic effects cited included market rejection and loss of market value of contaminated grains. The knowledge base of VEOs on aflatoxin and PHM in general, was reinforced by previous formal agricultural education received at colleges, TANIPAC trainings, working with other development NGOs on promoting PHM, and long professional experience. They emphasized that aflatoxin as not just a crop issue, but rather a public health and food system problem.

5.2.5 Training and Retooling on Aflatoxin

The respondent officers received comprehensive prior college training, other initiatives on PHM by the Ministry of Agriculture (MoA), working collaboration with NGOs, TANIPAC trainings that, among others, covered aflatoxin topics related with: causes, spread, effects, preventive pre-and post- harvest GAPs, and market implications. Thus, the trainings under the TANIPAC project was reinforced their knowledge based on aflatoxin – including enriching their extension tool box of GAP solutions.

The perceived the project training and retooling relevant and effective, but noted some gaps that should be improved in the future - limited training materials, inadequate provision of PHM tools such as moisture meters, inadequate availability of aflasafe to farmers after it was promoted, and limited inputs support to farmers.

Furthermore, after the training and retooling, the extension staff were involved in the implementation of TANIPAC activities. The project facilitated promotion of aflatoxin-smart GAPs through established clusters of FFSs and demonstration plots. Apart the from the practical on-farm demonstrations, other extension methods were used transfer awareness, knowledge and technology as well – farm visits, public meetings, and occasionally at the church congregations.

5.2.6 Adoption of Pre- and Post-Harvest Aflatoxin-Smart Practices

Drawing from the responses and insights drawn from key informant interviews with VEOs, the farm-level adoption of different GAPs can categorized into – widely, partially and weakly adopted practices.

The widely adopted GAPs by farmers as assessed by the respondent VEOs include improve land preparation through proper tillage and timely preparation before the start of the rains, use of improved seeds, increase application of fertilizers, use of tarpaulins during drying, use of shelling machines, cleaning and sorting of produce. The lessons drawn is that farmers show good uptake where demonstrations and sensitization are strong – in addition to affordability and compatibility of the technology within the farmer's farming ecosystem.

Partially adopted GAPs with moderate adoption rate among farmers, mainly due to constrained labour and financial resources, include line planting, spacing, soil-water management, weeding winnowing/cleaning/sorting, use of hermetic PICS bags, and

Aflasafe was not adopted beyond being tried at the FFS and demonstration plots. As a novel biotechnology promoted by the project, it still needed time to be tested and promoted for a wider adoption – needed to create an effective market demand. Beyond the project tenure, no extensive market promotion has been done by the private manufacturer (Agro-Z Company). Neither, the government has seriously promoted aflasafe technology. In practice, the merit of aflasafe technology is vested in improving the quality of the grains rather than upgrading quantitative productivity. And when the market does signal a pricy effective demand for aflatoxin-safe maize – upstream adoption of aflasafe is not likely to happen in a sustainable way. Sustainable adoption is a market-driven phenomenon, increased buyers' demand for aflatoxin-safe maize at a premium, will be transmitted to back to stimulate adoption of the technology. This situation might not happen in new product market development cycle, and can costly and riskier for a private investor – likely of what is happening with Agro-Z as a sole commercial manufacturer of aflasafe. However, given the public 'good' interest to safeguard public health, the government may need to work closely with Agro-Z to de-risk private investment and promote the aflasafe technology.

5.2.4 Recommendations for Scaled Adoption of Aflatoxin-Smart Practices

The respondent VEOs provided some recommendations to help scale adoption of aflatoxin-smart GAPs, including:

Continued aflatoxin awareness creation and education transfer: this would require intensifying awareness creation and education transfer to farmers, value chain actors and other stakeholders in the grain value chain. It is also critical to share public health statistics to raise urgency at the local and higher food safety and public health planning scales. For example, the acute aflatoxicosis tragedies that resulted into human deaths

in Manyara and Dodoma regions, once appropriately communicated, have had an awakening alerts in the local communities that need to be part of the solution.

Improved access and affordability of PHM technologies: the respondent officers underscored the need to make PICS bags, tarpaulins, improved seeds, fertilizers, and aflasafe cheaper and locally available to farmers. They also advocated for youth-led production of PHM solutions.

Scale-up extension support: according the respondent VEOs, the food safety centric agricultural extension needs to be supported in terms of strategies and investments including: expanding a network FFS and demo plots, providing extension officers with working extension tools such soil test kits and strengthen their facilitation and outreach capacity.

Enforcement of food safety regulatory frameworks: the respondent officers suggested strengthening and enforcing aflatoxin by-laws to discourage drying on bare ground and trading contaminated grains. The enforcement of such by laws, should be extended across the value chain targeting key players that are farmers, traders, transporters and processors.

5.3 Farmers' Focus Ground Discussions

A total of 5 Focus Group Discussions (FGDs) with project and non-project farmer participants were conducted. The qualitative information garnered through the Focus Ground Discussions (FGDs) with farmers were analysed under five themes: 1) Farmers' awareness, training and knowledge on aflatoxin; 2) Adoption of pre- and post- harvest aflatoxin smart practices – before and after the project interventions (2020); 3) Productivity effects of GAPs; 4) Sustainability of adoption of GAPs; and 5) Farmer recommendations for scaled uptake of GAPs. Thematic analysis carried out across the FGD cases with insights in terms of significant lessons and storylines.

5.3.1 Farmers Awareness, Training and Knowledge on Aflatoxin

The level of farmers' awareness on aflatoxin varied among the FGD participants – with project farmers showing high-level of awareness and knowledge on aflatoxin as compared to non-project farmers. Project farmers were able to identify aflatoxin risk, favourable conditions for aflatoxin occurrence, crops affected and its effects on human health. However, non-project farmers demonstrated to have some awareness on aflatoxin associating the problem with mould infestation. Generally, aflatoxin awareness among farmers and across space is spreading but still uneven. The significant storylines drawn across the FGD cases include:

- Most farmers identified aflatoxin as rotting or mould (blackish, yellowish, greenish, mushroom-like) caused by moisture and poor drying.
- Training sources through which farmers learned about aflatoxin included FFS (Farmer Field Schools) mainly for project farmers, extension officers, radio/social media, and peer farmers.
- Project farmers cited health effects associated with aflatoxin that included: cancer, stunting, liver disease, swelling of stomach, and indirect transmission through livestock products when animals are fed with contaminated feeds.
- Both project and non-project farmers consistently recognized economic effects associated with aflatoxin contamination involving rejection of contaminated

grains by traders, loss of income from marketing failure, or selling faulty produce at discounted prices.

- With the past 5 years farmers seem to have received trainings on aflatoxin and post-harvest management by different change agents and through government extension – some groups (e.g., 2025 seminar participants) had very recent training (2025), while others have had relatively longer exposure (2022-2023). However, some non-project farmers showed very low awareness as a quote from one of them shows: "I have never heard of aflatoxin before".
- Localized aflatoxin related tragedies that farmers recalled to have happened in their locales seem to strengthen awareness in certain areas. During FGD in Chemba, one participant was quoted recalling – "...we heard that people died in Kiteto because of aflatoxin." Such localized aflatoxin risk perception is reinforcing the awareness in the local communities.

5.3.2 Adoption of Pre- and Post- Harvest Aflatoxin-Smart Practices

During the FGD sessions, the farmer participants evaluated the extent of local adoption and diffusion of pre- and post- harvest aflatoxin-smart practices – before the project (before 2020) and after the project (after 2020). Good practices that have been increasingly adopted by the local farming communities after the project interventions include: used of improved seeds, lined and spaced planting, use of shelling machines, cleaning of produce and use of hermetic PICS bags for storage of grains kept mainly for home consumption. Increased use of improved seeds has overly replaced the use of local home-saved seeds. Line and space planting was mainly associated with project training through the FFSs. The maize grain stored for deferred sales is kept in normal propylene bags with intensive use pesticides when storage extends much longer.

Since 2020, some villages have experienced mechanization shifts from hand-hone and ox-plough tillage technologies to increased use of tractors and mechanical planters. Such technological shift has boosted timeliness of planting and reduced drudgery. Off-season irrigation is increasingly practiced but in a few sites with access to irrigation water, while majority of the farmers are still dependent on rainfed farming. Otherwise, adoption challenges seem to have persisted in adoption rate of good drying practices, harvesting, non-use of aflasafe, improper and over-use of pesticides and limited use of industrial fertilizers. Apparently, the technology adoption and diffusion is partial and uneven — high for visible and mechanized practices, low for "behavioural" ones like drying, harvesting and produce hygiene.

5.3.3 Productivity Effects of GAPs

Across the FGDs, the participants reported improved in yields of maize from an average of 3-4 bags before 2020 to 8-12 bags per acre now. Such yield gains were attributed to increased use of improved seeds, use of fertilizer mainly organic manure, line and space planting and timely weeding. Farmers see a direct link between GAPs and higher yields, motivating adoption. Yield improvements vary slightly depending on agro-ecological conditions. For other crops including groundnuts show mixed adoption of GAPs, especially where intercropped with maize.

5.3.4 Sustainability of adoption and diffusion of GAPs

Farmers strongly believe they will continue GAPs because they see visible benefits. Productivity gains were tangible and seemed to be a major motivation factor of sustainability and diffusion of aflatoxin-smart GAPs, even in contexts of low aflatoxin awareness. Peer learning among farmers is a strong motivating factor in the uptake and diffusion of GAPs – with those who see neighbours' yield gains were more likely to adopt. Farmers also reported that shrinking farm sizes pushed farmers to intensify production using GAPs to optimize production per unit area. Farmers reported that sustainability was limited by input affordability particularly of tarpaulins, fertilizers and pesticides.

The project's FFS and its extension of Farmer-to-Farmer (F2F) approach helped scale adoption and diffusion of GAPs. Motivation farmers to consistently participate in FFS varied, some farmers expected publicity/visibility (e.g., TV coverage), and when not realized, engagement dropped. This was mentioned by a participants in Nakopi village (Nanyumbu) during the FGD as quoted – "…majority of farmers participated in '*Shamba Darasa*' expecting that they will be seen on TV nation-wide… but this did not happen." Farmers want recognition and visibility particularly by their peer farmers in the community as motivation for participation. Apparently, sustainability is promising but dependent on input access and trust in farmer-to-farmer diffusion mechanisms.

5.3.5 Farmer Recommendations for Scaled Uptake of GAPs

Farmers perceived measures for scaled uptake and diffusion of GAPs informs the kind of interventions that might work under farmers' local contexts and conditions. Across the FGDs, farmers suggested the following measures as gateways to up-scaling adoption and diffusion of GAPs:

- Continued education and awareness creation, especially practical demonstrations.
- Ensure availability and affordability of farm inputs such as tarpaulins, PICS bags, improved seeds and fertilizers.
- Improve irrigation access to increase productivity of GAPs through investments in agricultural water technologies such as boreholes, and promotion of lowland farming.
- Strengthen farmer extension and follow-up support — one-off FFS seasons were seen as inadequate.
- Promote community-based seed production (QDS) to reduce reliance on external suppliers.
- Farmers stressed on the need for better market pull factors – such as rejection of mouldy produce consistently and rewarding premium prices for clean produce.
- Farmers also emphasized on availability and affordability of game-changing technological solutions such as planters, silos, shelling machines as scalable motivating factors. For example, the use of Chinese hand-planters already helped farmers to automatically plant in line and space, the practice that was seen time-consuming and labourious with use of ropes and hand-hoe.
- Generally, farmers are not only asking for knowledge but also practical enabling environment support for improved access to inputs, markets, irrigation, affordable mechanization.

5.4 Value Chain Actors' Assessments

Typology of Value Chain Actors (VCAs) interviewed include traders, transporters and processors in the maize and groundnuts value chain. The transcripts from the VCA Key Informant Interviews (KIs) were analysed thematically by drawing empirical insights on: personal and business profile, training exposure, awareness and knowledge, post-training business practices, wider training benefits and recommendations for improved food safety and growth in maize and groundnuts value chains – for benefiting businesses and while safeguarding public health by reducing aflatoxin contamination in the value chain.

5.4.1 Personal and Business Profile

The key informant interviews with VCAs covered grain traders, millers, nutritious flours processors and transporters – with business experience ranging from 3 years to over 30 years. Participation of women was mainly in the business of processing nutritious flours, with men dominating grain trading, milling and transportation business. The business operational scale varied – majority were small village-level traders with limited storage, while a few others were large-scale trading processors and regional exporters. Education levels were mixed: some completed Form IV and vocational trainings (VETA and TBS), others relied on practical experience.

5.4.2 Training Exposure

Under the project, the training of VCAs on aflatoxin and good post-harvest management was conducted in both Mainland Tanzania and Zanzibar. In Zanzibar, VCAs were trained by the MAINL in collaboration with ZFDA and ZBS. Most of the VCAs trainings were conducted in 2023, with some VCAs reporting earlier exposures (2022, 2024).

The key informant VCAs recalled the coverage of aflatoxin-centred training to include topics on: definition of aflatoxin, its causes, symptoms, health and economic effects, and preventive PHM practices - proper harvesting; drying; storage; transportation; packaging; and use of tarpaulins, pallets, PICS bags. While some had received similar training on aflatoxin before, a few had never received any organized trainings, but acquired knowledge on aflatoxin informally through extension officers, ward leaders, or the media. Some VCAs had positions in leadership at the community – e.g., the hamlet chairperson who used that position to cascade aflatoxin knowledge to people under his local jurisdiction through hamlet meetings. Trained VCAs also reported to have conveyed gained knowledge through peer interactions with traders, grain millers and processors who did not have opportunity to be trained on aflatoxin and PHM.

5.4.3 Awareness and Knowledge

The respondent VCAs had a broader understanding of aflatoxin – being caused by moisture coming into contact with dried grains, poor drying, and inappropriate storage. Health effects widely cited by respondent VCAs included cancer, liver and kidney diseases, child stunting, reproductive health issues, and compromised health of livestock. Economic effects reported by respondent VCA entailed: market rejection, lower prices, consumer distrust, and export incompliance barrier that decimates grain export trade. Some responses from VCAs indicate some knowledge gaps and misconceptions remain: some VCAs linking directly aflatoxin contamination to use of pesticides and insect pests, and the belief that aflatoxin and not aflatoxin-causing fungi

"comes from the soil". Apparently, the VCAs trained in the project showed a stronger knowledge on aflatoxin, especially the market implications and PHM practices.

5.4.4 Post-Training Business Practices

The trainings seem to have improved business trading and PHM practices of the VCAs. Commonly adopted best practices include: increased use of tarpaulins instead of spreading the produce on the bare ground during handling and drying of grains; sorting out mouldy grains and sometimes burning them; use of hermetic PICS bags and pallets for safe storage; improved transportation hygiene by cleaning vehicles, lining trucks, avoiding mixing with non-food loads; and increased role in educating farmers and customers on aflatoxin and its control measures. However, some VCAs are not trading grains responsibly even after having some knowledge on the health effects of aflatoxin: they still sold mouldy maize to local brew producers and customers intending to use the same faulty maize as animal feed. Thus, the major challenges downstream the grain value chain and end-market were reported, among others, to be: unaffordability of tarpaulins, lack of central drying and aflatoxin-smart warehouse facilities, and some continued unscrupulous grain trading practices with customers preferring cheap contaminated maize, and traders mixing clean and moldy maize to maximize profit while compromising public health.

5.4.5 Training Benefits

The trained VCAs respondents boasted a range trading practices and self-actualization benefits in their grain business including:

Improved product quality: the VCAs felt that higher market acceptability of their grain products has improved together with their reputation to customers and food safety regulators such as TBS.

Reduced trade losses: by rejecting bad maize early, the VCAs reduce the risk of incurring losses from market rejections during subsequent trading.

Better business practices: some introduced quality-based pricing where they started paying better prices for quality produce; and some became stricter in enforcing existing food safety by-laws.

Market differentiation: the VCA based in Kilosa who markets his maize to Dar Es Salaam highlighted a growing niche market of elite customers that demand quality and safe products – that are also ready to pay relatively higher price accordingly.

Extended social benefits in the value chain: some VCA assumed a role of educating other participants in the grain value chain – their peers, women sorters, youth, and customers – on the occurrence and effects of aflatoxin.

Personal growth and self-actualization: some VCAs felt self-satisfaction as the traded safe products and advocating for the same among peers and customers, which contributed to increased confidence, recognition as community educators, and stronger trust with customers.

Emphasis of managing aflatoxin in Mainland Tanzania for aflatoxin-safe grains imported in Zanzibar: Most of the food (80%) consumed in Zanzibar including grains is imported from Mainland Tanzania. Hence interventions to improve food safety in the Mainland is critical to ensure the food imported in Zanzibar is safe. As one VCA in

Zanzibar emphasized: *"... more education is needed to farmers especially Tanzania mainland where most of the grains consumed in Zanzibar come from"*.

5.4.6 Perceived Recommendations

A people-centred approach to eliciting measures needed to scale positive impacts – envisages on underpinning what in the first place, the very stakeholders see and believe as relevant solutions. In this context, the opinions were sought from the respondent VCAs – deduced perceive recommendations include:

Continued education to farmers on aflatoxin and food safety at large: nearly all actors recommended continuous, wide-scale sensitization on aflatoxin occurrences, effects and control – via extension officers, schools, village meetings, and media.

Improved PHM infrastructure, facilities and services: the respondent VCAs recommended for increased public and private investments in central drying facilities, warehouses, and affordable access to moisture meters, tarpaulins, PICS bags and metal silos. Respondent VCAs suggested financial and capital support mechanisms such as PHM loans and subsidies.

