Country and Economic Assessment for Aflatoxin Contamination and Control in Tanzania;

A supplement to the 2012 Report

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ideas, and findings as clearly and accurately as possible and consider the report a true reflection of wishes of all who participated in the process.

LIST OF ABBREVIATIONS

AFB_1	Aflatoxin B_1
AfDB	African Development Bank
ASDP	Agricultural Sector Development Plan
ASCG	Agricultural Sector Consultative Group
ASLM	Agricultural Sector Lead Ministries
AUC	African Union Commission
CAADP	Comprehensive Africa Agricultural Development Plan
CFR	Case Fatality Rate
CPI	Consumer Price Index
DALYs	Disability-Adjusted Life Years
GAHPs	Good Animal Husbandry Practices
GAPs	Good Agriculture Practices
GMP	Good Manufacturing Practices
HACCP	Hazard Analysis Critical Control Points
FAO	Food and Agriculture Organisation
FAOSTAT	Food and Agriculture Organization Statistics Division
FNP	Food and Nutrition Policy
HBV	Hepatitis B Virus
HCC	Hepatocellular Carcinoma
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
IR	Incidence Rate
JECFA	Joint Expert Committee on Food Additives
Kg	Kilogram
MoALF	Ministry of Agriculture, Livestock and Fisheries
MoHCDGEC	Ministry of Health, Community Development, Gender, Elderly and Children
MoITI	Ministry of Industries, Trade and Investments
MSC	Mycotoxin Steering Committee
NAP	National Agriculture Policy
NEPAD	New Partnership for Africa's Development
NBS	National Bureau of Statistics
NM-AIST	Nelson Mandela African Institution of Science and Technology
PACA	Partnership for Aflatoxin Control in Africa
PS	Permanent Secretary
PO-RALGCSGG	President's Office Regional Administration, Local Government, Civil Service and Good Governance

SPS	Sanitary and Phytosanitary
TAMP	The Agricultural Marketing Policy
TAFSIP	Tanzania Food Security Investment Plan
TBS	Tanzania Bureau of Standards
TFDA	Tanzania Food and Drugs Authority
TFNC	Tanzania Food and Nutrition Center
THE	Total Health Expenditure
TPSF	Tanzania Private Sector Foundation
US$	US Dollar
USA	United States of America or US
USAID	United States AID
VLIR-UOS	Flemish Interuniversity Council for University Development
WHO	World Health Organization
VSL	Value of Statistical Life
Wt	Weight
YLD	Year of Life in Disability
YLL	Years of Life Lost

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GLOSSARY

Aflatoxin: any of a class of toxic compounds produced by certain moulds found in food, which can cause liver damage and cancer.

Case fatality rate (CFR): a measure of the severity of a disease and is defined as the proportion of reported cases of a specified disease or condition which are fatal within a specified time.

Disability-adjusted life year (DALY); a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death.

Phytosanitary: relating to the health of plants, especially with respect to the requirements of international trade.

EXECUTIVE SUMMARY

This report supplements the report released by the Abt Associates Inc in 2013 on the Country and Economic Assessment for Aflatoxins in Tanzania. It is an output of the work done by the United Republic of Tanzania, through national consultants led by the Nelson Mandela African Institution of Science and Technology (NM-AIST), with support from the African Union Commission through the Partnership for Aflatoxin Control in Africa (PACA). Extensive information on knowledge and awareness of aflatoxins among Tanzanians as well as information on aflatoxin contamination for maize and groundnuts was collected. Data of aflatoxins contamination in rice from three main rice growing districts of Tanzania; Kilosa (Morogoro), Mbarali (Mbeya) and Misungwi (Shinyanga) were also collected. A review of existing food safety policies and those being developed, to identify gaps that could be addressed to strengthen the food safety system of Tanzania was also performed. In addition, a health and economic impact analysis for aflatoxins, based on aflatoxin biomarker data for children in Tabora, Iringa and Kilimanjaro, was done. The Tanzania Food Security Investment Plan (TAFSIP) document was reviewed to identify areas into which aflatoxin measures could be mainstreamed. The situation analysis and action planning was conducted in consultation with several key stakeholders including the government line ministries, regional economic communities (RECs), donors and the private sector. It was found that the general awareness about aflatoxins was low, amongst stakeholders interviewed. Furthermore, it was found that knowledge about Good Agricultural Practices (GAP) is not widespread and that guidelines on GAP were not available. The assessment looked at data of aflatoxins in maize which were generated by NM-AIST, TFDA and the International Institute for Tropical Agriculture (IITA). The data was collected from Handeni in Tanga (by the NM-AIST), from Rungwe in Mbeya and Hanang in Manyara (by the TFDA) and Babati, Kiteto in Manyara (by the IITA). In summary, prevalence data confirms the Abt associates report that aflatoxin contamination is a major concern in the Eastern and Western zones. Estimation of the health and economic impact due to aflatoxins shows that there are about 3,334 cases of hepatocellular carcinoma (HCC), annually and that 95% of these cases (3167 persons) die each year from the disease. The losses in terms of Disability Adjusted Life Years are about 96,686 DALYs, annually. The financial impact resulting from such illness and loss of life ranges from $ 6 million to $ 264 million, annually. The review of policies revealed that there is a poor institutional framework for food safety control under the ministry responsible for agriculture. It further showed that although TFDA is mandated to oversee food safety issues in Tanzania, it is so strongly aligned to the ministry responsible for health that it could not adequately address food safety issues under the ministry responsible for agriculture. Additionally, the ministerial Board for TFDA does not have representatives from key ministries responsible for food safety regulation; MoALF and MoITI. The analysis confirmed that, although factors related to food safety issues were mentioned in many areas of the TAFSIP document it did not explicitly mention food safety or to be more precise, the aflatoxin problem. Finally recommendations for aflatoxin intervention strategies for inclusion in the Tanzania Agricultural Sector Plan (ASDP) through which TAFSIP is implemented are made. These