Improved policy and regulatory frameworks: the VCAs advocated for development and enforcing by-laws for prevention and control of aflatoxin and food safety in general. For example, the grain trader in Itilima argued that traders selling contaminated grains should be punished under the law, as quoted: *"...there are still traders who buy spoiled grains and mix them with clean produce..., I am suggesting that there should be by-laws to punish such traders..."*. It was argued another respondent grain trader in Itilima that the government should prioritize aflatoxin control the same at same level even more it is enforcing quality in the cotton sector, as quoted: *"...the issue of aflatoxin in maize should be emphasized as much as the quality of cotton is emphasized by our government, I believe people will change ..."*.

Targeting groups with limited awareness and knowledge: it was suggested that trainings should be constantly scaled mainly targeting groups with exceedingly limited awareness and knowledge on aflatoxin such as women and youth that are major players in some handling operations in the grain value chain (e.g., harvesting, cleaning, drying, and sorting), also untrained small-scale grain processors.

5.5 Youth Artisans Metal Silo Initiative

The transcripts from youth artisan Key Informant Interviews (KIs) were analysed thematically entailing insights on: personal and business profile, training exposure, awareness and knowledge, post-training business practices, wider training benefits and recommendations for growth of metal silo fabrication business as perceived by the artisans themselves.

5.5.1 Personal and Business Profile

Most artisans are young to middle-aged men (20s–40s), with a few older artisans of up to 51 years old in Itilima and at least one female artisan in Kilosa. Education ranges from primary to secondary school level, with some having formal vocational training (VETA graduates) and many learning about metal works and welding informally through apprenticeships in their neighbourhoods.

The respondent artisans had experience spanned from beginners (since 2019–2021) to those with over 10 years in welding. Many run small local workshops, with limited external support – with an exception of the project support with tools. Some artisans combine their metal works and welding business with other income generating activities.

5.5.2 Training Exposure

Through the collaborative arrangements under the project, the artisans attended two main phases at VETA and SIDO – in a duration of 2-4 weeks. According the artisans, the trainings at VETA covered the metal works theory, introduction to aflatoxin, entrepreneurship, welding basics and manufacturing of metal silos. The training and incubation program at SIDO included practical fabrication, business skills, and advanced machinery. Comparatively, the respondent artisans appreciated VETA training as more structured but theoretical, while SIDO was praised for better tools and practical exposure – though some criticized superficial teaching, poor supervision, or inadequate allowances. Thus, the artisans felt that trainings at SIDO was more practical and impactful on their skillsets. By design the program at SIDO was intended to undertake the business incubation which is more practical.

The artisans were asked on the process through which they enrolled in the training and incubation program. Accordingly, the entry often came through contact with district officials, extension officers, word of mouth, or workshop visits by VETA officials in collaboration with the district management. Some mentioned that they were selected due to visibility or consistent workshop presence.

5.5.3 Awareness and Knowledge

As part of the evaluation, awareness and knowledge of artisans were assessed, particularly on the aspects of aflatoxin and post-harvest management technologies. Generally, the artisans were able to articulate well the causes, and health and economic effects of aflatoxin. Major causes of aflatoxin contamination cited by artisans include poor drying, damp storage, staking bags right on the floor, and delayed harvesting. Commonly recognized health risks included liver cancer, death, and child stunting; some participants also mentioned kidney and lung diseases. The economic effects reported by respondent artisans included market rejection of crops, reduced prices, and export losses – where one artisan cited Kenya rejecting maize import from Tanzania.

However, there were apparent misconceptions among the artisans on technically describing aflatoxin – with some artisans associating aflatoxin with pesticide spraying or general “rotting” food, which shows partial knowledge gaps.

Furthermore, there was a widespread awareness among artisans about a variety of post-harvest management technologies as preventive solutions to aflatoxin contamination: metal silos, hermetic PICS bags and traditional cribs and granaries.

5.5.4 Post-Training Business Practices

The post-training outcomes on business practices by artisans was mix of some improvements and frustrations. Very few artisans have fabricated or sold silos — only isolated cases – one case in Kilosa were artisan manufactured and sold one 5-bag silo. Only a few artisans have produced sample/demo silos but not commercial units – the widely cited bottleneck is lack of demand and high manufacturing costs that make them

unaffordable to farmers. However, trainings had impacts beyond the metal silo business - a few applied have adopted PHM practices personally, including drying grain properly, using PICS bags, discarding contaminated maize. The major barriers that have limited impacts as reported by respondent artisans include:

- High costs of metal sheets which is the basic raw material in the metal fabrication. For silos of 5-10 bags capacity the material fall in the range of TZS 600,000 – 1,000,000 per silo, hence making the technology unaffordable to smallholder farmers
- Lack of rolling/folding machines and specialized equipment. Two components of the metal silo – the cylinder and cone – requires specialized rolling machine technology which is not accessible in the local working environment. Such machine technology is mainly available at regional SIDO centres. For example, the artisan at Nanyumbu had to travel to the regional SIDO centre to access the rolling service – incurring a travel cost of around TZS 300,000 (30-50% of manufacturing costs)
- Despite of artisans' readiness, there is still inadequate awareness of farmers on the metal silo technology, and existence of youth fabricators in their areas. The respondent artisans felt that the technology is not effectively promoted through the government extension system – citing limited involvement of extension officers in mobilizing communities to embrace the metal silo technology.
- Youth artisan key informants cited the major constraints they still face including limited equipment (especially rolling machines), frequent tool breakdowns, and high capital requirement that restricts growth of their silo manufacturing business.

Training Benefits

The interviews with artisans indicate an array of impactful benefits the training and incubation program have had on them including: improved skillsets on metal works and welding especially on accuracy of measurements, machine handling, and metal silo fabrication. Some appreciated that through the knowledge gained the can now diversify their manufacturing portfolio into fabrication of other machines such as shellers, choppers, and presses.

The artisan confessed that the program has impacted them with business knowledge, particularly on entrepreneurship, cost estimation, customer care, savings, business registration, tendering. Many reported reduced losses from better costing skills. The project-supplied equipment have enabled artisans to open new or improve workshops, though majority of them were concerned about the durability of some provided machines such as the grinder which was not robust and long-lasting enough.

Interestingly, the youth artisan associated the training and business incubation program self-transforming for personal growth through increased confidence, recognition from attendance certificates provided after the training, reputation in the community, and occasional roles as ambassadors educating farmers on aflatoxin and PHM.

5.5.6 Perceived Recommendations

The respondent artisans underscored some recommendations on what they thought would make stir growth of their metal silo business to help with PHM and aflatoxin control in particular. Such perceived specific recommendations given by the respondent artisans include:

- Increase farmers' awareness about the technology: most emphasized intensified education campaigns through schools, village meetings, and extension officers to create the local effective demand for the technology.
- Leverage financial capital support to artisans: artisans requested for loans, subsidies, or government purchase of demonstration silos that will boost their capital base. Many preferred individual loans over group loans due to fear of collective default.
- Increased access to special equipment and infrastructure: artisans mentioned a range of machines and tools, and facilities they need to efficiently and cost-effectively manufacture affordable and quality metal silos including rolling machines, paint sprayers, well-equipped central workshops to reduce costs and improve efficiency.
- Leverage policy support: artisans suggested the government advancing a policy requiring public and private institutions (e.g., schools, institutes, prisons, hospitals etc.) adopt metal silos storage technology. The artisans also urged for stronger extension service collaboration, and direct government contracts.
- Needed future skillsets: many artisans expressed interest in diversifying into manufacturing other agro-machineries such as shellers, de-hullers, milling, oil presses, and feed choppers. However, this endeavour would require tailored trainings and access to advanced tools.

PART SIX
LOCAL FOOD SYSTEMS AND FARMER EVALUATION SURVEY

6

6.1 Local Food Systems: Reckoning Aflatoxin Prevalence and Exposure

6.1.1 An Overview

In the first place, food safety risks such as aflatoxin arise from structural and functional failures of the local food systems. Aflatoxin can be mitigated by addressing the root causes engrained within the local food system. In the context of this end-line evaluation, this is a pretext of understanding how the project interventions addressed the local drivers, conditions and contexts of aflatoxin contamination within the local food systems.

The basic structural tenets of any food system entail food value chain, food environment and food consumption. The food value chain delivers the food through production, storage, processing, and distribution to consumption. Food safety is envisaged within the food environment but is also an integral component of the food value chain. Other elements of food environment are food availability, economic affordability and food messaging. Consumption pattern is mainly defined by consumer behaviour and practice, including elements – such as food culture, literacy, choices and nutrition transitions.

Inextricably, the ultimate outcomes of the food system include – food and nutrition security, health, income and environmental sustainability. The food system is shaped by mega-trends and drivers, *inter alia*, including – environment and climate, technology, income growth, urbanization, governance and socio-cultural contexts.

The local food system entailing its agro-climate and farming systems influences the risk of aflatoxin problem in crops such as maize and groundnuts. High humidity coupled with rainfall coinciding with harvesting of maize and groundnuts increases the contamination risk. Also, relatively low and erratic rainfall distribution induces tress into the plant which makes it susceptible to attack by pests and diseases including those that are fungal related. In this regard, the end-line evaluation draws local insights from 5 districts in Mainland Tanzania and Zanzibar to shed light on the local food systems in relation to aflatoxin and food safety at large.

6.1.2 Local Food Systems: Implications on Aflatoxin

An Outlook of Local Food System of Kilosa

Kilosa District is located around 6.83° S, 36.98° E, has a varied topography with elevations from approximately 300 meters in lowlands to over 2,200 meters in the

Ukaguru Mountains (URT, 2017[27]). It experiences a bimodal rainfall pattern, with annual precipitation typically between 800 mm and 1,200 mm. The main Masika rains (March-May) are followed by the Vuli short rains (November-January). The district's primary aflatoxin risk is driven by high relative humidity, often ranging from 60% to 85%, which persists during the main harvest period of June to August (TMA, 2021[28]). This warm, humid air severely hampers the drying of maize and groundnuts, creating ideal conditions for *Aspergillus flavus* growth and toxin production. From agro-climatological conditions, post-harvest contamination would the most significant threat, placing Kilosa at a high and persistent risk.

In Kilosa, the major food crops are maize, rice and sweet potato that are locally grown in the area. Kilosa produces food crops that are marketed into other regions. Maize prone to aflatoxin contamination. In Kilosa, majority of crop producers do not keep livestock in significant numbers as the Maasai pastoralists and Sukuma agro-pastoralists do. The major livestock species kept in Kilosa include cattle, sheep and goats. Animals are grazed in rangeland and on harvested crop fields. Kilosa is a renowned hotpot area with high rate of conflicts between farmers and pastoralists. Grazing on harvested fields in a humid place like Kilosa subjects livestock to feeding on aflatoxin-contaminated left-overs on the fields.

An Outlook of Local Food System of Nanyumbu

Nanyumbu District is located at 10.70° S, 38.85° E in southern Tanzania, has a lower elevation ranging from 200 to 500 meters. Its climate is hot and humid, heavily influenced by its proximity to the coast with Indian Ocean. It experiences a unimodal rainfall distribution, with 900 mm to 1,100 mm of rain falling primarily from November to May (Mtwara RC, 2017[29]). The dominant risk factor is the pervasive high temperature and humidity, which often stays above 70% for much of the year (TMA, 2021). The main harvest for maize and groundnuts (May-July) immediately follows the rainy season, creating extremely difficult conditions for crop drying. This slow drying process in a warm, moist environment is ideal for post-harvest aflatoxin contamination – particularly of groundnuts which is important in the local food system.

In Nanyumbu, three major energy-source foods are maize and cassava – with maize mostly sourced from Songea. Cassava is grown locally. Both maize and cassava are prone aflatoxin contamination if not handled properly. Livestock rearing is not the local culture in Nanyumbu.

An Outlook of Local Food System of Chemba

Chemba District, located in the Tanzania's semi-arid central area around 5.23° S, 35.88° E, has an elevation typically between 900 and 1,200 meters (Chemba DC 2021[30]). The district's climate is harsh, with low and highly unreliable unimodal rainfall ranging from 500 mm to 800 mm per year (Chemba DC, 2021). This short rainy season (December-April) is followed by a long, hot (temperature range of 15-30°C), and dry period. This

[27] URT (2017). Morogoro Region Investment Guide. President's Office, Regional Administration and Local Government.
[28] TMA (2021). Climate Normals for Selected Stations in Tanzania (1981-2020). Ministry of Works and Transport.
[29] Mtwara RC (2017). Mtwara Region Investment Profile. Government of Tanzania.
[30] Chemba DC (2021). Chemba District Council Five Years Strategic Plan (2021/22 – 2025/26).

environment makes drought stress the overwhelming driver for pre-harvest aflatoxin contamination. Crops are chronically water-stressed, making them easy targets for fungal infection in the field. In the past, the district has suffered from incidences of acute aflatoxicosis that results into scores of human deaths.

In Chemba, the cereals grown for food include maize, sorghum, and millet. Sweet potato is the tuber grown mainly for food. As many other areas in the semi-arid drylands, farmers sell most of the food grown at the peak harvest only few month after harvest – and later they buy back to ensure household food security. Major species of livestock are kept in the village including cattle, goat and sheep. Cattle, goats and sheep are grazed on communal grazing land – *mbugani* and harvested crop fields. The livestock rearing and grazing systems, also aggravate the risk of human aflatoxin exposure through the livestock based food chain.

An Outlook of Local Food System of Itilima

Itilima District is situated on the semi-arid plains of the Lake Victoria basin around 3.05° S, 33.95° E. It is a low-lying district with an elevation of around 1,100 to 1,300 meters. The climate is marked by an often erratic unimodal rainfall pattern, with average annual rainfall between 600 mm and 900 mm, concentrated from November to April (Itilima DC 2015[31]). The key risk factor is drought stress, which induces pre-harvest contamination. During the growing season, inconsistent rainfall weakens maize and groundnut plants, compromising their natural defences against fungal invasion. Late-season rains might complicate the drying process to accelerate aflatoxin toxin contamination.

Farmers in Itilima grow maize, rice, sweet potato and sorghum as major food crops – that are also sold for cash. The sweet potato tuber is mainly processed in either of the two ways, peeled and sun-dried into grits or cooked before sun-drying. This is the common traditional processing of sweet potato in most of the semi-arid areas in Tanzania. The traditional handling and processing including sun-drying of sweet potato grits (*michembe*), expose it to aflatoxin contamination. Amri and Leonoi (2016[32]) found that 36% of the sun-dried sweet potato samples collected from Kahama district in the semi-arid Shinyanga region, had detectable concentration of aflatoxin with contamination in ranges from 10.49 µg/kg) to 75.12 µg/kg. Livestock species kept in Itilima include cattle, goats and sheep – grazed of communal rangelands and harvested crop fields. According to the FGD, it is increasingly a common practice of feeding cattle with maize bran. With limited awareness on the transmittable effect of aflatoxin to humans through consumption animal products – when animal are fed on contaminated feed.

An Outlook of Local Food System of Kibondo

Kibondo District lies in Tanzania's western highlands around 3.58° S, 30.72° E, with elevations ranging from 1,200 to 1,500 meters above sea level (Kibondo DC, 2016[33]). This altitude contributes to a relatively cooler climate and reliable precipitation, with annual rainfall between 600 mm and 1,600 mm distributed in a bimodal pattern (October-December and March-May. Although less prone to severe drought, intermittent dry spells

[31] Itilima DC (2015). Strategic Plan for Itilima District Council (2014/15 – 2018/19).

[32] Ezekiel Amri, Saning'o Lenoi (2016). Aflatoxin and Fumonisin Contamination of Sun-Dried Sweet Potato (Ipomoea batatas L.) Chips in Kahama District, Tanzania. Journal of Applied & Environmental Microbiology, 2016, Vol. 4, No. 3, 55-62

[33] Kibondo DC (2016). Kibondo District Council Investment Profile.

can still weaken crops making them prone to fungal infestation. However, the district is reported to have – on average – the lowest humidity of around 10% (Kibondo DC, 2016). This combination of agro-climatic conditions and farming systems in general – makes Kibondo a low-to-moderate risk area for aflatoxin contamination.

The major food crops in local food system in Kibondo include maize, cassava and beans. The same food crops are also traded. Crop producers keep small ruminants such as goats and sheep – with keeping cattle being uncommon among the native locals in the area. The harvesting of maize starts from end of April to May when long rains have receded, hence reducing risk of aflatoxin during the drying process.

An Outlook of Local Food System of Zanzibar

Zanzibar is a net importer of food crops particularly grains. The major food crops in the archipelago are wheat, rice, maize, cassava and banana – with much of the three first crops imported mainly from Mainland Tanzania. Zanzibar's food self-sufficiency in grains is estimated to be less than 20% - with recent increase in local production of rice. Moreover, Zanzibar as other Islands, face limitation on physical expansion of food production. Indeed, the opportunity cost of Island's arable land is inevitably astronomical when compared to its competing uses such as residential and hospitality constructions. Climate change is exacerbating agricultural challenges particularly through its impacts on sea-level rise and sea-salt intrusion in the arable seascapes. For Zanzibar, food production opportunities in intensive horticulture and blue farms for culture fisheries and seaweeds, are limited by inability to afford technology and capital investment. Even when the Island advances its development, food importation remains not only necessary, but also a feasible and cost-effective solution for the archipelago's food system.

6.1.3 Local Food Systems, Aflatoxin Prevalence and Exposure: Evidences and Reflections

Evidences garnered during this end-line evaluation (Table 4) from its mixed methods, indicate a diversity of structural and functional tenets – and aflatoxin related outcomes of the local food systems – across the 5 selected districts of Mainland Tanzania, and Zanzibar. Across the local food systems, mix of major food staples are defined with what can be locally grown. For Zanzibar which is a net importer of food, the food basket is entails grains with established import supply chains – wheat, rice and maize. Fresh roots and tubers, and bananas are predominantly produced locally, with limitation for longer supply chains due to their high perishability amidst of underdeveloped cold chain facilities. With exception of Nanyumbu and Zanzibar, the four remaining districts depend mostly on home-grown foods by 74-99%.

While the case of Zanzibar being a net importer of food is not surprising, the case of Nanyumbu sourcing more than half (53%) of its major food (maize) reiterates the significance of localized food security planning. Earlier discussion informed by farmers' FGD in Nanyumbu noted that maize is not widely grown – among the major problem being the challenge of animal pests (wildlife) from vast nearby bushes and forestry reserves. Nanyumbu imports maize flour from neighbouring Ruvuma region – astonishingly farmers could single out locally preferable brands of maize flour imported from Ruvuma. In Nanyumbu, the local food purchasing power is boosted by better prices of cashew and groundnuts. Notably, for a net importing area, the food safety risk should in the first place

be addressed in the food import supply chain. For instance, in Nanyumbu and Zanzibar, strengthened aflatoxin detection and enforcement of control measures would have more pay-offs when implemented in the maize importation routes and supply chains. This endeavour was fulfilled by TANIPAC project by strengthening testing capacities of ZBS and ZFDA responsibly for food standards and safety in the market, respectively.

Table 4: An Overview of the Local Food Systems: Food Production

	Kilosa	Nanyumbu	Chemba	Itilima	Kibondo	Zanzibar
Major food crops	Maize, Rice and Sweet Potato	Maize, Cassava	Maize, Sorghum and Millet	Maize, Rice, Sweet Potato and Sorghum	Maize, Cassava and Beans	Wheat, Rice, Maize, Cassava, Bananas
Type of livestock	Cattle, sheep and goats (kept mainly by pastoralists)	Livestock rearing especially cattle is not the culture	Cattle, goats and sheep are	Cattle, sheep, goats and pigs	Goats and sheep	Poultry, Dairy
Livestock feeding system	Grazing on rangelands and harvested crop fields	NA	Grazing on rangelands and harvested crop fields	Grazing on rangelands and harvested crop fields	Grazing on rangelands and harvested crop fields	Intensive (intensive zero grazing and intensive poultry systems)
Agri-food market	Supplier of food to the markets	Buyer of food mainly maize from Songea	Supply of food to the markers but also buys back	Supply food to other regions	Supplier of food to the markets	Net importer of grains and animal feed from Mainland
Home-grown food sourcing (%)	74	47	90	99	87	< 20%

Source: URT (2024[34]), RGZ (2021[35]) & End-line Evaluation Farmer FGDs (2025)

Furthermore, reduced prevalence (contamination) and dietary exposure in the local food systems is the central impact pathway of the TANIPAC project. Reduction in dietary aflatoxin exposure through effective prevention and control of contamination in the maize and groundnuts food value chain was the project's intended public health outcome. Structurally and functionally, the five selected districts present more or less distinct local food systems (Table 5). It is worth finding out how the dynamics within the local food systems relate evidentially to the post-intervention results and situations at the local level, and local food systems in particular.

As explained earlier, in 2024, the TBS that was a collaborating party conducted a systematic study in the project intervention areas in Mainland Tanzania to assess the prevalence of aflatoxin contamination, food consumption pattern and dietary exposure of the households. As indicated in Table 5, empirical results from the TBS study indicate levels of adult dietary aflatoxin exposure related with consumption of stiff porridge (*ugali*) that vary across the five localities. Across the selected districts in Mainland Tanzania, the exposure levels exceed the benchmarking limit 0.04 ng/KG-Bw/Day. However, Chemba

[34] URT (2024). Report on assessment of Stakeholder's food consumption Pattern, aflatoxin contamination and Exposure in TANIPAC project areas.
[35] RGZ (2021). Situation Analysis of the Aflatoxin Problem in Zanzibar.

and Kibondo have the least aflatoxin exposures of 2.4 and 3.5 ng/KG-Bw/Day, respectively. Low exposure for Kibondo seems to be associated with low prevalence in terms of detected un-dehulled maize flour samples (10%) and contamination level (3.53 µg/KG). Chemba and neighbouring Kondoa are historically reported as hotspots for aflatoxicosis outbreaks that resulted into human deaths. As a consequence of such public health tragedies Chemba has attracted interventions, such as TANIPAC aimed at addressing the aflatoxin problem – hence the improvements seen in terms of low prevalence and exposure to aflatoxin. Fewer samples of maize products from Chemba had the least aflatoxin contamination levels.

Itilima and Nanyumbu had the highest exposure levels of 66.70 and 42.00 ng/KG-Bw/Day, respectively. Households in Nanyumbu rely by 63% on maize flour imported from Songea. Thus, aflatoxin contamination experienced in Nanyumbu is actually an imported problem. As households in Itilima depend on home-grown food by 99%, the highest level of aflatoxin contamination is a localized problem. Dietary exposure to aflatoxin can abated through some practices in food preparation before consumption such as – sorting, washing, soaking and de-hulling. Apparently, in Kilosa, majority of consumer households do not sort their maize produce (52%) – leading to higher aflatoxin contamination.

The aflatoxin situation survey in Zanzibar (RGZ 2021) reported that out of collected 46 random maize samples collected from grain stores for aflatoxin testing, locally grown maize constituted only 15% - with 85% being imported from Mainland Tanzania. Out of 46 maize samples collected from grain dealers (stores), 7 were domestically produced. Out of 14 samples that had detectable aflatoxin levels, 11 samples (28%) were imported and 3 samples (43%) were locally grown. However, despite of its smaller proportionality, locally grown maize samples had much higher median concentration of aflatoxin contamination of 270 ppb as compared to 9.5 ppb for imported maize samples. The same study established maize-related dietary exposure of 80.75 ng/KG bw/day, which by far exceeds the tolerable limit of 0.04 ng/KG bw/day. Per capita maize consumption in Zanzibar is estimated at 378.5 g/day.

Table 5: An Overview of the Local Food Systems: Dietary Food Intake

	Kilosa	Nanyumbu	Chemba	Itilima	Kibondo	Zanzibar
Food Preparation Practices						
Sorting	48	90	80	76	91	NA
Washing	12	27	6	4	0	NA
Soaking	2	0	1	0	0	NA
De-hulling	59	76	10	4	16	NA
Maize grains						
Detected (%)	87.50	NA	37.50	NA	NA	30
AFT Range (µg/KG)	0.80-394.47 (96.74)	NA	0.27-10.41 (0.95)	NA	NA	2.3 – 727 (12.8)
Un-dehulled maize flour						
Detected (%)	100	63.64	52.24	96.77	10.13	NA
AFT Range (µg/KG)	2.36-236.50 (14.92)	1.32-391.82 (109.98)	0.03-322.06 (0.90)	0.10-828.79 (26.08)	0.94-11.88 (3.53)	NA
De-hulled maize flour						
Detected (%)	93.44	50.00	38.46	100	NA	NA
AFT Range (µg/KG)	0.34-384.39 (11.04)	0.86-273.9 (16.68)	0.15-4.28 (1.04)	0.42-527.90 (49.25)	NA	NA

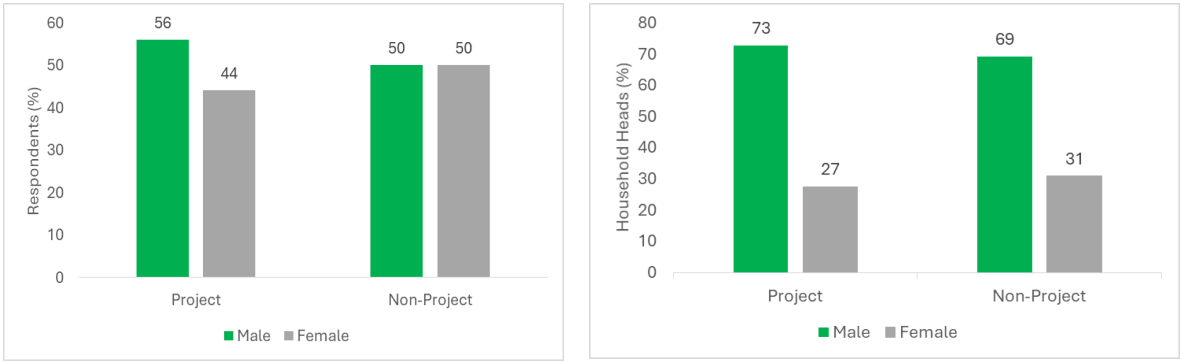
	Kilosa	Nanyumbu	Chemba	Itilima	Kibondo	Zanzibar
Composite Maize Products						
Detected (%)	93.33	48.89	47.92	96.04	8.08	NA
AFT Range (µg/KG)	0.34-394.46 (13.39)	0.86-391.82 (18.65)	0.03-322.06 (0.93)	0.10-82.79 (26.10)	0.94-11.88 (3.53)	NA
Median adult exposure, *ugali* (ng/KG bw/day)	**17.30**	**42.00**	**2.40**	**66.70**	**13.30**	**80.75**

Source: URT (2024[36]), RGZ (2021[37]) & End-line Evaluation Farmer FGDs (2025)

6.2 Farmer Evaluation Survey

6.2.1 Respondent Farmers' Profile

For both groups, the respondent samples were relatively balanced in the representation of men and women involved in the evaluation survey (Figure 8). This regard, the evaluation survey captured the perspectives of both male and female farmers. However, the sample households were predominantly male-headed, which is unsurprising in the context of rural Africa.



a) Sex of Respondent Farmers b) Sex of Household Head

Figure 8: Sex of Respondent Farmers and Household Heads

Figure 9 indicates that the largest proportion of respondent farmers falls within the 30–39 age group (25.7%), followed closely by the 40–49 age group (22.8%) and the 20–29 age group (21.8%). Collectively, the age range of 20 to 49 accounts for approximately 70.3% of the sample. The results show a younger to middle-aged farmer population, with very few respondents under 20 (0.6%) and only a small percentage (9.8%) in the 60+ age bracket. This suggests the study addresses on the most economically active segment of the farming community.

[36] URT (2024). Report on assessment of Stakeholder's food consumption Pattern, aflatoxin contamination and Exposure in TANIPAC project areas.
[37] RGZ (2021). Situation Analysis of the Aflatoxin Problem in Zanzibar.

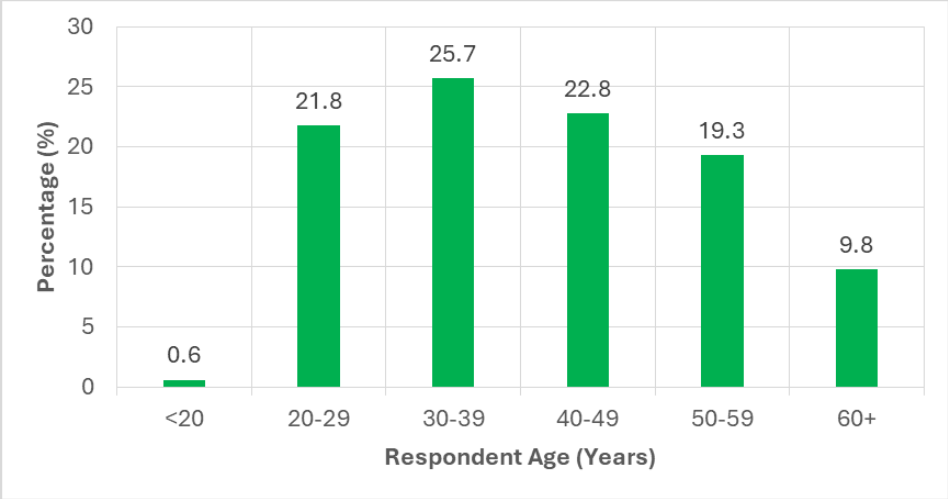


Figure 9: Distribution of Age of Respondent Farmers

A vast majority of both project and non-project respondent farmers completed primary education (82 and 81%, respectively). The second largest group is those who have completed secondary education – comprising 13 and 7 percent of project and non-project respondent farmers, respectively (Figure 10). Very few (<3%) among both groups of respondent farmers attended tertiary and University education. This indicates a population with a generally low level of formal education, with primary education being the most common highest level attained.

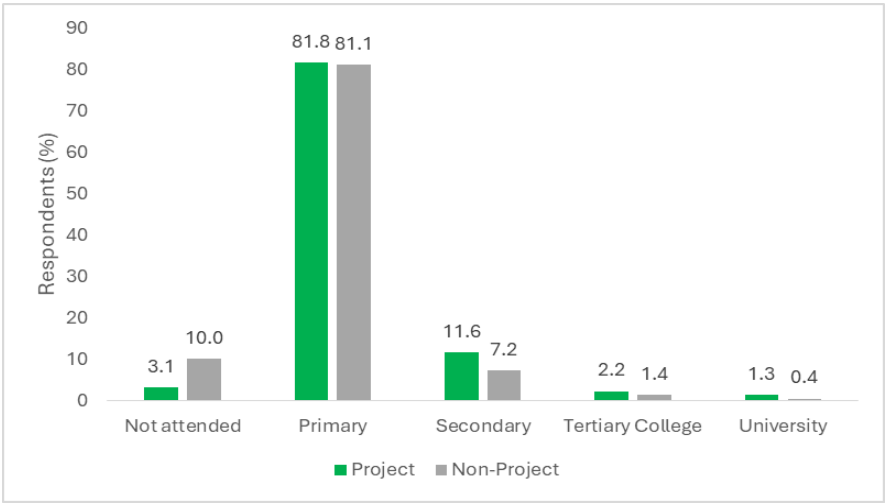


Figure 10: Main Occupation of the Household Head

The data clearly establishes the primary economic focus, with an overwhelming 92% of household heads engaged in crop production (Figure 11). Similar to the household head, the spouse's main occupation is overwhelmingly crop production (89%). This high percentage confirms that the sample represents a population heavily reliant on crop agriculture. However, proportionately project farmers diversified less into non-farm activities as compared to non-project farmers (8% vs. 11%).

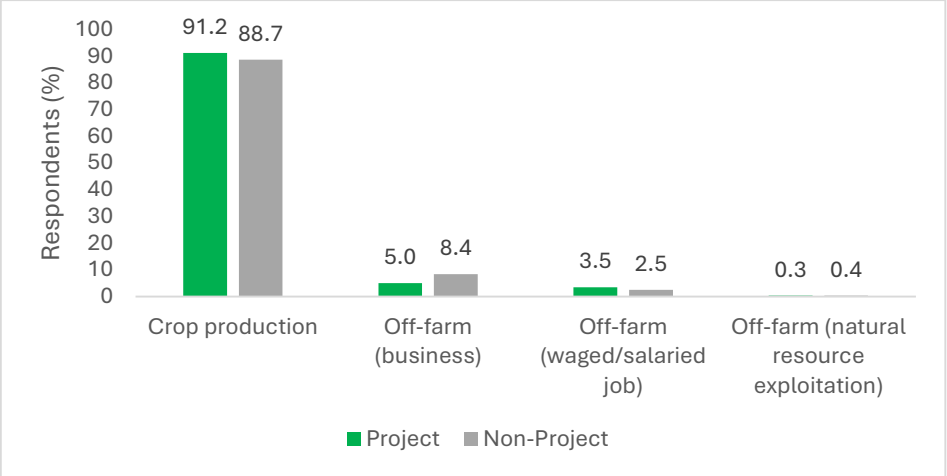


Figure 11: Main Occupation of the Household Head

Furthermore, the design of the farmer survey included specific questions that targeting youth who were still living with family. This intent was to capture information regarding the participation of youth in agriculture with their families. Adult children living with their families also predominantly engage in crop production (66.4%), though a larger percentage of adult children (23.9%) were still engaged in off-farm activities related with business and provision of other services (Figure 12). Apparently, less than 2% of respondent adult children had formal salaried and waged jobs. These results reinforce the central role of crop production as the main source of income and livelihood for the entire household.

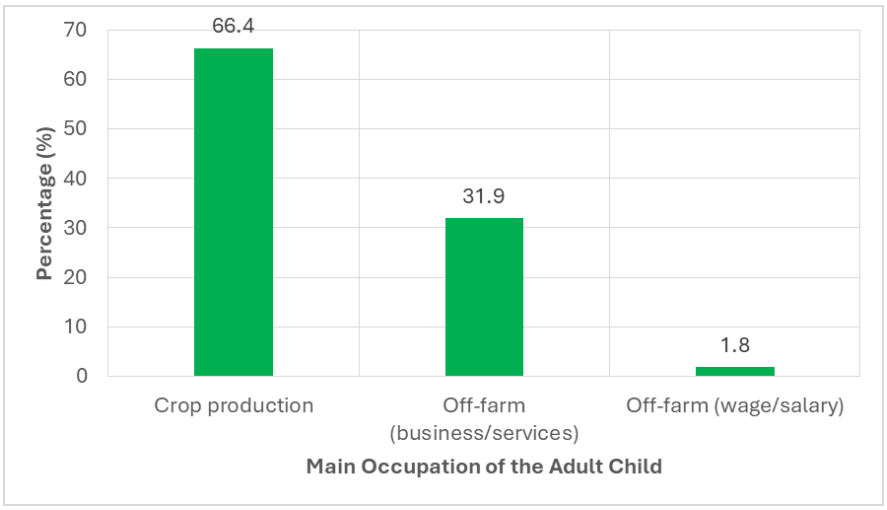
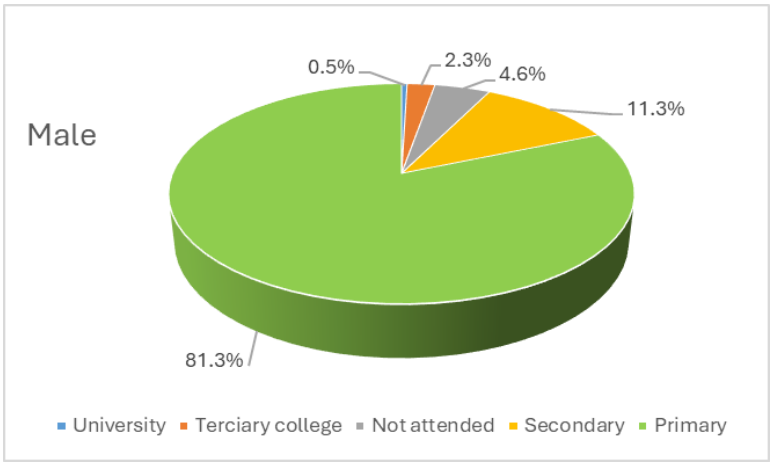


Figure 12: Distribution of Main Occupation of Adult Child (Youth)

The patterns of education levels of farmer respondents shows that majority of both male and female farmers (81%) had primary education as their highest formal education attained (Figure 13). Among those who never attended formal schooling, the proportion of female respondent farmers was slightly higher (more than double) compared to male.