recommendations are designed to enable famers and traders prevent aflatoxin contamination of foods, and equip consumers with knowledge to avoid aflatoxins exposure and effects.

1. INTRODUCTION AND OBJECTIVES

1.1 Introduction

The African Union Commission (AUC) through the Partnership for Aflatoxin Control in Africa (PACA), extended assistance to Tanzania to identify concrete investment options for the country in the area of food safety with focus on aflatoxin control. This assistance came after recognizing that proper implementation of the Tanzania Agriculture and Food Security Investment Plan (TAFSIP) cannot be fully realized without inclusion in it of a comprehensive Aflatoxin Strategy and Investment Programme. The Government of Tanzania is implementing the TAFSIP as part of the efforts to advance the implementation of the Comprehensive Africa Agricultural Development Plan (CAADP).

The process of identifying concrete investment options was informed by findings of the Country Aflatoxin Assessment which was carried out in 2012 and published by Abt Associates Inc in 2013. PACA provided support to Tanzania to review the 2013 country aflatoxin assessment report and identify recommendations that can be included in the comprehensive Aflatoxin Strategy and Investment programs. The review was also aimed at identifying gaps that can be addressed to strengthen the food safety aspects in the document by considering Tanzania's food safety system. The review was performed by a team of consultants who worked in consultation with the Tanzania Mycotoxins Steering Committee (MSC) and with the guidance of the relevant authorities of the country. In particular, close consultation with the following bodies and offices was done; the Partnership for Aflatoxin Control in Africa (AUC-PACA) as well as the Ministry of Health, Community Development, Gender, Elderly and Children (MoHCDGEC), the Ministry of Agriculture, Livestock and Fisheries (MoALF), the Ministry of Industry, Trade and Investments (MoITI), the Prime Ministers' Office responsible for Government Business Coordination, President's Office – Regional and Local Government Authority (PO-RALGCSGG) and President's advisor on nutrition. Other government agents consulted include the management teams of the Tanzania Food and Drugs Authority (TFDA) (including the National Mycotoxin Steering Committee), Tanzania Food and Nutrition Center (TFNC) and Tanzania Bureau of Standards (TBS). District authorities consulted and from which rice samples were collected are Mbarali in Mbeya, Misungwi in Shinyanga and Kilosa in Morogoro. In addition, a deeper analysis of aflatoxin knowledge and awareness from data collected from stakeholders in Bukombe, Njombe and Kongwa in the year 2012 was also done. Bukombe, Njombe and Kongwa are the districts from which information and samples were collected for assessment of aflatoxin problem for maize and groundnut. Data of aflatoxins in maize and groundnuts generated after the 2012 assessment were also collected and analysed to determine the distribution of aflatoxins occurrence in Tanzania.

The review catalyzed strategic actions in Tanzania by identifying existing programs that can integrate aflatoxin control measures, avoid duplication of efforts and provide the necessary input to align aflatoxin control with broader food safety and Sanitary and Phytosanitary (SPS) issues.

In addition, the assessment includes estimation of the economic and health impact of aflatoxins using biomarker data. The findings and recommendations of the assessment guided the review of the TAFSIP and development of a National Aflatoxin Mitigation Strategy and Investment Program for Tanzania.