A few respondent farmers in both categories attained higher education in tertiary colleges and universities. Apparently, the smallholder farm-sector is dominated with farmers with low-level of formal education. However, there has been increasing participation of elite farmers (young graduate) in medium-scale commercial farming through a range of initiatives under SUGECO at Sokoine University of Agriculture (SUA) and the BBT program at the Ministry of Agriculture.

a)



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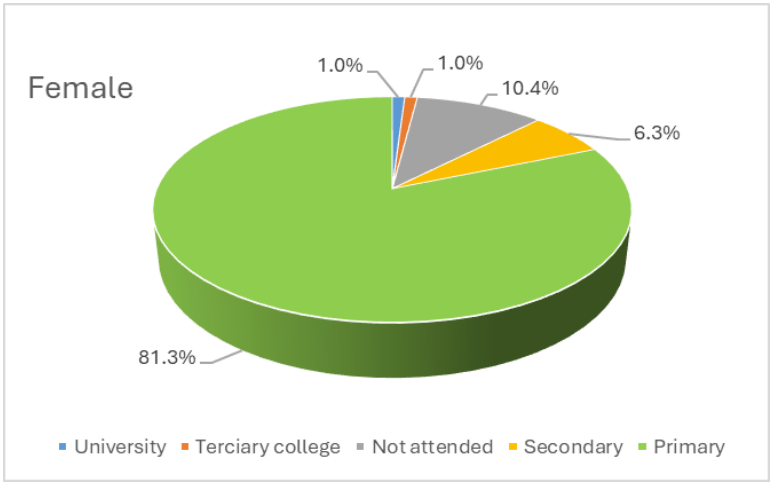
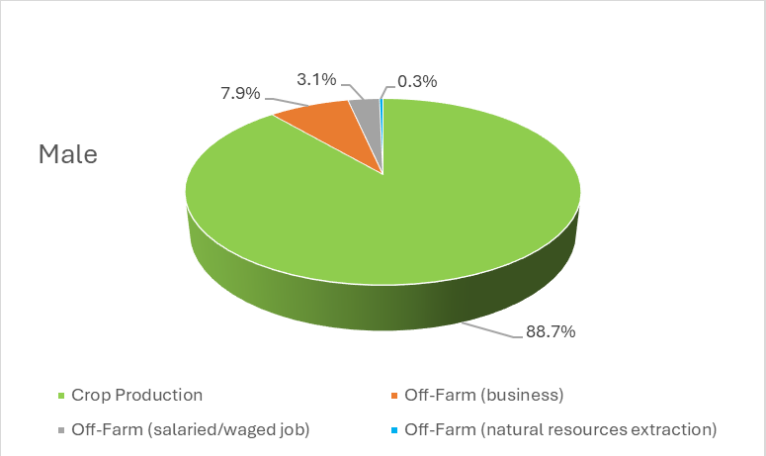


Figure 13: Education Levels of Male and Female Farmers

While crop production is the predominant occupation for both gender groups, findings highlight a clear gender disparity in occupational structure (Figure 14). Relatively, female-headed households exhibit a significantly higher concentration in this sector (92%) compared to male-headed households (81%). Conversely, male-headed households demonstrate greater livelihood diversification. They have a distinct advantage in accessing off-farm opportunities, with higher engagement in both business ventures and salaried/waged jobs.

a)



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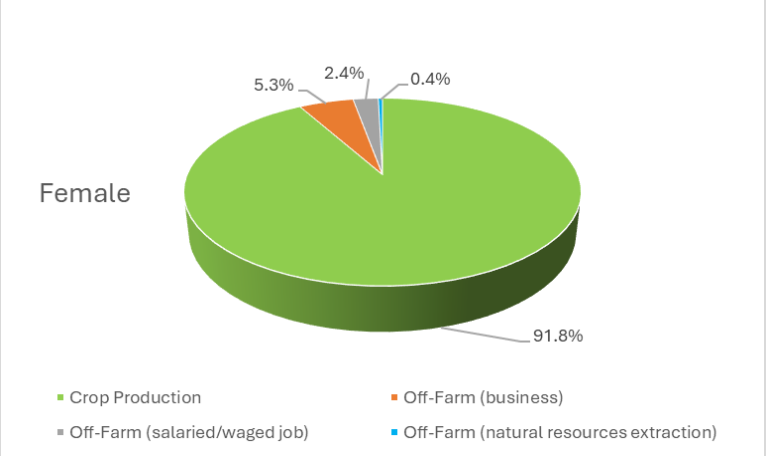

Figure 14: Education Levels of Male and Female Farmers

6.2.2 Aflatoxin Awareness and Knowledge

Slightly over a half (54%) of all respondent farmers were aware of aflatoxin. Apparently, there was stark difference in aflatoxin awareness among project and non-project farmers. Over three quarters (95%) of the project farmers were aware of aflatoxin starkly far above that of non-project farmers of 29%, which is close to project's baseline of 32%.

For those who were aware among the two groups were asked when did they become so. The aim here was to try to find whether the period related anyhow with timing of the project's awareness creation interventions. Farmers' aflatoxin awareness recall years were clustered in three distinct time-windows that logically matched with: 1) Pre-TANIPAC intervention (before 2019), 2) Pre-awareness interventions at the local level (2019-2021), and 3) Post-awareness interventions at the local level (2022-2025).

Results in Figure 15 indicate that majority of respondent farmers in both categories (>90%), became aware of aflatoxin in the 2022-2025 time-window that coincides with the period when the TANIPAC intensified aflatoxin awareness creation interventions at the local level. The analysis indicates that before 2022-2025, only very few project and non-project farmers (1-5%) were aware of aflatoxin.

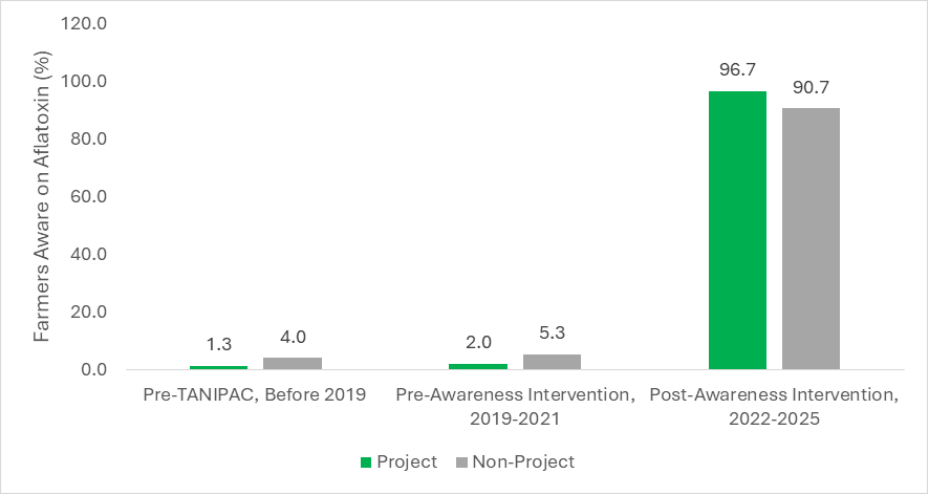

Figure 15: Farmers Aflatoxin Awareness over Time

Apparently, farmers' awareness creation were through a range of communication and engagement channels – predominantly a combination rather than single options (Table 16). Such Five major channels of aflatoxin awareness creation reported by farmers include: 1) friends and other farmers (29%), 2) extension, friends and other farmers (19%), 3) extension (13%), 4) radio, friends and other farmers (9%), and 5) other farmers (6%). With dominance of awareness creation through other farmers and friends, and extension – suggests peer-to-peer communication and extension services being the dominant channels for effective learning among farmers. Radio was a predominant mass media channel through which rural farmers became aware of aflatoxin.

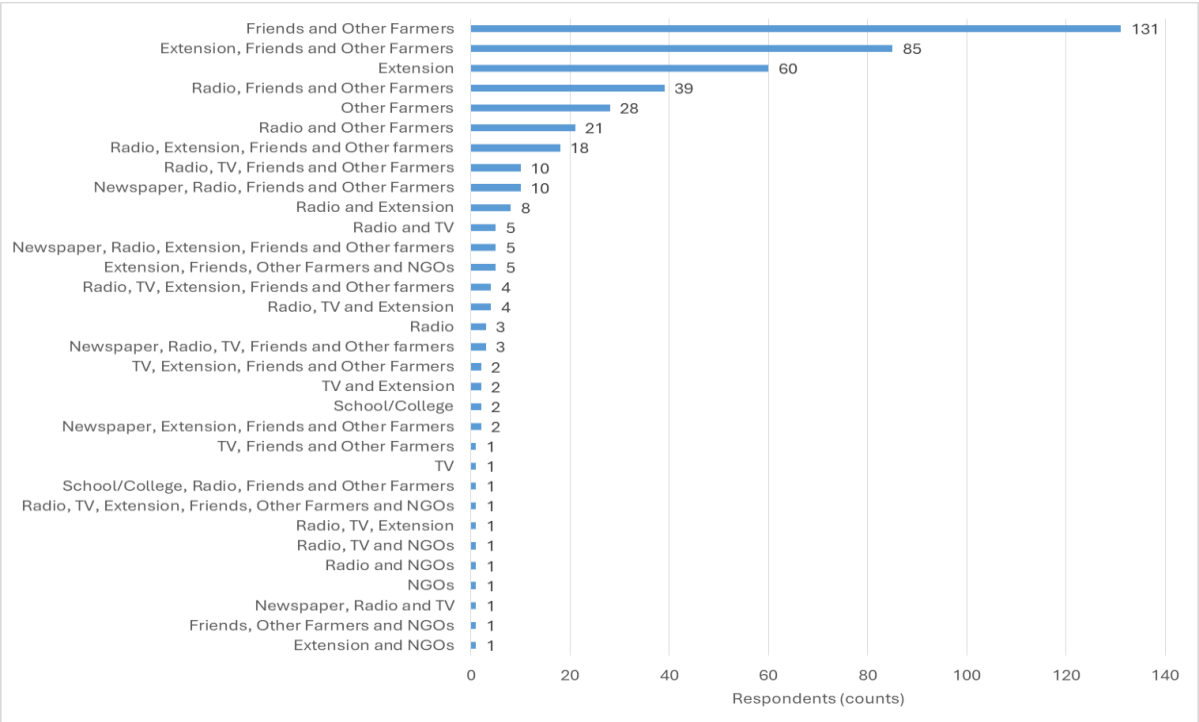

Figure 16: Temporal Distribution of When the Farmer Heard About Aflatoxin

Figure 17 presents a widespread misunderstanding among farmers about the causes of aflatoxin. The data shows that a significant majority of both project (68.7%) and non-project (75.2%) farmers incorrectly believe insect pests are the primary cause of contamination. Rodents were the second most frequently cited incorrect cause of aflatoxin contamination by both groups.

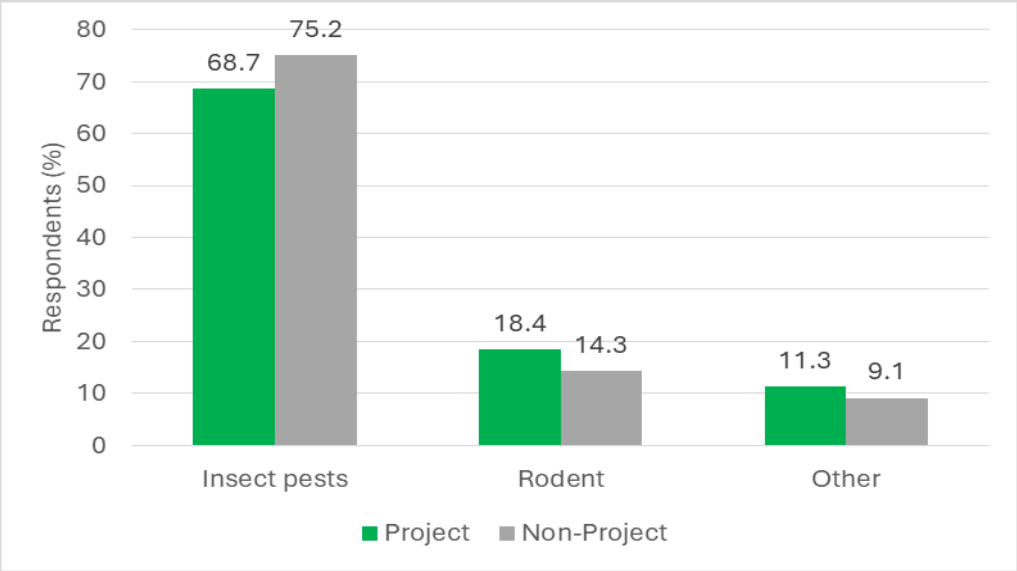

Figure 17: Farmer Reported Causes of Aflatoxin Contamination

As farmers do not do any technical tests, predominantly the signs of aflatoxin contamination recognized by farmers included those that are largely visible or sensed (Figure 18). These include discolouration, visible mouldiness, wetness, insect infestation and mouldy smell (51%). These signs are not by themselves affirmative of the aflatoxin contamination but rather favourable factors for aflatoxin-producing fungi to release toxins.

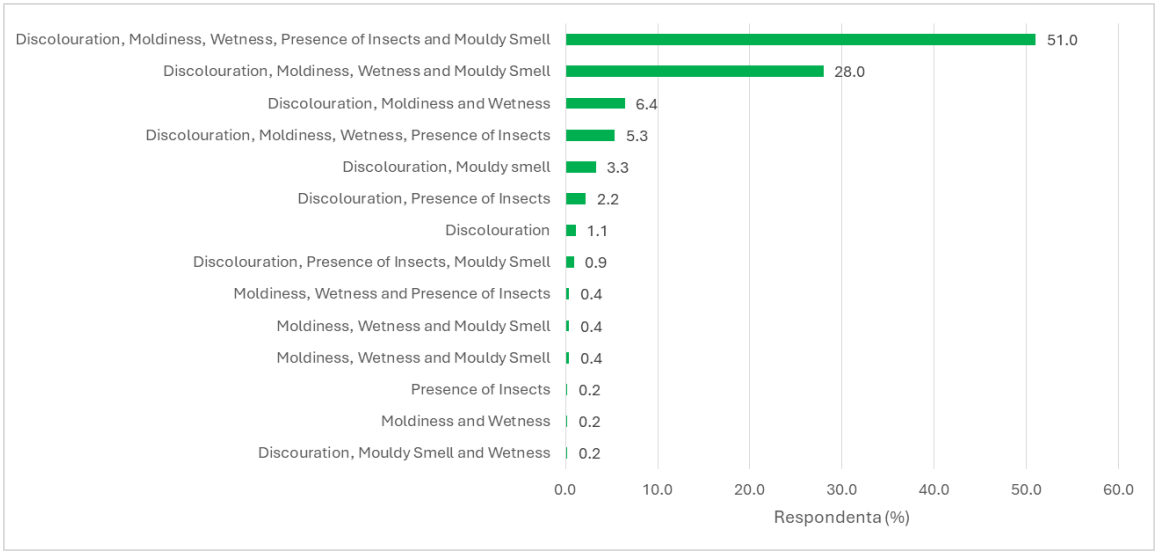

Figure 18: Farmer Reported Signs of Aflatoxin Contamination

The analysis of farmers' awareness of food safety risks reveals a significant knowledge gap between project and non-project participants. A striking finding is that nearly a third of non-project farmers, 32%, could not name any food safety hazards, indicating low awareness in the group (Figure 20). Project farmers demonstrated an understanding various food hazards. They not only identified single issues but frequently pointed to complex, concurrent risks. For instance, approximately 25% of project farmers recognized the combined threat of aflatoxin, pesticide residues, heavy metals, and microbial contaminants—the most cited response in that group. High awareness was also shown for microbial risks alone (~23%) and other multi-hazard scenarios involving aflatoxin, pesticide residues, and physical contaminants. This heightened understanding among project participants is likely a direct outcome of the project's intensive awareness-creation activities, particularly those focused on aflatoxin. The data strongly suggests the project might have contributed in the promotion of safe food.