1.2 Objectives

The main objective was to supplement the findings of the 2012 Tanzania Country Assessment for Aflatoxins and to develop a National Aflatoxin Mitigation Strategy and Investment Program for incorporation in the Tanzania Agricultural Investment Plan.

Specifically, the review aimed at:

- Collecting information on knowledge and awareness of aflatoxins and food safety systems for mitigation of the problem.
- Updating the status of aflatoxin prevalence along agricultural value chains for maize and groundnut and assessing the status of aflatoxin contamination in the value chain for rice.
- Supplementing the aflatoxin economic analysis in order to reveal the current cost of aflatoxin contamination to health.
- Reviewing Tanzania policies on Food Safety, Food and Nutrition, Agricultural products marketing and Food Security in order to identify areas to improve aflatoxin management.
- Formulate evidence-based recommendations required for aflatoxin mitigation in the country through strengthened food safety control systems.

2. AWARENESS AND KNOWLEDGE ON CONTROL MEASURES

2.1. Introduction

This chapter reports the findings of a survey of stakeholder's awareness and knowledge on the aflatoxin problem and its control strategies. Data were collected through a semi-structured questionnaire and in-depth interview of key-informants. The semi-structured questionnaire data were collected during the year 2012 assessment from three geographically distant districts of Bukombe, Kongwa and Njombe, and were available for analysis and use in this report. The key-informants were interviewed in Dar es Salaam, both in year 2012 (during the 2012 assessment) and year 2014 (in the course of this assessment). The key informants interviewed were representatives of ministries responsible for health, trade, industry and agriculture; food manufacturing sector, research institutions and food safety government authorities. In addition to data on knowledge and awareness, the interviews generated information on how the existing food safety related policies address the problem of aflatoxins. In this assessment, the key informants were also asked to suggest the appropriate government ministry or agency for placement of a PACA-supported coordinator of aflatoxins activities in Tanzania.

2.2. Views of district level stakeholders

As already mentioned, at the district level the survey aimed at capturing the status of knowledge and practices related to aflatoxins. Various stakeholders including farmers, millers and mothers of children at weaning age were interviewed using a semi-structured questionnaire. The distribution of stakeholder's interviewed in each of the three districts of Bukombe, Kongwa and Njombe is shown in Table 1

Table 1: Numbers of interviewed stakeholders in Bukombe, Kongwa and Njombe districts

Stakeholder category	District		
	Bukombe	Kongwa	Njombe
Farmers	8	2	1
Political leaders	1	0	0
Posho millers	0	0	1
Mothers	4	2	1
Government Officials (Agriculture, Nutrition, Nursing, Livestock or trade)	6	8	7
Processors	1	3	0
Cooperative societies representative	0	1	0
Retailers of agricultural inputs or maize or groundnut products	5	1	0
Wholesalers of agricultural inputs or maize or groundnut products	2	0	0

All stakeholders	**27**	**17**	**10**

Stakeholder distribution varied among the districts depending on their availability. Bukombe district had the most comprehensive coverage of interviewees and the highest number of farmers interviewed. Since this was a qualitative study, the purpose was not to balance the sample sizes for any statistical analysis, but rather to obtain opinions from district stakeholders who were available and accessible.

2.2.1. State of aflatoxin awareness

Aflatoxin knowledge was probed by inquiring on whether one had ever heard or understood the meaning of aflatoxins. Of the 54 (27 in Bukombe, 17 in Kongwa and 10 in Njombe) stakeholders, 20% were aware of aflatoxins. At a district level the proportion of awareness was low with 35% for Kongwa, 19% for Bukombe, and 0% for Njombe. Even though the sampling did not allow for statistical analyses of significance, it indicates an obvious knowledge deficit among different district-level stakeholders.

In Njombe most of the interviewees were government officials. They were also asked about their opinions on whether there was enough knowledge about aflatoxins among the people they were working for. These results therefore do not only represent the official's states of knowledge but also the officials' opinion of the knowledge among the people they serve. Surprisingly, some government officials, such as nursing officers did not know what aflatoxins were and this calls for more focused studies among such caretakers to understand the extent of their ignorance about aflatoxins. The distribution of aflatoxin knowledge among stakeholders is shown in Figure 1.