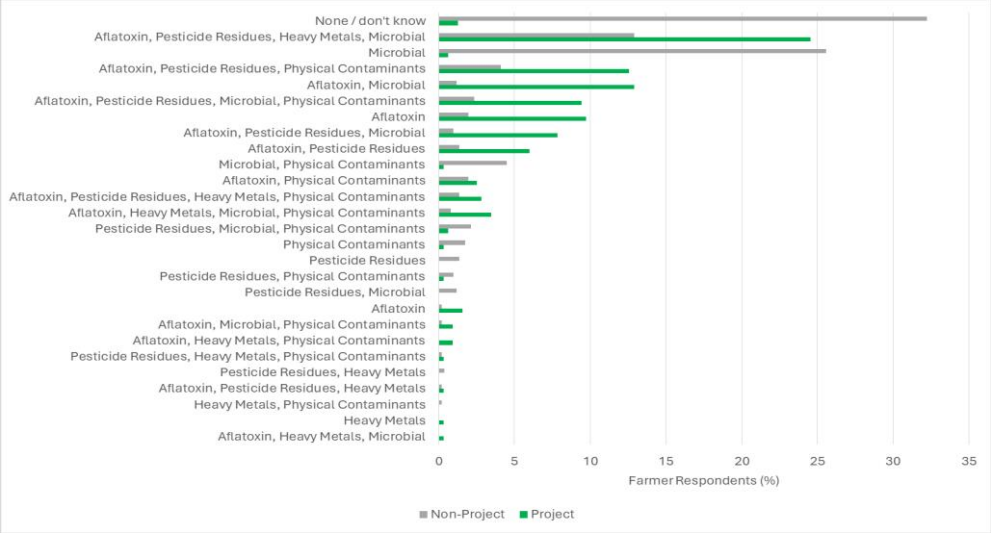

Figure 20: Food Safety Risks that Farmers Knew About

6.2.3 Adoption of Pre- and Post- Harvest GAPs

The Difference-in-Differences (D-D) counterfactual analysis reveals the project had a significant and positive net impact on the adoption of both pre-harvest and post-harvest Good Agricultural Practices (GAPs). The results isolate the project's influence by comparing the change in adoption rates between project and non-project farmers over the same period (Table 6).

The project's impact was substantial for pre-harvest activities, resulting in a 19-point net increase in the average adoption rate. The analysis shows the project was particularly effective in promoting the use of Aflasafe, which saw a 35-point increase in adoption attributable to the project. Other areas with major project-driven improvements include the proper use of improved inputs (D-D of 29), crop protection (27), and timely land preparation (22). In contrast, the project had a minimal effect on practices like improved cropping systems (2) and proper weeding (4).

The project also positively influenced post-harvest GAPs, leading to a 12-point average increase in adoption compared to the control group. The greatest impact was observed in hygienic handling of harvests, with a remarkable 37-point net increase. Farmers in the project also showed significantly higher adoption of using tarpaulins (D-D of 31), sorting mouldy and damaged produce (29), and employing proper shelling techniques to avoid grain damage (20). However, the project had no discernible impact on several post-harvest practices, such as proper transportation, drying produce to the required moisture level, and the use of storage pesticides, all of which had a D-D value of 0.

Table 6: Counterfactual Assessment of Adoption of GAPs among Project and Non-Project Farmers

Good Agricultural Practices	Differences in Adoption Rates After and Before 2020		Counterfactual (D-D)
	Project	Non-Project	
Pre-Harvest Good Agricultural Practices (GAPs)			
Use of Bio-Control Product (Aflasafe)	35	0	35
Proper Use of Improved Inputs	50	22	29
Crop Protection Including Proper Use of Pesticides	41	14	27
Timely Land preparation	27	5	22
Line Planting and Spacing	33	12	21
Timely Planting	20	2	18
Timely Harvesting	15	5	10
Proper Weeding	16	12	4
Improved Cropping Systems (rotation, intercropping)	2	0	2
Average Adoption Rate of Pre-Harvest GAPs	***27***	***8***	***19***
Post-Harvest Good Agricultural Practices (GAPs)			
Hygienic Practices During Handling of Harvests	60	23	37
Use of Tarpaulins in Handling Produce	53	22	31
Sorting of Mouldy and Damaged Produce	37	8	29
De-Hulling Before Milling	28	4	24
Proper Shelling to Avoid Mechanical Damage of Grains	36	16	20
Use of Hermetic Bags	41	25	16
Pre-storage Cleaning and Sorting	23	8	15
Use of Shelling Machines	33	21	12
Stacking of Bags in Stores (esp. use of pallets)	18	7	11
Clean and Sort Before Milling	17	9	8
Avoid Piling Undried Produce	18	11	7
Proper Storage of Processed Flour (dry)	16	9	7
Properly Designed Storage Facility	29	23	6
Avoiding Transporting Produce When it is very Wet	12	7	5
Proper Drying	3	1	3
Grain Carrier Dry, Clean and Rain/Dust Proofing	16	14	2
Proper Use of Storage Pesticides	1	1	0
Proper Transportation (Lining the Vehicle)	0	0	0
Drying Produce to Required Moisture Level	0	0	0
Average Adoption Rate of Post-Harvest GAPs	***23***	***11***	***12***

To fairly measure the project's success, we must account for pre-existing differences between project and non-project farmers. We use Propensity Score Matching (PSM), a statistical matchmaking tool, to create "statistical twins" or “best neighbours” by pairing

project farmers with non-project farmers who are nearly identical in characteristics like farm size, income and education. This ensures comparison of comparable subjects, hence isolating the project's true effect – as compared farmers were more or less similar with only difference being that project farmers received interventions while their counterparts did not.

Post-matching statistical diagnostics[38] demonstrated a stronger statistical matching of farmers in the treatment and control groups, hence comparable against the treatment effects. As explained earlier under the methodology part, the intervention outcome (adoption of GAPs) was measured through the respective GAI. The post-matching regression estimation revealed a significant and positive outcome: the project substantially increased the adoption of GAPs among project farmers by a 2.29-point significantly higher ($p < 0.001$) than their matched counterparts (non-project). This result provides strong evidence of the project's success in promoting improved farming methods, demonstrating its direct and measurable impact on farmer behavior and practices.

Furthermore, the findings indicate that farmers predominantly learned about Good Agricultural Practices (GAPs) from their peers. Overall, 74.1% of respondents cited their peer farmers as their main source of knowledge, a finding that holds true for both project (67.0%) and non-project (78.5%) farmers. This significant reliance on peer learning is consistent with the project's farmer-to-farmer outreach strategy, which required lead farmers participating in the FFS to train their peers. Government extension staff were the second most important source of information (25.3%). Project farmers reported a relatively higher reliance on government extension (32.4%) than non-project farmers (20.9%). This difference is likely due to the project's collaboration with the public extension system in the project districts. Notably, NGOs were a negligible source of information for all respondents (0.6%).

Figure 21: Farmer Reported Main Sources of Knowledge on GAPs

[38] The intercept of the model, representing the mean *GAI* in the control group, was estimated at 7.00 (SE = 0.32, $p < 0.001$). The model accounted for approximately 18.7% of the variance in GAI ($R^2 = 0.187$), indicating a moderate fit.

6.2.3 Agriculture Production and Productivity

Maize cultivation is by almost every farmer –with 96.7% of respondents growing the crop. Groundnut cultivation is significantly lower at 33.1% participation. This indicates that maize is the dominant crop among the surveyed farmers. Maize cultivation is high for both sexes (female: 97.0%; male: 97.2%), showing no significant gender disparity in growing the staple crop. Groundnut cultivation is slightly higher among male respondents (35.8%) compared to female respondents (30.8%). When grown for subsistence needs groundnuts is traditionally the women crop. In major groundnuts producing areas like Nanyumbu, groundnuts is grown mainly for cash and sold at better prices – hence likely to attract men.

Both average and median maize yield and revenue levels of maize were higher among project farmers as compared to non-project farmers (Table 8). The yield medians of the least (1st Quartile) and highly (3rd Quartile) performing farmers were higher among project farmers than their counterparts. Although the project farmers realized more revenue on average, but such gross income was not much different from that earned by non-project farmers. Likely due to market dynamics, the yield increment among project farmers over their counterparts did not translated into revenue difference.

The analysis clearly indicates that project farmers achieved significantly higher maize productivity than non-project farmers (Table 7). The mean yield for project participants was 1.92 Mt/Ha, compared to just 1.39 Mt/Ha for non-participants, an advantage that was also reflected in the median and quartile yields. This productivity gain translated directly into higher income, with project farmers earning a mean revenue of TZS 555,527 per hectare versus TZS 526,583 for their counterparts. While this difference in mean revenue is statistically significant, it's noteworthy that the median, first quartile, and third quartile revenues were identical for both groups.

Table 7: Productivity and Revenue from Maize

Statistics	Project	Non-Project
Productivity (Mt/Ha)		
Mean	1.92	1.39
Median	1.26	1.12
Standard Deviation	3.38	1.46
Inter-Quartile Range	1.41	1.17
First Quartile (25th Percentile)	0.75	0.63
Third Quartile (75th Percentile)	2.16	1.80
Revenue (TZS/Ha)		
Mean	555,527	526,583
Median	500,000	500,000
Standard Deviation	169,632	143,184
Inter-Quartile Range	100,000	100,000
First Quartile (25th Percentile)	500,000	500,000
Third Quartile (75th Percentile)	600,000	600,000
Mean yields and revenues difference for maize between the two groups were statistically significant		

Results in Table 8 indicate that project farmers realized higher average productivity and revenue from groundnuts when compared to non-project farmers. The mean productivity for project farmers stands at 1.13 Mt/Ha, while non-project farmers average 0.93 Mt/Ha. The yield increment translates into revenue, with project participants earning an average of TZS 1,999,683 per hectare, which is higher than the TZS 1,786,883 earned by their non-project counterparts. The project farmers in the both least (1st Quartile) and better (3rd Quartile) performing brackets realized higher median yields than non-project farmers.

Table 8: Productivity and Revenue from Groundnuts

Statistics	Project	Non-Project
Productivity (Mt/Ha)		
Mean	1.13	0.93
Median	0.7	0.6
Standard Deviation	1.14	0.96
Inter-Quartile Range	1.03	0.9
First Quartile (25th Percentile)	0.38	0.30
Third Quartile (75th Percentile)	1.41	1.20
Revenue (TZS/Ha)		
Mean	1,999,683	1,786,883
Median	1,122,500	980,000
Standard Deviation	2,080,035	2,059,385
Inter-Quartile Range	2,109,375	1,853,396
First Quartile (25th Percentile)	590,625	507,604
Third Quartile (75th Percentile)	2,700,000	2,361,000
Mean yields and revenues difference for groundnuts between the two groups were not statistically significant		

Respondent farmers reported post-harvest losses in stored maize averaging at 2.6%, with maximum loss at 83%. Storage losses in both maize and grains were mainly due to insect pests and rodents. Furthermore, insect pests was widely reported by farmers as the most significant cause of storage losses for both maize and groundnuts – accounting for 76.6% and 59.1% of farmers' responses, respectively (Figure 22). Rodents are the second leading cause of storage losses for both crops, accounting for 17.6% and 30% of the responses for both maize and groundnuts, respectively. Notably, mould was not widely reported, but might still be a major issue. This is likely because the damage from pests and rodents is quantitative and easily visible to farmers, whereas mould infestation causes more qualitative damage that may be less seriously regarded.

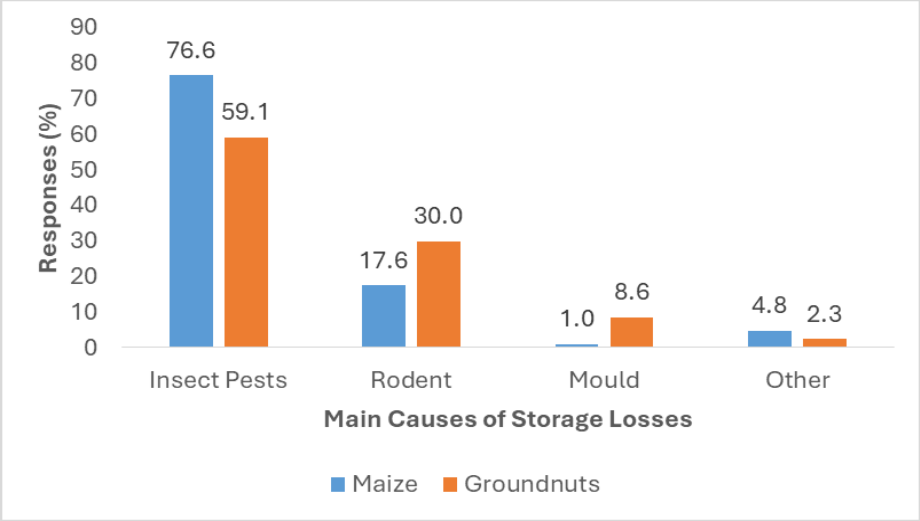

Figure 22: Causes of Storage Losses in Maize and Groundnuts

6.2.4 Farm-Level Handling and Market Acceptability of Mouldy Maize and Groundnuts rains

The majority of farmers, both project (86.8%) and non-project (74.6%), reported sorting and discarding mouldy maize and groundnuts, indicating a general awareness of the risks associated with mould (Figure 23). However, some non-project farmers were more likely to engage in riskier handling practices. For instance, a higher percentage of non-project farmers reported not sorting the mouldy grains at all (10.5% vs. 4.7%) or sorting them for use in brewing and oil pressing (9.2% vs. 6.0%). A small percentage of both groups sorted out and fed the contaminated grain to livestock. These findings suggest that while disposal is the primary strategy, a notable proportion of farmers, particularly those in the non-project, still utilized mouldy grains.

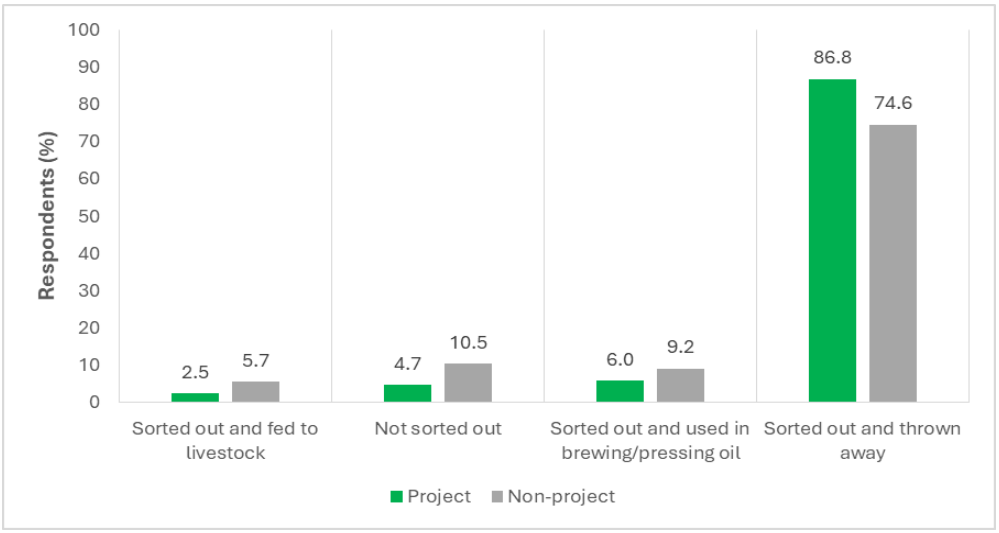

Figure 23: Farmer Reported Decisions on Mouldy Maize and Groundnuts

As presented in Figure 24, the most common trader response to mouldy grain is outright rejection until the produce is sorted, an outcome more frequently reported by project farmers (55.7%) than non-project farmers (47.7%). Conversely, non-project farmers more often reported that traders would simply "complain and pay less" (28.9% vs. 21.7%). This suggests that with less-informed farmers, buyers may use mould contamination as a bargaining tool to negotiate a discounted price. Project farmers, informed by awareness training, might have influenced buying traders to conduct themselves a food safety ensuring manner. Contrary, traders dealing with farmers less or uninformed on food safety seem to be more likely to purchase unsafe produce unscrupulously mix with clean produce or repurpose unsafe produce for uses like brewing or animal feed.

Figure 24: Farmer Reported Traders' Decisions on Mouldy Maize and Groundnuts

6.2.5 Distribution of Household Income

The project intervention, aimed at improving the production and marketing of aflatoxin-safe maize and groundnuts, was expected to have a significant positive income effect. However, the results show no significant difference in monthly household income between project and non-project farmers (Figure 25). The income distribution is remarkably similar across most income levels. For instance, 48.9% of project farmers and 47.0% of non-project farmers earn less than 100,000 TZS per month. However, maize and groundnuts is only a fraction of the portfolio of household income sources.

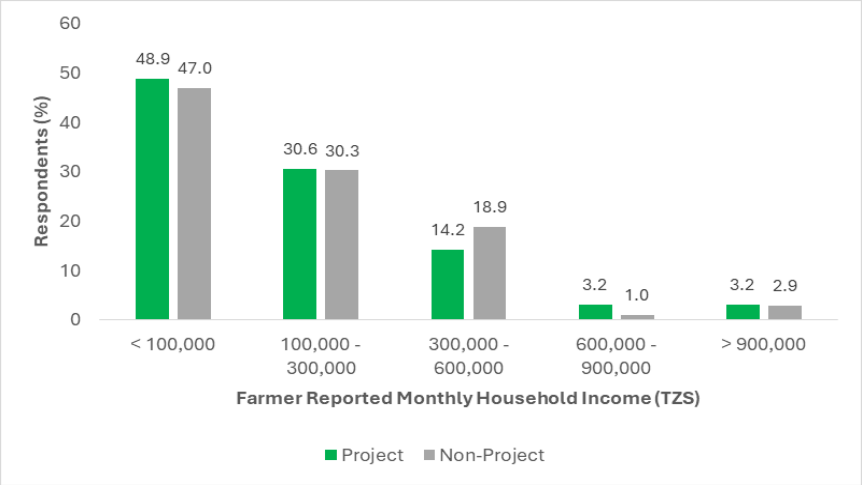

Figure 25: Farmer Reported Monthly Household Income

However, crop enterprise contributes significantly more to the household income of project farmers. On average, crop farming accounts for 60.7% of total income for project households, compared to 48.9% for non-project households (Table 9). This suggests that while overall household income did not differ significantly between the two groups, the crop enterprise contributes relatively more the incomes of the project farmers than their counterparts.