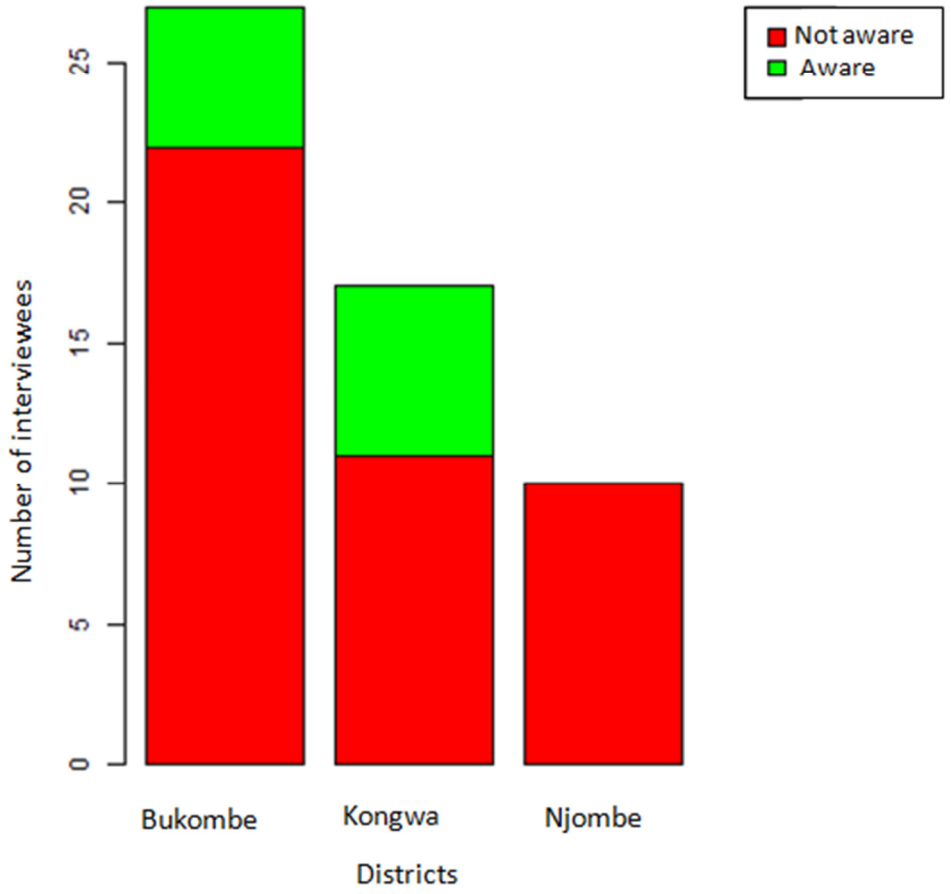

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Figure 1: The distribution of stakeholders' knowledge and awareness about aflatoxins in Bukombe, Kongwa and Njombe districts

2.2.2. Access to Good Agricultural Practices

Participants were also asked about their access to guidelines on good agricultural practices (GAP) and whether they had ever gone through training on GAP. It was found that knowledge about GAP is not widespread and that guidelines on GAP were not available. Distribution of stakeholders according to their GAP knowledge and access is shown in Figure 2. Bukombe district had the highest number of farmers interviewed and it recorded the highest proportion of lack of GAP knowledge. This implies that most farmers are not exposed to GAP in general.

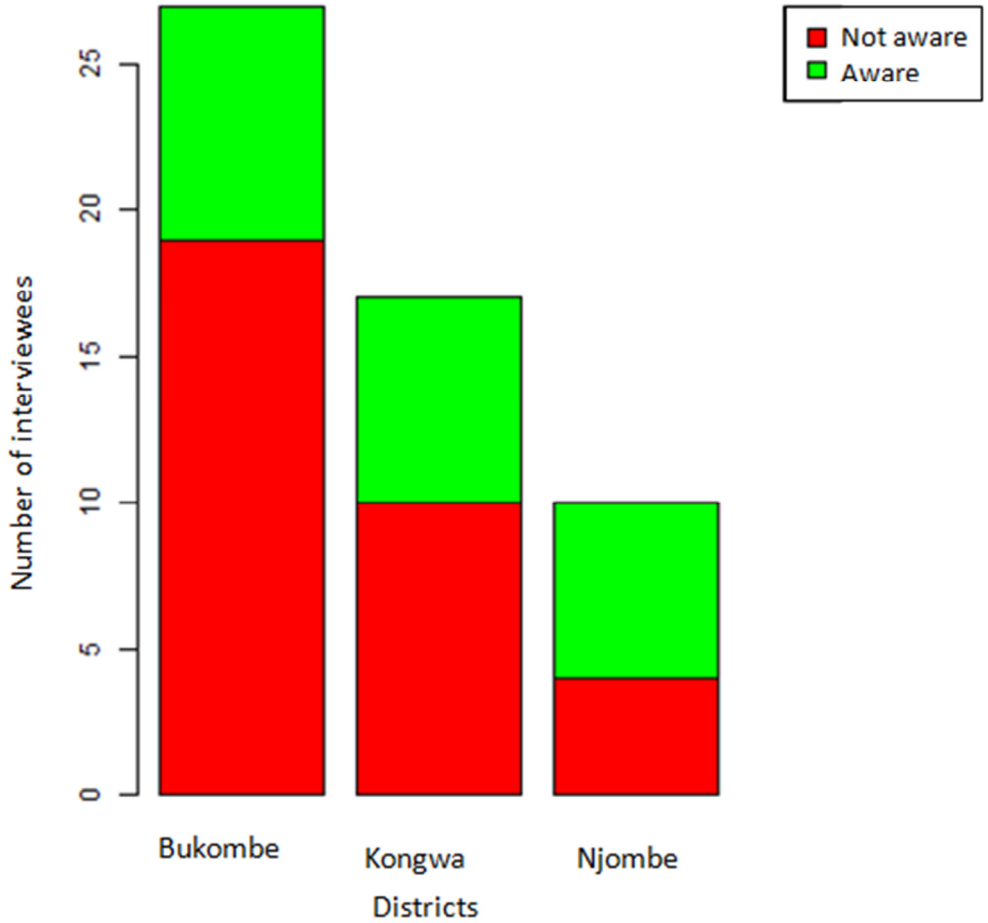

Figure 2: The distribution of stakeholders' according the knowledge and access of GAP in Bukombe, Kongwa and Njombe districts

2.2.3. Use of visual identification for quality of maize and groundnut

In assessing practices related to aflatoxin control, participants were asked about how they assessed quality of maize and groundnuts. All mentioned the use of visual methods to tell the quality of maize and groundnut. In visual inspection the qualities assessed were color, texture, hardness and softness. In general there were no non-visual technologies employed to test quality of maize or grains. However, a supervisor in Kongwa district informed the interviewers that he was aware that humidity measuring devices existed at the station for maize.

2.2.4. Willingness to learn about aflatoxins

Interviewees were also asked about their willingness to learn about aflatoxins and their control strategies. In all districts, participants expressed willingness to learn about aflatoxins and their control measures. This response is an important entry point for interventions.

2.3. Views of National level Stakeholders

Stakeholders in Dar es Salaam who were from various key sectors were solicited for their opinions on aflatoxin policies and practices in Tanzania. These stakeholders came from sectors such as agriculture, trading, food industry, health, research institutions, livestock, ministries and higher offices of the government. Their views are presented below for various policy issues.

2.3.1. Adequacy of National Policies on Aflatoxins

Stakeholders were asked to give their opinion on the adequacy of the existing national policies related to food safety in addressing the problem of aflatoxins. The policies mentioned by the key informants were the Agricultural Products Marketing Policy of 2008, the Food and Nutrition Policy of 1992 and the National Agriculture Policy of 2013. They also commented on suitability of food safety control systems as well as on the draft Food Safety Policy and draft Food and Nutrition Policy. Most stakeholders indicated that the national policies were not explicit on the problem of aflatoxins. The fact that most stakeholders felt that aflatoxins were not well addressed in national policies provides a ground to emphasize inclusion of aflatoxin-specific policy statements into different national policy documents.

2.3.2. Adequacy of National Policies on Good Agricultural Practices (GAP)

There is a link between knowledge on GAP and knowledge on aflatoxins. Upon inquiring the stakeholders on their opinion about adequacy of national policies on good agricultural practices (GAP) we found that a moderate number were of the opinion that most national policies adequately addressed good agricultural practices, but several other stakeholders were of the opinion that the national policies were deficient in addressing good agricultural practices.

2.3.3. Stakeholders' will to support aflatoxin initiatives

Almost all stakeholders interviewed were willing to support initiatives that might be introduced to mitigate the problem. The only exception was a stakeholder from the private trading sector who chose to reserve his preferences. This is an important result from a practical point of view as it indicates presence of an environment to support initiatives against aflatoxins.

2.3.4. Placement of a country aflatoxin coordinator

In the year 2014 interview the key informants were asked to give their suggestions on the placement of a country aflatoxin coordinator who would be hired by PACA for Tanzania. Most stakeholders were of the opinion that the country aflatoxin coordinator be placed at the Tanzania Food and Drugs Authority (TFDA). Three other institutions/ministries that were proposed are the Prime Minister's Office (PMO), Tanzania Food and Nutrition Center (TFNC) and the ministry responsible for agriculture. The view by many that TFDA should host the coordinator was based on the fact that the authority is responsible for enforcement of the Tanzania Food, Drugs and Cosmetics Act (2003) which is the only Law with specific provisions for food safety control

3. THE STATUS OF AFLATOXIN PREVALENCE ALONG THE AGRICULTURAL VALUE CHAINS FOR MAIZE, GROUNDNUT AND RICE

3.1. Introduction

In Tanzania, aflatoxin susceptible foods such as maize and groundnuts are widely consumed, acting as main sources of aflatoxin exposure. In developing countries, flatoxins have a widespread occurrence in tropical latitudes. Exposures to high doses of the toxins can cause fatal liver toxicity. Chronic exposure due to low doses is associated with a range of health effects including liver cancer, child stunting and immune suppression.