Table 9: Contribution (%) of crop farming to the household income

Statistics	Project	Non-Project
Mean	60.7	48.9
Median	60.0	50.0
Standard Deviation	25.9	28.2
Inter-Quartile Range	45.0	45.0
First Quartile (25th Percentile)	40.0	25.0
Third Quartile (75th Percentile)	85.0	70.0

6.2.5 Food and Nutrition Security

Before and after the project, the both project and non-project households took more than two meals per day –for both adults and children members (Tables 10 and 11). However, project households too more slightly more meals on average than their counterparts after 2020 for both adults (2.8 vs. 2.7) and under-five children (2.74 vs. 2.66). The median number meals taken by adults from project households in both sects (1st and 3rd Quartiles) – but there were no difference in terms how frequently two groups fed their under-5 children.

Table 10: Number of Meals per day taken by Adults After and Before 2020

Statistics	After 2020 to Now		Before 2020	
	Project	Non-Project	Project	Non-Project
Mean	2.8	2.7	2.7	2.7
Median	3	3	3	3
Standard Deviation	0.43	0.48	0.51	0.51
Minimum	2	2	2	2
Maximum	3	4	5	5
Inter-Quartile Range	1	1	1	1
First Quartile (25th Percentile)	2.3	2.0	2.0	2.0
Third Quartile (75th Percentile)	3	3	3	3

Table 11: Number of Meals per day taken by Under-5 Children After and Before 2020

Statistics	After 2020 to Now		Before 2020	
	Project	Non-Project	Project	Non-Project
Mean	2.74	2.66	2.88	2.73
Median	3	3	3	3
Standard Deviation	1.19	1.29	1.06	1.23
Minimum	0	0	0	0
Maximum	6	6	6	6
Inter-Quartile Range	0	1	0	0
First Quartile (25th Percentile)	3	3	3	3
Third Quartile (75th Percentile)	2	3	3	3

The end-line farmer survey collected data on food consumption that enabled estimation of the household dietary diversity – one of the project's key indicator on food and nutrition outcomes. Food safety risks including aflatoxin tend to vary among a variety of foods – as the vary on how each food is grown and handled in the supply chain until it reaches the final consumer and how it is finally prepared for consumption. Thus, dietary diversification remains one of the strategies of mitigating exposure to aflatoxin contamination as well as other food safety hazards. In this context, respondent farmers were asked to report on the weekly frequency (days) of consuming a variety of food items that were later during the analysis clustered into respective 12 dietary food groups (Table 12).

Table 12: Distribution of food items covered in farmer survey into dietary groups

Dietary Food Groups		Food Items Covered in Farmer Survey
1	Cereals	Porridge (uji), Stiff porridge (ugali), Rice, Sorghum, Millet, Wheat, Bread/buns/chapati, Makande (maize and beans)
2	White Tubers and Roots	Irish potatoes, Sweet potatoes, Cassava, Banana
3	Vegetables	Green vegetables, Mushroom
4	Fruits	Fruits
5	Meat	Beef, Pork, Chicken
6	Eggs	Eggs
7	Fish and Seafood	Fish, Sardines

8	Legumes, Nuts, and Seeds	Beans, Soya bean, Bambara nuts (njugu mawe), Peanuts as snacks, Peanuts as ingredient in food/sauce, Pigeon peas (mbaazi), Cow peas (kunde), Mung beans/green gram (choroko)
9	Milk and Milk Products	Fresh milk, Fermented milk, Tea with milk
10	Oils and Fats	Groundnut oil, Sunflower oil
11	Spices, Condiments, Beverages	Tea, Local beer, Spices
12	Not typically specified, but was considered	Others

Computation of the Household Dietary Diversity Score (HDDS) involved counting whether the household reported consumption of any food item within each of the 12 groups. Therefore, the maximum counts is 12, meaning that the household diversifies within the bounds of 12 dietary groups. The results in Table 13 indicate that the project households had a more diversified mix of diets – at average and median as well. Even by looking into the levels of within sects in both groups, the least diversified in diet-wise among the project households ate from an extra one dietary group above the non-project households.

Table 13: Household Dietary Diversity Scores

Statistics	**Project**	**Non-Project**
Mean*	9.33	8.51
Median	10	9
Standard Deviation	1.77	1.79
Minimum	1	1
Maximum	12	12
Inter-Quartile Range	3	3
First Quartile (25th Percentile)	8	7
Third Quartile (75th Percentile)	11	10
** The mean difference between project and non-project households was statistically significant (P<0.001)*		

PART SEVEN
PROJECT PERFORMANCE:
AN EMPERICAL VERIFICATION

7

7.0 An Overview

Part Seven covers a thorough evaluation of performance of the project in terms of its contribution to the higher-level impacts, achieved outcomes, outputs and outputs from planned activities and investments. The final updated results matrix of the project is the foundation of the evaluation – to subject the results to wealth empirical evidence to objectively verify results-based performance of the project. Therefore, the very component of this Part include: 1) An Outlook of the Project's Development Objective; 2) Contribution of the Project the High-Level Goals and Impacts; 3) Evaluation of the Project Performance towards Outcomes, and 4) Evaluation of the Project Performance towards Outputs.

7.1 Development Objective

The overall development objective of TANIPAC project was to contribute to the agricultural sector growth and safeguard public health through prevention and control of aflatoxin in the Tanzanian food system. The project's strategic purpose was to improve food and nutrition security, and agri-food trade through food safety centric interventions in the maize and groundnuts value chains – and ultimately contribute to poverty reduction.

The project's development objective remain relevant to Tanzania, given the country's economy-wide and sector transformation ambitions. Addressing food safety concerns such as aflatoxin, is the gateway for Tanzania to realize it vision of becoming a competitive agri-food trade hub in the region and Africa at large. As stipulated in its Agricultural Master Plan (AMP), Tanzania targets to realize a net agricultural exports valued at US$ 6 billion by 2030 and over US$ 20 by 2050 (from current US$ 1.2 billion). Indeed, this vision is being walked as Tanzania is a leading producer of grains in the East Africa Community (EAC) and among the three big producers in the Eastern and Southern Africa after Ethiopia and South Africa.

Furthermore, the ambition of Tanzania feeding the continent and the world has been reiterated in the country's recent Development Vision 2050 (TDV 2050) with Tanzania intending to be the leading producer of food in Africa and among top 10 food producers in the world by 2050. Achieving such development ambitions requires Tanzania to address food safety concerns including aflatoxin.

7.2 Results-Based Performance Evaluation

This end-line evaluation uses the results-based matrix that was updated by end of June 2025. In cognizance that the project has been extended until end of December 2025 – the might be some updates that will be accommodated in this end-line evaluation report.

7.2.1 Project Impacts Pathways

The impact pathways address the contribution of the TANIPAC project to national income, food security, and public health. The project's performance, as measured against its end-targets, demonstrates substantial success across economic and food security indicators, largely exceeding initial expectations.

Improved National and Household Income

The project has yielded significant economic benefits, particularly in trade and farmer profitability, over-achieving all targets set for national income improvement. Recently, the exports of maize and groundnuts have remarkably surged, which imply increased compliance with food safety export requirements. The increase in export value for both primary crops is extraordinary. The maize export value reached USD 268.2 million in 2024, far surpassing the end-target of USD 68.59 million and the baseline of USD 42.74 million. Similarly, the groundnuts export Value soared to 50.9 million USD, dramatically exceeding the target of USD 6.64 million (Table 7).

At the household level, farmers' income from both crops also significantly improved. The annual income from maize reached TZS 1,159,455 in 2024, surpassing the end-target of TZS 1,129,372. The improvement in income from groundnuts was even more pronounced, reaching TZS 744,882 against a target of TZS 608,711. This indicates that the project's interventions have successfully translated into tangible financial gains for participating farmers.

Improved Food and Nutrition Security

The project has successfully met or surpassed most of its goals related to food security and nutrition, marking a substantial reduction in vulnerability of women and children through improved food safety and quality of diets. The most impressive achievement in this category is the dramatic drop in Moderate to Severe Food Insecurity (measured through FIES). The rate plummeted from a baseline of 55.1% to just 10.9% in 2024, significantly over-achieving the end-target of 27.6%. This suggests a successful intervention in stabilizing household food supply. Tanzania has improved its food self-sufficiency position. The Food Self-Sufficiency Ratio (FSSR) has improved from 120 to 124, meeting the target of >120 (Table 14).

Significant progress has been made in dietary diversification. The Women's Minimum Dietary Diversity (MDD) score more than doubled, increasing from 2/12 to 5/12, handily surpassing the end-target of 3/12. The Children's Minimum Dietary Diversity also successfully reached its end-target of 3/7. However, while the Child Stunting Rate decreased from 31.8% to 30.2%, it had not yet met the ambitious end-target of 28% at the time of the 2022 evaluation.

Table 14: Improved Food and Nutrition Security, National Income and Public Health (Impacts)

Results	Unit	Description	Baseline year	Baseline Value	End-Target	Evaluation as of 30th June 2025	Achievement
Impact Indicator 1: Improved national Income	USD	Maize Export Value	2019/20	42,736,000	68,590,000	268,200,000	
		Groundnut Export Value	2019/20	2,213,000	6,640,000	50,900,000	
	TZS	Farmer's income from maize	2019/20	1,075,592	1,129,372	1,159,455	
		Farmer's income groundnuts	2019/20	579,725	608,711	744,882	
Impact Indicator 2: Improved Food and Nutrition Security	%	Food Self-Sufficiency Ratio (FSSR)	2019/20	120	>120	124	
	%	Moderate to Severe Food Insecurity – measured through FIES	2019/20	55.1	27.6	10.9	
	Number	Women's Minimum Dietary Diversity (MDD)	2019/20	2/12	3/12	5/12	
		Children's Minimum Dietary Diversity (< 5 years)	2019/20	2/7	3/7	3/7	
	%	Child Stunting Rate	2019/20	31.8	28	30.2	
Performance Evaluation Colour-Codes: Deep Green = end-target fully achieved							

7.2.2 Increased Quantity of Safe Product Consumed and Traded

Table 8 provides details on the performance of the TANIPAC project against its set of outcomes: Outcome 2.1 on "increased quantity of safe maize and groundnuts products consumed and traded" and Outcome 2.2 on "improved adoption of aflatoxin smart technologies". The project has demonstrated notable success in awareness creation, knowledge transfer and adoption of technologies and practices – and production. Zanzibar is a net important of grains mainly from Mainland Tanzania where farm-level aflatoxin interventions were emphasized. In this respect, there were no farm-level targets on production of maize and groundnuts for Zanzibar. However, it is worth reporting on the production statistics.

Outcome 2.1: Increased Quantity of Safe Product Consumed and Traded

The project achieved significant success in improving the safety of maize, over-achieving its target. The percentage of safe maize complying with aflatoxin levels rose from a baseline of 77.6% to 93.5% by end of the project, surpassing the end-target of 86% (Table 8). This reflects an improvement in the prevention and mitigation of aflatoxin contamination in maize. While groundnut safety also improved from a baseline of 81.7% to 89.9%, it fell just short of the ambitious end-target of 92%. This suggests aflatoxin control measures for groundnuts still face some challenges compared to maize.

Performance in increasing production was mixed across the two crops, while trade volume showed strong growth. Maize production in Tanzania Mainland (TZM) increased from 6,002,000 Mt to 6,500,000 Mt, moving beyond the baseline but failing to reach the end-target of 8,011,000 Mt (Table 8).

Groundnut production in Tanzania Mainland (TZM) experienced a decline, dropping from a baseline of 895,219 Mt to 586,216 Mt in 2024, placing it below the baseline and far from the target of 900,000 Mt. This negative performance highlights a potential challenge in scaling groundnut cultivation or addressing factors leading to output reduction.

Despite the mixed production results, exports exceeded their targets. Maize export volume reached 581,438 Mt, surpassing the target of 400,000 Mt. Groundnut export volume reached 23,568 Mt, nearly meeting the target of 26,150 Mt. The percentage of maize export also exceeded its target (7.3% vs. 6.2% target).

Outcome 2.2: Improved Adoption of Aflatoxin Smart Pre- and Post-Harvest Technologies

The project successfully disseminated information about aflatoxin and related technologies to target groups. Awareness among farmers rose dramatically from 32.4% to 89.5%, far exceeding the 75% target. Value Chain Actors (VCAs) achieved 100% awareness, surpassing the 75% target. Similarly, awareness of pre- and post-harvest technologies among farmers reached 87.9% (Target 75%), and reached 100% among VCAs (Table 15).

The high awareness translated directly into strong adoption rates. The adoption rate of pre- and post-harvest technologies and practices by farmers reached 75%, significantly exceeding the end-target of 60% (Table 8). The adoption rate among VCAs reached 100%, surpassing the target of 86%.

Apparently, the project has been highly successful in improving crop safety, awareness, and the adoption of technologies, and in significantly increasing export trade. However, the challenges still exist in meeting quantitative production targets, especially for groundnuts, which exhibited a decline in production volume. Increasing productivity and production remains a priority of the transformation of agriculture in the country.

Table 15: Delivery of Project Outcomes (Outcomes 2.1 and 2.2)

Results/Indicator (as per RLF)	Unit	Description	Baseline (year)	Baseline Value	End-Target	Evaluation by 30th June 2025	Achievement
Outcome 2.1: Increased quantity of maize and groundnuts and related by-products consumed and traded							
Indicator 1: Safe maize and groundnuts that comply aflatoxin levels	%	Maize	2019/20	77.6	86	93.5	
	%	Groundnuts	2019/20	81.7	92	89.9	
Indicator 2: Agricultural production sold in the regional markets	Mt	Maize production, TZM	2019/20	6,002,000	8,011,000	6,500,000	
		Maize production, ZNZ	2020	1,599.9	2,121.2	Not set	
	Mt	Maize export	2019/20	168,923	400,000	581,438	
	%	Maize export	2019/20	3.1	6.2	7.3	
	Mt	Groundnuts production, TZM	2019/20	895,219	900,000	586,216	
		Groundnuts production, ZNZ	2019/20	433.1	698	Not set	
	Mt	Groundnut export, TZM	2019/20	11,784	26,150	23,568	
	%	Groundnuts export, TZM	2019/20	1.3	2.6	4.5	
Outcome 2.2: Improved adoption of aflatoxin smart pre- and post- harvest technologies							
Indicator 3: Awareness rate on aflatoxin problem	%	Farmers	2019/20	32.4	75	89.5	
		Value Chain Actors (VCAs)	2019/20	54	75	100	
	%	Farmers	2019/20	23	75	87.9	

Results/Indicator (as per RLF)	Unit	Description	Baseline (year)	Baseline Value	End-Target	Evaluation by 30th June 2025	Achievement
Indicator 4: Awareness rate of pre- and post-harvest technologies and practices		Value Chain Actors (VCA)	2019/20	45	75	100	
Indicator 5: Adoption rate of pre- and post- harvest technologies and practices	%	Farmers	2019/20	10	60	75	
		Value Chain Actors (VCAs)	2019/20	75	86	100	
Performance Evaluation Colour-Codes: Grey = target not set; Deep Green = end-target fully achieved, Light Green = above the baseline, but end-target not achieved, and Red = negative performance, below the baseline.							

7.2.3 Infrastructure Development (Output 1)

TANIPAC's Output 1 focuses on the development of physical infrastructure for post-harvest management (PHM) and aflatoxin control. The project successfully delivered on all planned physical infrastructure. All four indicators for Output 1 have been achieved (Table 16).

The target of developing and equipping NBCU was fully met by end-of the project. This achievement is vital for domestically manufacturing and deploying Aflasafe or similar bio-control agents, essential for pre-harvest aflatoxin mitigation – and enhanced food safety. Tanzania Plant Health and Pesticides Authority (TPHPA) is the frontline operator of the NBCU.

The project achieved its goal of establishing and equipping CARL. Serving as the central facility, CARL has the potential advancing food safety in the country through delivery a range of services including, inter alia, accurate for soil and plant testing, aflatoxin testing, standardization of testing protocols, and food safety laboratory services. Tanzania Agriculture Research Institute (TARI) is the frontline operator of the CARL facility.

Establishing and equipping the PHCoE for grains was fully achieved. This centre serves as a hub for technology transfer, agro-processing and marketing of grains. The project envisioned the PHCoE to contribute in the transformation of the Tanzanian grain sector by ensuring food safety and market competitiveness. The PHCoE is managed by the National Food Reserve Agency (NFRA).

Furthermore, the project successfully constructed and equipped 14 community-level storage warehouses with in-door and outdoor PHM facilities. The grain storage facilities are managed by the NFRA as a frontline operator involving buying grains from farmers with enforcement of quality and safety compliance. In food insecure regions, the maize stocks at the facilities would be available later on for purchase by the local communities.

Table 16: Evaluation of Infrastructure for PHM and Aflatoxin Control Developed (Output 1)

Results/Indicator (as per RLF)	Unit	Description	Baseline (year)	Baseline Value	End-Target	Evaluation by 30th June 2025	Achievement
Indicator 1: National Biological Control Unit (NBCU) Strengthened	Number	NBCU constructed and equipped	2019/20	0	1	1	
Indicator 2: Post Harvest Centre of Excellence for grains Established	Number	PHCoE constructed and equipped	2019/20	0	1	1	
Indicator 3: Central Agricultural Reference Laboratory (CARL) Established and Equipped	Number	CARL constructed and equipped	2019/20	0	1	1	
Indicator 4: Community-Level Storage Facilities Constructed and Equipped	Number	Warehouses Constructed and Equipped	2019/20	0	14	14	
Performance Evaluation Colour-Codes: Deep Green = end-target fully achieved							

7.2.4 Awareness creation and Capacity Building (Output 2.1)

The output (2.1) addresses awareness creation – and strengthening institutions involved agricultural R&D and food safety regulation. Output 2.1 is characterized by a high degree of success in training and capacity development, with most direct targets being met or significantly exceeded. However, there are a few results areas where the achievement narrowly fell below the actual targets.