As reported elsewhere, aflatoxin contamination in staple foods is common in Tanzania and poor storage practices together with the high intake of contaminated staple crops lead to widespread exposures in humans. Aflatoxin exposure can be monitored either by measuring levels of contamination in food or by measuring biomarkers in blood or urine. Biomarkers of aflatoxin exposure are widely used for studies aimed at understanding the health effects of aflatoxins. Such biomarkers have shown widespread exposure in adults and children across several countries, including high levels in Tanzanian children.

The 2012 country assessment of aflatoxins found high occurrence of aflatoxins in groundnut and maize. As rice is becoming an important food in Tanzania this assessment/supplemental report includes it in the current analysis. Although rice is not as susceptible to aflatoxins contamination as are maize and groundnut, its importance in food security for Tanzania necessitated its assessment. According to FAOSTAT (2012), rice ranks fifth on Tanzania's key agricultural crops after maize, cassava, cow milk and sweet potatoes. In terms of share in calorie intake among Tanzanian households, rice contributes about 10%. In subsequent sections we describe in details the occurrence of aflatoxins in maize, groundnut and rice.

3.2. Occurrence of aflatoxins in maize

The 2012 country assessment reported prevalence of aflatoxins in 274 maize samples. These samples were obtained from Morogoro in the Eastern Zone, Shinyanga in the Western zone, Manyara in the Northern zone, Iringa, Mbeya & Rukwa in the Southern Highlands and Ruvuma in the Southern zone. The results showed a significant variation of aflatoxin prevalence across the regions. In summary, 43% of the maize samples from the Eastern zone (Morogoro) and 40% from the Western zone (Shinyanga) contained aflatoxin B_1 (AFB_1) at levels above 5ppb. The average contamination level for Morogoro and Shinyanga was 50ppb and 28ppb, respectively. The contamination was much lower in other zones: in the Northern zone (Manyara), 9 percent of the samples were above 5 ppb; in the Southern Highlands (Iringa, Mbeya, and Rukwa), only 4 percent were above 5 ppb; and in the Southern zone (Ruvuma), none of the samples were above 5 ppb.

In this assessment, more prevalence information was obtained from published literature. Literature information was obtained from Kimanya et al. (2008) for prevalence in the Northern zone (Kilimanjaro), Southern Highlands zone (Iringa), Southern Zone (Ruvuma) and Western zone (Tabora). This literature shows a very big variation in aflatoxin contamination, with Tabora having the highest contamination and Ruvuma, the lowest (Table 1). The occurrence of aflatoxins in maize from Tabora is similar to the occurrence reported in the 2012 report. Both Tabora and Shinyanga regions are located in the Western zone. In more recent studies, Kimanya et al. (2014) and Magoha et al. (2014) report contamination for the Northern zone region of Kilimanjaro which confirm the findings in Kimanya et al. (2008) that aflatoxin contamination in that region is relatively low.

New information was also obtained from Kamala et al. (2015). This publication shows aflatoxin contamination in maize from Mbeya (Southern Highlands zone), Manyara (Northern zone) and Morogoro (Eastern zone). As shown in Table 1, Morogoro is one of the regions with the highest occurrence of aflatoxins in maize. Similar results for high prevalence of aflatoxins in the Eastern zone were reported by Ibrahim (2014) who reported on aflatoxin occurrence in the Eastern zone region of Tanga (Table 2).

Table 2: Occurence of aflatoxins in maize and maize-based foods in Tanzania

Zone	Region	Number of samples	Samples with detectable aflatoxins (%)	Highest contamination (ppb)	Percent of samples exceeding maximum limit	Reference
Eastern	Morogoro	40	NA	162.4	43	Abt Associates Inc, 2013
		20	95	1,081	85	Kamala et al. 2015
	Tanga	60	37	206	13	Ibrahim, 2012
Northern	Kilimanjaro	30	NA	80	7	Kimanya et al. 2008
		41	NA	386	5	Kimanya et al. 2014
		67	NA	69.5	23	Magoha et

						al. 2014
	Manyara	65	NA	27.6	9	Abt Associates 2013
		20	50	19	2	Kamala et al. 2015
Southern	Ruvuma	30	NA	26	3	Kimanya et al. 2008
		40	NA	19.7	3	Abt Associates Inc, 2013
Southern Highlands	Iringa	30	NA	58	7	Kimanya et al. 2008
	Rukwa, Mbeya and Iringa	99	NA	19.7	2	Abt Associate Inc. 2013
	Mbeya	20	35	8	2	Kamala et al. 2015
Western	Tabora	30	NA	158	30	Kimanya et al. 2008
	Shinyanga	30	NA	162.4	40	Abt Associates Inc, 2013

NA, Not available

3.3. Occurrence of aflatoxins in groundnut

In the 2012 assessment it was found that aflatoxin (AFB_1) present in 20% of groundnut samples from Manyara (Northern zone) and Mtwara (Southern zone) and in 8% of samples from Shinyanga (Western zone) were above the maximum tolerable limit of 5 ppb, set for AFB1 in groundnut for human consumption in Tanzania. The mean contamination levels in the samples that exceeded the legal limit were 20 ppb (for Manyara and Shinyanga) and 18 ppb (for Mtwara).

In efforts to look for new data on aflatoxin contamination in groundnut (generated after release of the 2012 report), we obtained summarized data from Dr Mponda of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) as shown in Table 3. The information is

for a total of 242 groundnut samples; 68 from Bahi (Central zone), 87 from Bukombe (Western zone) and 87 from Nanyumbu (Southern zone). Overall, the mean contamination in these samples was 113 ppb and the highest level of contamination was 2,591 ppb. Approximately 18% of the samples were contaminated above 5 ppb. Generally, the contamination levels generated by ICRISAT are higher than those reported in the 2012 report (Table 3). This shows that the magnitude of the problem of aflatoxin contamination in groundnut is possibly higher than previously reported and thus more surveillance data are necessary to evaluate the status in Tanzania.

Table 3: Occurence of aflatoxins in groundnuts, Tanzania

Zone	Region	Number of samples	Mean contamination (ppb)	Samples exceeding maximum limit (%)	Reference
Northern	Manyara	20	38	20	Abt Associates Inc 2013
Southern	Ruvuma (Nanyumbu)	87	100	NA	Dr Mponda (Personal communication)
	Mtwara	40	31	20	Abt Associates, 2013
Western	Shinyanga	40	31	18	Abt Associates, 2013
	Shinyanga (Bukombe)	87	123	NA	Omari Mponda (Personal communication)
Central	Dodoma (Bahi)	68	115	NA	Omari Mponda (Personal communication

NA, Not available

These new data (Figure 3) and the data reported in the 2013 report confirm that contamination levels of aflatoxins are higher in groundnuts than in maize.

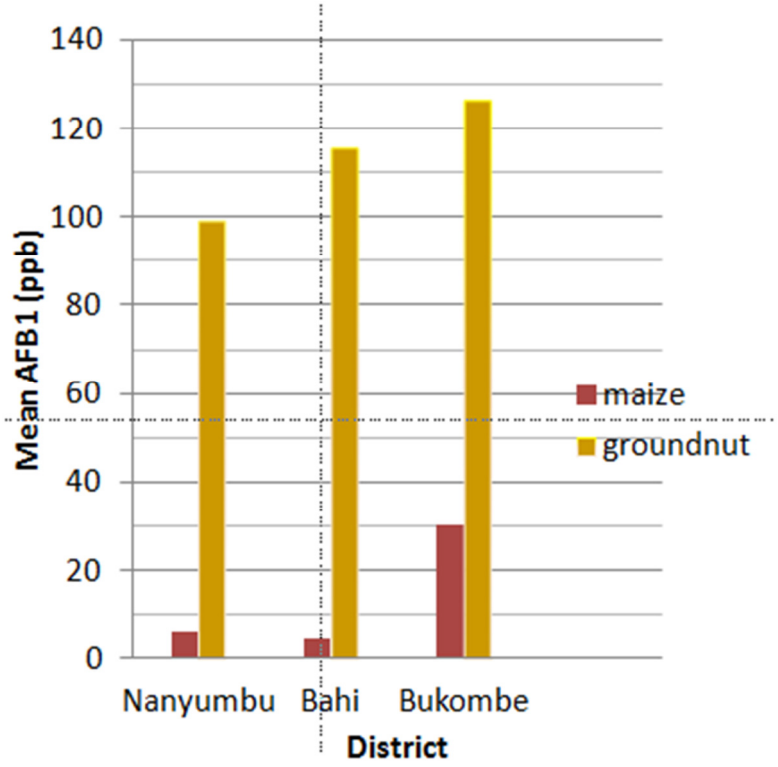

Figure 3: Comparison of aflatoxin B1 (AFB1) contamination levels in maize and groundnut