Direct Training and Capacity Development

The target of training 60,000 farmers was largely met across all three outreach modalities – seminars, meetings, and workshops reached (61,910); Farmer Field Schools (FFS) and Demonstrations (59,482). Training on PHM technologies and practices also reached 59,482 farmers, confirming wide awareness creation and dissemination of practical knowledge (Table 10).

The training of technical facilitators was successful. The number of extension workers trained/retooled on aflatoxin-smart GAPs reached 1,351, which is more than double the end-target of 669. Furthermore, the target of training 100 tutors on aflatoxin management modules was fully achieved, securing the long-term institutional capacity for knowledge transfer.

Farmer Engagement and FFS Operationalization

The results indicate success in engaging farmers through on-farm interactive learning environments. A total of 59,482 farmers enrolled and participated in the FFS and on-farm demonstrations, almost fully achieving the end-target of 60,000 farmers. This reflects high demand and successful implementation of the participatory learning model. The project established 180 clusters of farmer-based FFS and demonstrations – representing a near-complete achievement of the target of 200 clusters. This suggests a robust network of field-level learning and demonstration sites was effectively operationalized.

Post-Harvest Technology Promotion and Supply Chain Development

Ensuring availability, accessibility and affordability of technologies was central in the project vision of deploying aflatoxin-smart PHM. In this regard, the project embarked on promoting hermetic technologies (bags and silos) and developing the private sector driven supply chain of these technologies. The promotion part of the PHM technologies involved practical training and demonstrations with target beneficiaries (farmers and VCAs). The project achieved the target of training business actors in the maize and groundnuts value chains – transporters, traders and processors (5,547) – were trained on aflatoxin occurrence, effects and control through good PHM technologies (Table 17).

The project procured a considerable number of PHM from manufacturers that were used during the practical training and demonstrations – that were ultimately left with farmers to continue using them after the training. The target was to procure 300,000 hermitic bags (PICS) for the practical trainings and demonstrations with target beneficiaries – the target was exceeded with 470,000 procured, used in practical trainings and finally distributed to farmers. In the promotion of PHM technologies through different platforms – field trainings and demonstrations, and national and regional outreach events – the project collaborated with the private manufacturer of the hermetic bags (Agro-Z). Such collaboration was intended to strengthen the technology supply chain through improved linkages of the manufacturer and potential end-users.

The hermetic metal silo technology promotion and supply chain development was actualized through a special program targeting local youth artisans. The project anticipated that training and business incubation of local youth artisans on manufacturing of the metal silos was the most effective, efficient and sustainable strategy to ensure local availability, access and affordability of the technology. In this respect, the project had a target of training 400 youth artisans on manufacturing of metal silo technology followed by business incubation – through a collaboration with SIDO and VETA. At the end, the project trained 420 artisans exceeding the target – incubated and equipped 393 instead the target of 400 artisans. A few of trained youth artisans did not manage to enroll in the business incubation part of the program. This successful output establishes a local supply chain capacity for hermetic metal silos storage technology.

Arguably, the project was overambitious in setting a target of capacitated youth artisans producing and selling 10,000 metal silos to customers. As discussed earlier, there were still some structural barriers, beyond the scope of project's interventions that youth artisans still faced to run a viable metal silo fabrication enterprise. Such structural barriers include costly access to workshop technology for rolling metal sheets, investment capital and inadequate technology awareness among potential customers – that would require more time and resources to address.

Table 17: Capacity Building of Farmers and Value Chain Stakeholders (Output 2.1)

Results/Indicator (as per RLF)	Unit	Description	Baseline (year)	Baseline Value	End Target	Evaluation by 30th June 2025	Achievement
Indicator 5: Farmers trained on pre- and post- harvest GAPs	Number	Trained through seminars, meetings and workshops	2019/20	0	60,000	61,910	
		Trained through Demo plots/FFS	2019/20	0	60,000	59,482	
		Trained on PHM technologies and practices	2029/20	0	60,000	59,482	
Indicator 6: Extension workers from private and public institutions Trained/Re-tooled on GAPs	Number	Trained and/or retooled on Aflatoxin-smart GAPs	2019/20	0	669	1,351	
Indicator 7: Tutors from public and private institutions trained on aflatoxin management modules	Number	Tutors trained on developed aflatoxin management modules	2019/20	0	100	100	
Indicator 8: Farmers' Field Schools ((FFS) Clusters established and operationalized	Number	Clusters of farmers in demo plots/FFS	2019	0	180	180	
Indicator 9: Farmers participation in FFS	Number	Farmers enrolled and participating in the FFS	2019/20	0	60,000	59,482	
Indicator 10: Youth artisans trained, equipped and incubated on metal silos fabrication	Number	Youth artisans trained in collaboration with VETA	2019/20	0	400	420	
		Youth artisans incubated and equipped in collaboration with SIDO	2019/20	0	400	393	
Indicator 11: Hermetic storage technologies Promoted	Number	Hermetic bags procured and distributed to resource-poor farmers	2019/20	0	300,000	470,000	
		Metal silos fabricated and distributed to farmers	2019/20	0	10,000	197	
Indicator 12: Value Chain Actors (VCAs) trained (traders, transporters, processors and SMEs)	Number	VCAs trained on aflatoxin	2019/20	0	5,000	5,547	
Performance Evaluation Colour-Codes: Grey = target not set; Deep Green = end-target fully achieved, Light Green = above the baseline, but end-target not achieved, and Red = negative performance, below the baseline.							

7.2.4 Institutional Strengthening (Output 2.2)

The project's Output 2.2 has been achieved by strengthening laboratory capacities, regulatory and human capital for sustainable aflatoxin control. With exception of long-term post-graduate training, the rest of respective project targets were achieved.

Legal and Regulatory Frameworks

The project achieved complete success in establishing a legal and regulatory environment, which is crucial for enforcing food safety standards and ensuring aflatoxin compliance across the target grain value chain. The end-target of developing and institutionalizing two Aflatoxin-related codes of practices and standards was fully achieved. These instruments provide the regulatory benchmarks for the industry's compliance and quality assurance. The target of developing and disseminating 18 by-laws for Local Government Authorities (LGAs) was met. This achievement is particularly

significant as it localizes the enforcement of regulations for aflatoxin prevention and control at the local level. The final target of developing two aflatoxin control guidelines (regulations) was also fully met. Overall, the successful delivery of all legal instrument targets provides the necessary legal teeth for sustained aflatoxin management and enforcement.

In-Service Staff Training and Capacity

The project invested in upgrading the skills of existing staff on aflatoxin problem. This helped to build an informed human capacity foundation needed to address aflatoxin and other food safety concerns in the food system. The project exceeded its target for short-course training, successfully training 20 staff against a target of 15 (Table 18). As a post-sale arrangement, the project engaged the laboratory equipment suppliers to train laboratory technicians and technical staff on professional and hands-on laboratory analytical skills using the supplied equipment, and a total 63 staff were trained exceeding the target of 60. This is vital for maintaining the operational integrity of the supplied equipment.

Another area of instructional strengthening entailed running a project scholarship program for long-term training at Masters and PhD levels. The post-graduate scholarship targeted mainly young early-carrier technical staff within the Ministry of Agriculture. As any scholarship, the enrollment was through a competitive and thematic process. The candidates were required to apply along the research themes addressing aflatoxin-related knowledge and technological gaps. In 2020/21, a total of 30 candidates were enrolled – comprising 22 and 8 applicants for Masters and PhD enrollments, respectively. However, within a few months of enrollment about 7 candidates dropped out at the very beginning of the scholarship. Thus, the project's scholarship advanced with 28 candidates (6 PhDs and 22 Masters) whom the project contracted with and started to support. On the way as of 30th June 2025, 9 candidates in total have dropped-out or are not anyhow likely to graduate. So far, 1 PhD has graduated and 2 are likely to graduate in November 2025. For Masters, 9 students have graduated and 7 are expected to graduate in November 2025. The project's achievement with long-term academic training entails 19 postgraduate candidates who have graduated or are expected to graduate by end of 2025. Such achievement is about 82.6% of the 23 candidates who formally enrolled in the program.

Table 18: Evaluation of Institutional Strengthening (Output 2.2)

Results/Indicator (as per RLF)	Unit	Description	Baseline (year)	Baseline Value	End Target	Evaluation by 30th June 2025	Achievement
Indicator 13: Legal instruments developed and disseminated for aflatoxin management	Number	Aflatoxin related codes of practices and standards developed and institutionalized	2019/20	0	2	2	
		By-laws for LGAs	2019/20	0	18	18	
		Aflatoxin control guidelines (regulations)	2019/20	0	2	2	
Indicator 14: In-service staff Trained	Number	Short course training	2019/20	0	15	20	
		Long course training	2019/20	0	23	23	
		Long course trainees graduated	2019/20	0	23	19	
		Trained on laboratory analytical skills	2019/20	0	60	63	
Indicator 15: Laboratory equipment procured and commissioned to regulatory and research institutions	Number	HPLC	2019/20	0	2	2	
		LC-MS/MS	2019/20	0	1	1	
		Investigator machine	2019/20	0	1	1	
Performance Evaluation Colour-Codes: Deep Green = end-target fully achieved, Light Green = above the baseline, but end-target not achieved							

7.2.5 Awareness Creation on Aflatoxin to the General Public (Output 2.3)

The delivery of Output 2.3 has been achieved or exceeded at or over the targets by sensitizing key stakeholders, developing a communication strategy, and distributing aflatoxin awareness materials. The results highlight an effective and multi-faceted outreach approach of the project (Table 12).

Stakeholder Awareness Creation and Outreach

The project effectively engaged influential and technical decision-makers, surpassing its engagement targets. The target for reaching key high-level stakeholders, including Members of Parliament (MP), management of agriculture line ministries, and regional/district leaders, was exceeded. The project reached 1,180 stakeholders against an end-target of 1,160. This achievement is critical for ensuring political buy-in and support for aflatoxin control policies and enforcement.

Awareness creation and sensitization of the media was also achieved – by reaching 217 journalists over the end-line target of 200. Engaging journalists ensures that technical information about aflatoxin is accurately communicated to the general public, amplifying the project's message.

Strategic Aflatoxin Communication Framework

The project successfully institutionalized a framework for coordinated communication of aflatoxin. The end-target of developing a National Aflatoxin Communication Strategy (NAfCS) was fully achieved. The development of this strategy provides a centralized, coherent plan for future public awareness campaigns. The project reached 44 stakeholders through the implementation of the NAfCS, exceeding the target of 30. However, the NAfCS needs to be promoted widely at the sub-national and local levels.

Awareness Material Development and Distribution

The quantitative output of communication materials demonstrates a strategic effort to saturate the target areas with information. The total number of awareness materials developed and distributed reached 49,494, significantly surpassing the end-target of 33,230 (Table 19). This indicates a productive effort in production and distribution of the aflatoxin Knowledge Sharing Products (KSPs).

The project distributed 44,464 printed products, far exceeding the 25,500 target. Printed materials are essential for reaching remote areas and serving as permanent reference guides for the target beneficiaries and the general public. While print distribution exceeded expectations, electronic media outputs were mixed: The target was exceeded with 12 documentaries produced against a target of 10; the number of TV programs aired fell slightly short of the target, reaching 18 programs against a target of 20; the target for radio programs was exceeded, with 170 programs aired against a target of 150; and radio is often the most accessible medium in rural farming communities, likely making this overachievement impactful. In 2019, the Tanzanian population was projected to be 55,890,747 (URT 2019[39]). The target was set to reach at least half of the 2019 population by end of the project – which was arbitrarily estimated at 50 million.

Table 19: Evaluation of Awareness creation on aflatoxin to the general public (Output 2.3)

Results/Indicator (as per RLF)	Unit	Description	Baseline (year)	Baseline Value	End Target	Evaluation by 30th June 2025	Achievement
Indicator 16: Key stakeholders reached and sensitized on aflatoxin	Number	Members of parliament, Management of Agriculture Line Ministries, Region and Districts	2019/20	0	1,160	1,180	
		Media (Journalists)	2019/20	0	200	217	
Indicator 17: National Aflatoxin Communication Strategy (NAfCS) Developed and Implemented	Number	Developed NAfCS Developed	2019/20	0	1	1	
		Stakeholders reached through the NAfCS	2019/20	0	30	44	
Indicator 18: Awareness materials Developed and Distributed	Number, Type	Awareness material developed and distributed in total	2019/20	0	33,230	49,497	
		Printed products	2019/20	0	25,500	44,464	
		Documentaries	2019/20	0	10	12	
		TV programs	2019/20	0	20	18	
		Radio programs	2019/20	0	150	127	
		Calendars	2019/20	0	2,500	3,000	
		T-Shirts and Caps	2019/20	0	5,000	4,700	
		Banners	2019/20	0	50	45	
Indicator 19: People reached with aflatoxin message	Number	Direct engagement	2019/20	0	140,509	198,212	
		Indirect engagement through media platforms	2019/20	0	50% of Tanzanians	25,000,000	
Performance Evaluation Colour-Codes: Deep Green = end-target fully achieved, Light Green = above the baseline, but end-target not achieved							

[39] URT 2019. 2019 Tanzania in Figures. NBS.

7.2.6 Management and Coordination (Output 3.1)

The project's Output 3.1 demonstrates highly effective project management and coordination, with the implementation meeting or exceeding nearly all administrative and reporting targets (Table 13). This strong organizational performance is a crucial underpinning for the successful delivery of technical outputs and the achievement of higher-level outcomes.

Planning and Reporting Compliance

The project's adherence to stringent planning and reporting requirements was excellent, with most indicators achieved. The target for submitting both quarterly progress reports and quarterly financial reports was achieved, with 22 reports submitted against a target of 20 for each. Similarly, the target for semi-annual reports was surpassed (5 achieved vs. 4 target). This level of consistent, timely, and frequent reporting indicates robust financial stewardship and operational transparency.

The number of AWPBs prepared and approved reached 6, exceeding the target of 5. Exceeding this target suggests adaptive planning or extension phases requiring additional formal planning cycles. Essential foundational documents, including the Baseline Report and the Zanzibar Aflatoxin Situation Analysis Report, were all completed on target (1 achieved for each).

Governance, Oversight and Supervision

The project maintained high fidelity to its governance structure, oversight and supervision mechanisms. The target of 10 signed Aide Memoires (AMs) was fully achieved. AMs are key deliverables from supervision missions, confirming that all planned missions took place and their findings were formally documented and agreed upon by the government and development partners.

The number of steering committee meetings reached 9, falling slightly short of the target of 10. While a minor shortfall, the high frequency still ensures continuous high-level strategic direction and problem-solving. The number of stakeholder engagement meetings reached 6, exceeding the target of 5. This indicates a proactive approach to maintaining communication, collaboration, and buy-in among key stakeholders.

Environmental and Social Safeguards

Compliance with critical environmental and social safeguard procedures was realized, demonstrating the project's commitment to responsible planning and implementation. The target for Environmental and Social Impact Assessment (ESIA) reports was fully met, with 17 reports achieved (Table 20). The target for Environmental and Social Management Plan (ESMP) reports was exceeded, with 24 reports submitted against a target of 20. The successful delivery of these safeguard documents confirms that project activities, including the construction of the strategic infrastructure (PHCoE, CARL and NBCU) and community warehouses, were executed in accordance with national and international environmental and social standards.

Table 20: Management and Coordination (Output 3.1)

Results/Indicator (as per RLF)	Unit	Description	Baseline (year)	Baseline Value	End Target	Evaluation by 30th June 2025	Achievement
Indicator 20: Management and Coordination, and reporting	Number	Annual Work Plan and Budget (AWPB) prepared and approved	2019/20	0	5	6	
		Baseline Report	2019/20	0	1	1	
		Zanzibar Aflatoxin Situation Analysis Report	2019/20	0	1	1	
		Stakeholder Engagement Meetings	2019/20	0	5	6	
		Steering Committee Meetings	2019/20	0	10	9	
		ESIA Reports	2019/20	0	17	17	
		ESMP Reports	2019/20	0	20	24	
		Quarterly Progress Reports	2019/20	0	20	24	
		Quarterly Financial Reports	2019/20	0	20	24	
		Signed Aide Memoires (AMs)	2019/20	0	10	10	
		Semi-Annual Reports	2019/20	0	10	12	
		Mid-Term Review Reports	2019/20	0	1	1	
		Project Completion Report (PCR)	2019/20	0	1	0	
		Case study & Lessons Report	2019/20	0	10	9	
		Impact Monitoring Reports	2019/20	0	1	0	
		Audit Reports (External)	2019/20	0	5	6	
		Internal Audit Reports	2019/20	0	20	24	
Performance Evaluation Colour-Codes: Deep Green = end-target fully achieved, Light Green = above the baseline, but end-target not achieved							

PART EIGHT
CONCLUSIONS, KEY LESSONS AND RECOMMENDATIONS

8

8.0 An Overview

Part Eight present conclusions, strategic successes, key constraints and gaps and finally the key strategic recommendations.

8.1 Conclusions

The TANIPAC project has been effective in addressing aflatoxin contamination, particularly in the maize value chain, demonstrating a series of transformative successes supported by clear evidence that has been underpinned in this evaluation report. The project has achieved a number of strategic successes, but still faced gaps and constraints that might have affected of the scale and scope of the results it could have achieved.

8.1.1 Strategic Successes

Enhanced Food Security and Public Health: The project made evidenced strides in improving food and nutrition security and contributing to public health by reducing aflatoxin contamination in maize, which is the major food staple and leading export food crop in the country. The report states, this was a primary goal, and its achievement is a cornerstone of the project's success.

Improved Exports of Target Crops: A major economic impact was the significant increase in the export value of maize and groundnuts that comply with aflatoxin and other food safety standards. The maize export value reached USD 268.2 million in 2024, far surpassing the end-target of USD 68.59 million and the baseline of USD 42.74 million. Similarly, the groundnuts export Value soared to 50.9 million USD, dramatically exceeding the target of USD 6.64 million.

Successful Development of Critical Infrastructure: The project successfully completed and equipped key infrastructure (PHCoE, CARL, NBCU, and 14 community storage facilities) for aflatoxin control, which will serve the national long-term transformation of the grain industry. Such strategic infrastructure include the National Biological Control Unit (NBCU) for producing Aflasafe, the Post-Harvest Center of Excellence (PHCoE) for grain management, the Central Agricultural Reference Laboratory (CARL) for testing, and 14 storage facilities.

Increased Awareness and Knowledge on Aflatoxin: TANIPAC was remarkably successful in its awareness creation and knowledge outreach, significantly exceeding its

targets for raising awareness about aflatoxin, particularly among farmers and value chain actors. The project also embarked on creation of awareness to policy-makers, politicians, and technocrats, and the general public. This widespread and inclusive awareness creation and knowledge outreach is fundamental for the long-term adoption of safer practices and governance for prevention of aflatoxin contamination.

Improved Adoption of Aflatoxin-Smart Practices: Beyond awareness, the project successfully translated awareness and knowledge into actionable practices and technologies to fight aflatoxin. The project promoted the adoption of aflatoxin-smart pre- and post- harvest technologies and practices. The end-line evaluation underscores improved behavior and adoption of a range of aflatoxin-smart GAPs.

Efficient Project Management: The project's coordination and management were highly effective, ensuring that administrative and reporting targets were met or exceeded. The report notes.

8.1.2 Key Constraints and Gaps

Despite its successes, it is also imperative for this evaluation to highlight gaps and constraints the project experienced in order to draw lessons for improvement in the current and future projects at the Ministry and in the country at large:

Lack of Sustainable Financing Post-Harvest Management Technologies for Farmers: Apart from demonstrating and promotion of PHM technologies effectively, a major challenge is the financial barrier for farmers to afford necessary technologies. The evaluation has shown that the cost of these technologies is prohibitive for most small-scale farmers, and there is a need for a financing mechanism to support their adoption. While there has been subsidies for productivity-enhancing inputs such as fertilizers and seeds for smallholder farmers– there has never been meaningful subsidies targeting PHM technologies.

Some Implementation Delays in Infrastructure Development: The project faced some delays, particularly in infrastructure development. These delays were often linked to the lengthy process of procurement and titling of land, the procurement process after the Government newly introduce D-Fund system that was lengthy than expected, unexpected poor performance of some contractors.

Funding Shortfalls and Slow Utilization: While the accounting unit of the PCT performed diligently and commended in the public finance performance overseer (NAOT) and Bank’s evaluations, the financial management faced some challenges. These challenges included, among others, the inadequate and timely release of funds from the counterpart Government and a slow 'burn rate' of the funds that were released, which was attributed to planning oversights and procurement delays. This indicates a need for better financial planning and execution in future projects.

Limited Capacity for Human Aflatoxin Monitoring: A critical gap was identified in public health monitoring. Tanzania currently lacks the capacity to conduct aflatoxin biomarker analysis in humans, which hinders the monitoring of public health impacts such as liver cancer. This limits the ability to measure the direct health benefits of the food safety interventions.

Delayed Development of Key Project Documents: The evaluation found that some important guiding documents that would have been developed and operationalized from the very begging of the project, were developed a bit late. Such documents include the gender mainstreaming guideline and the national aflatoxin communication strategy.

8.2. Recommendations

Based on the evidence presented in the report, the following strategic recommendations are proposed to build on the project's successes:

7. **Extending Promotion of PHM Technologies with Tailored Farmer Financing Model:** For smallholder farmers to ultimately access promoted PHM technologies there must a sustainable financing mechanism to support farmers in adopting and investing in post-harvest technologies.
8. **Addressing Yield Gap in Crop Agriculture:** To enhance food and nutrition security, despite of improvements in the use of productivity enhancing-inputs and mechanization in the agriculture value chain, yield gaps (realized vs. potential) are still wide in most crops including maize and groundnuts. Tailored strategies for yield gap closure, *inter alia*, include accelerating extension services delivery, financing and access to profitable markets.
9. **Promote Grain Trade Diplomacy:** As Tanzania is already producing surplus food grains and vowed to even expand grain export base in the region and beyond, it should actively engage in grain trade diplomacy through bilateral and regional agreements to expand market access for Tanzanian grains. The strategic food safety centric infrastructure developed under the TANIPAC, and other similar initiatives in advancing PHM should be the launcpad for the country to leverage a competitive regional grain export trade.
10. **Develop Food Safety Centric National Certification and Traceability System for Grains:** In order to improve market competitiveness of Tanzania's grains in the regional and international markets, it is recommended to the Government, in collaboration with stakeholders and development partners, to develop and implement a comprehensive food safety centric certification and traceability for grains. The very fabrics of a versatile grain certification and traceability system, *inter alia* – high-level political will, strategic laboratory facilities (incl. CARL) and other mega-investments in logistics and energy (incl. SGR, Modernized Dar Es Salaam Port, and Mwalimu Nyerere Hydro Power Station). Moreover, the endeavour would require development of appropriately equipped ISO-accredited food safety central laboratories – coupled with a network of satellite food safety testing facilities in-country and at the borders.
11. **Modernize Grain Commodity Trading System:** A part of its long-term ambition (2050), Tanzania has a reachable ambition of being a leading producer of food in Africa and among top 10 countries feeding the world. Strategically, this requires the country to modernize its food trading systems particularly grains. The PHCoE developed under the TANIPAC is a radical step walking this path. The Centre should can start adopting modern grain commodity exchange systems, including futures markets and advanced traceability systems. Moreover, a "One Stop Centre (OSC)" to facilitate domestic and export grain trade should be established

at the PHCoE. The OSC is expected to streamline the grain trading process including coordinated food safety and standards, grading, value addition, testing, certification, and licensing.

12. **Accelerate Public-Private Partnerships (PPPs):** The food grain industry holds a niche attracting public and private investments as related social and economic returns on investment is commensurate. As the country's Vision 2050 prospects to develop corporate-styled State Owned Enterprises (SOEs) – creating efficient SOEs and an opportunity space for PPP. The regulatory framework for PPP exists – and all such opportunities provide the critical conditions for plausible PPP investments in the grain industry. As the grain industry has an engrained 'public good' nature, the state take a more active role in grain sector planning and trade while fostering a conducive environment for private sector participation.

ANNEXES

Annex 1: TANIPAC Project Results-Based Logical Framework (RBLF)

Results	Indicator	Unit of Measure	Baseline Year 2019 and 2020	End Target	Progress towards end target as of 30th June 2025	Assessment (% realized)	Means of verification	Assumption
IMPACT LEVEL								
1.1 Improved food and nutrition security, national income and public health	**Impact 1:** Improved income for rural households in the project area	**Maize (TZS)**	1,075,592	1,129,372	1,159,455	On-track	Import and Export report (Tanzania Revenue Authority)	(1) Government commitment and political will
		Groundnuts (TZS)	579,725	608,711	744,882	On-track	Import and Export report (Tanzania Revenue Authority)	
	Impact 2: Food Insecurity Experience Scale (FIES) based on insecurity prevalence	**Moderate to severe food insecurity (in %)**	55.1	27.6	10.9	On-track	Survey reports	
	Impact 3: Minimum Dietary Diversification (MDD)	**Women**	2/12	3/12	5/12	On-track	Survey reports	
		Children under 5	2/7	3/7	3/7	On-track	Survey reports	
OUTCOME LEVEL								
2.1 Increased quantity of safe maize and groundnuts and their related by-products consumed and traded	**Outcome 1:** % of safe maize and groundnuts that comply with aflatoxin levels	**Maize (in %)**	77.6	86	93.1	On-track	Surveillance Report (Tanzania Bureau of Standards)	High compliancy to GAP, GMP, GHP & GPH
		Groundnuts (in %)	81.7	92	48.0	Further assessment to confirm the results	Surveillance Report (Tanzania Bureau of Standards)	
	Outcome 2: Percentage of agricultural production sold in the regional markets	Maize: Production (Mt)	6,002,000	6,500,000	8,011,000	On-track	TRA/Ministry of Agriculture	
		Maize Exported to the Region (Mt)	168,923	400,000	581,438	On-track	TRA/Ministry of Agriculture	

Results	**Indicator**	**Unit of Measure**	**Baseline Year 2019 and 2020**	**End Target**	**Progress towards end target as of 30th June 2025**	**Assessment (% realized)**	**Means of verification**	Assumption
		Percentage (%) of Maize sold to the Region	3.1	6.2	7.3	On-track	TRA/Ministry of Agriculture	
		Groundnuts: Production (Mt)	895,219	900,000	586,216	On-track	TRA/Ministry of Agriculture	
		Groundnuts Exported to the Region (Mt)	11,784	23,568	26,150	On-track	TRA/Ministry of Agriculture	
		Percentage (%) of Groundnuts sold to the Region	1.3	2.6	4.5	On-track	TRA/Ministry of Agriculture	
2.2 Improved adoption of aflatoxin smart pre-and postharvest technologies	**Outcome 3:** Awareness rate (%) on aflatoxin problem (disaggregated by gender)	**By farmers (in %)**	32.4	75	89.5	On-track		
		By VCAs (in %)	54.0	75	100	On-track		
	Outcome 4: Awareness rate (%) of new technologies and practices (disaggregated by gender)	**By farmers (in %)**	23	75	87.9	On-track	Survey report	(3): Available Market Incentive and behaviour change
		By VCAs (in %)	45	75	100	On-track	Survey report	
	Outcome 5: Adoption rate of pre and post-harvest technologies and practices (disaggregated by gender)	**By farmers (in %)**	10	60	75	On-track	Survey report	
		By VCAs (in %)	75	86	100	On-track	Survey report	
OUTPUT LEVEL								
Results	**Indicator (including CSI)**	**Unit of Measure**	**Baseline : 2019 & 2020**	**End Target**	**Progress towards end target as of**	Assessment **(% realized)**	**Means of verification**	Assumption

Results	**Indicator**	**Unit of Measure**	**Baseline Year 2019 and 2020**	**End Target**	**Progress towards end target as of 30th June 2025**	**Assessment (% realized)**	**Means of verification**	Assumption
					30th June 2025			
1.1 Strengthened National Biological Control Units (NBCU) at Kibaha, Coast region	**Output 1:** Quarantine facility constructed	Number	0	1	1	100%	Progress reports, M&E reports, Technical reports	(4): Strong will to prioritize agriculture sector as driver for economic growth
1.2 Established and equipped Post harvest center of excellence for grains	**Output 2:** Post harvest center of excellence (PHCoE) constructed and equipped	Number	0	1	**Overall c**onstruction works has reached 100%	Completed in March 2025	Progress reports, M&E reports, Technical reports	
	LOT 1: Market Center	Status (in %)	0	1	1	100%		
	LOT 2: Agro-processing Plant	Status (in %)	0	1	1	100%		
	LOT 3: Technology transfer center	Status (in %)	0	1	1	100%		
1.3 Established and equipped Central Agricultural Reference Laboratory	**Output 3:** Central Agricultural Reference Laboratory (CARL) constructed and equipped	Number	0	1	1	100%	Progress reports, M&E reports, Technical reports	
1.4 Constructed and equipped 14 storage facilities	**Output 4:** Number of storage facilities constructed and equipped	Number	0	14	14	Completed in December 2024	Progress reports, M&E reports, Technical reports	
	LOT 1- Chemba	Status (in %)	0	1	1	100%		
	LOT 2 - Bukombe	Status (in %)	0	1	1	100%		
	LOT 3 - Kasulu	Status (in %)	0	1	1	100%		
	LOT 4 - Kibondo	Status (in %)	0	1	1	100%		
	LOT 5 - Babati	Status (in %)	0	1	1	100%		
	LOT 6 - Kiteto	Status (in %)	0	1	1	100%		
	LOT 7 - Gairo	Status (in %)	0	1	1	100%		
	LOT 8 - Nanyumbu	Status (in %)	0	1	1	100%		

Results	Indicator	Unit of Measure	Baseline Year 2019 and 2020	End Target	Progress towards end target as of 30th June 2025	Assessment (% realized)	Means of verification	Assumption
	LOT 9 - Buchosa	Status (in %)	0	1	1	100%		
	LOT10 -Namtumbo	Status (in %)	0	1	1	100%		
	LOT11 - Itilima	Status (in %)	0	1	1	100%		
	LOT12 - Nzega	Status (in %)	0	1	1	100%		
	LOT13 - Unguja	Status (in %)	0	1	1	100%		
	LOT14 - Pemba	Status (in %)	0	1	1	100%		
2.1 Capacity building to stakeholders in the value chains for maize and groundnuts	**Output 5:** Number of farmers	Trained on Good Agricultural Practices (GAP)	0	60,000	61,910	102%	M&E reports	
		Demonstrated GAP – through demo plots	0	60,000	59,482	99%	M&E reports	
		Trained on Postharvest Practices (practical sessions)	0	60,000	59,482	99%	M&E reports	
	Output 6: Extension workers from public and private institutions	Number trained on GAP	0	669	1,351	201%	M&E reports	
	Output 7: Tutors from public and private institutions	Trained on aflatoxin management modules	0	100	100	100%	M&E reports	
	Output 8: Clusters of farmers	Clusters established and supported.	0	180	180	100%	Progress reports, M&E reports, Technical reports	
	Output 9: Participation in Farmers field School or demo plots	Number of farmers participated	0	60,000	59,482	99%	M&E reports	
2.2 Institutional Strengthening	**Output 10:** Youth metal artisans	Number trained on metal silo fabrication technology	0	400	420	103%	Progress reports, M&E reports, Technical reports	

Results	Indicator	Unit of Measure	Baseline Year 2019 and 2020	End Target	Progress towards end target as of 30th June 2025	Assessment (% realized)	Means of verification	Assumption
		Number incubated and trained on entrepreneurship skills	0	400	393	98.5%	Progress reports, M&E reports, Technical reports	
	Output 12: Promotion of hermetic storage technologies	Number of hermetic bags distributed vulnerable farmers	0	300,000	470,000	156%		
	Output 13: Number of value chain actors (traders, transporters, processors and SMEs) trained	Number	0	5,000	5,547	111%	Progress reports, M&E reports, Technical reports	
	Output 14: Legal instruments developed and disseminated for aflatoxin management	Codes of practices and standards	0	2	2	100%	Progress reports, Technical reports	
		By-laws for 18 districts	0	18	18	100%		
		Regulations	0	2	2	100%		
	Output 15: Number of in-service staff trained/capacitated	Number trained on Short course	0	15	20	133%	Progress reports, Technical reports	
		Number supported on Long course	0	23	23	100%		
		Number of long course trainees graduated	0	23	10	44%		
		Number trained on Lab analytical Skills	0	60	63	105%		
	Output 15: Laboratory equipment procured and commissioned to regulatory and research institutions	HPLC	0	2	2	100%	Progress reports, M&E reports,	
		LC-MS/MS	0	1	1	100%		
		Investigator machine	0	1	1	100%		

Results	Indicator	Unit of Measure	Baseline Year 2019 and 2020	End Target	Progress towards end target as of 30th June 2025	Assessment (% realized)	Means of verification	Assumption
2.3 Awareness creation on aflatoxin management to the general public	**Output 17:** Key stakeholders reached and sensitized on aflatoxin management	Member of parliament, leaders for line-Ministries, Region & District	0	1,160	1,180	102%	Progress reports, Technical reports	
		Journalists	0	200	217	109%	Progress reports, Technical reports	
	Output 18: National Aflatoxin Communication Strategy	Number of strategy reviewed	0	1	1	100%		
	Output 19: Implementation of the National Aflatoxin Communication Strategy	Number of actors both public and private involved	0	30	44	146%	Progress reports, M&E reports,	
	Output 20: Awareness materials distributed	Number	0	33,230	49,497	149%	Progress reports, M&E reports, Technical reports	
		Printable materials	0	*25,500*	*44,464*	173%		
		Documentaries	0	*10*	*12*	120%		
		TV Program	0	*20*	*18*	90%		
		Radio Program	0	*150*	*127*	85%		
		Calendar	0	*2,500*	*3,000*	120%		
		T-shirt & Caps	0	*5,000*	*4700*	94%		
		Banners	0	*50*	*45*	90%		
	Output 21: Number of people reached with aflatoxin messages	Direct engagement	0	140,509	198,212	141%		
		In-direct engagement through TV, Radio and social media platforms	0	50% of Tanzanian	25,000,000	100%		

Results	**Indicator**	**Unit of Measure**	**Baseline Year 2019 and 2020**	**End Target**	**Progress towards end target as of 30th June 2025**	**Assessment (% realized)**	**Means of verification**	Assumption
3.1 Project support services	**Output 22:** M&E periodic reports	AWPB prepared and approved	0	5	6	120%	Progress reports	
		Approved baseline report	0	1	1	100%		
		Aflatoxin Situational Assessment report for Zanzibar	0	1	1	100%		
		Stakeholders meeting	0	5	6	120%		
		Steering Committee meeting	0	10	9	90%		
		ESIA reports	0	17	17	100%		
		ESMP reports	0	20	24	120%		
		Quarterly Physical progress reports	0	20	24	120%		
		Quarterly Financial reports	0	20	24	120%		
		Signed Aide memoires (AM)	0	10	10	100%		
		Semi-Annual reports	0	10	12	120%		
		Mid-term reports	0	1	1	100%		
		Completion report	0	1	1	100%		
		Case Study & lessons	0	10	9	90%		
		Impact monitoring reports (end review)	0	1	1	100%		
		Audit reports (external)	0	5	6	120%	CAG report	

Results	**Indicator**	**Unit of Measure**	**Baseline Year 2019 and 2020**	**End Target**	**Progress towards end target as of 30th June 2025**	**Assessment (% realized)**	**Means of verification**	Assumption
		Internal Audit reports	0	20	24	120%	Audit Report	