3.4. Occurrence of aflatoxins in rice

Samples of rice were taken from three main rice-producing districts of Tanzania of Kilosa, Mbarari and Misungwi. These districts are geographically distant and are in different agro-ecological zones. In total 101 samples; 29 from Misungwi (Western zone), 39 from Mbarali (Southen Highlands zone) and 33 from Kilosa (Eastern zone) were collected and analysed for total aflatoxins. Results of the analysis suggest that aflatoxin contamination in rice grown and consumed in Tanzania is very low. Out of the 101 samples, 15 (15%) had detectable levels of aflatoxin. The levels of aflatoxins in the positive samples ranged from 0.01 – 3.83 ppb (Mean 1.19 ppb). Based on the maximum limit of 10 ppb set for total aflatoxins in rice for human

consumption in Tanzania, all the rice stocks from which the samples were taken are fit for human consumption.

As shown in Table 4, there was a considerable difference in contamination between Misungwi and the other districts. Prevalence of contamination was lower in Misungwi (6%) than in Kilosa (20%) or Mbarali (18%). In Misungwi, only two samples were contaminated (0.89 ppb and 1.95 ppb). Contamination levels in Kilosa ranged from 0.05 – 2.45 ppb (Mean, 1.25 ppb) and in Mbarali, from 0.01 – 3.83 ppb (Mean, 1.05 ppb). In addition to the information from the samples analysed, we obtained aflatoxin contamination information for 10 samples of rice from Morogoro which were analysed in a framework of a VLIR-UOS-supported project. This information supports the observation that aflatoxin contamination in rice is low. As shown in Table 4, the range of aflatoxin contamination in 70% of the samples was 1.6 - 3.1ppb.

Table 4: Occurence of aflatoxins in rice, Tanzania

Zone	Region (district)	Number of samples	Samples with detectable aflatoxins (%)	Range of contamination (ppb)	Reference
Eastern	Morogoro (Kilosa)	10	70	1.6 – 3.1	Analice Kamala (Personal Communication)
		33	20	0.05 -2.45	This survey
Southern Highlands	Mbeya (Mbarali)	39	18	0.01 – 3.83	This survey
Western	Shinyanga (Misungwi)	29	6	0.89 -1.95	This survey

4. HEALTH AND ECONOMIC IMPACTS OF AFLATOXINS

4.1. Introduction

The impact of aflatoxins on health, agriculture and trade in Tanzania was discussed at length in the 2013 report. As pointed out in that report, Tanzania is characterized by subsistence agricultural farming whereby most agricultural food products are consumed by the producers. Consequently, the highest impact of aflatoxin is on health of the local population. It was further reported that some segments of the population were aware of the health effects but their reliance on one or two crops (mainly maize and rice), as food did not give them the liberty to avoid consuming the contaminated crops.

In the 2013 report, it was also asserted that in Tanzania there is negligible perceived impact of aflatoxin contamination on agriculture and food security. This was attributed to the fact that aflatoxin contamination did not cause a visible damage to the crops. A small degree of awareness on aflatoxin-related effects on agriculture was observed in 2012 among livestock keepers. Although they did not associate low livestock productivity to aflatoxins, they attributed it to moldy feed. Indeed, aflatoxins affect production of healthy poultry and livestock by causing a decrease in production of eggs and milk, respectively. Aflatoxins are also known to cause illness to animals. It is important to note that aflatoxins can be one of the causes of food insecurity and ultimately affect the livelihood of people as a whole because of the fact that aflatoxins remain in the food chain and affect humans.

As reported in 2013, with an increasing awareness about aflatoxins, standards will be established requiring farmers to adopt good agricultural practices in order to lessen aflatoxin contamination, among other things. When aflatoxin-status certification standards will be enforced households will feel a direct economic impact of aflatoxin contamination because their produce will be rejected in markets. However, currently this situation does not exist.

During key-informants interviews with officials of the Ministry of Industry, Trade and Investmnets, it was acknowledged that they did not have data on violation rates for the existing aflatoxin standards[1]. In view of the above, it is imperative that deliberate efforts are made to direct resources in the agricultural value chain that will mitigate aflatoxin contamination particularly in susceptible crops.

The main aim of the current analysis was to supplement the 2012 economic impact assessment of aflatoxin contamination and exposure in Tanzania. The methodology employed in the 2012 economic impact assessment followed steps used in aflatoxin risk assessment (1, 2) and economic impact which include; identification of a key crop of concern, determination of the

[1] Ministry of Industry and Commerce Official (2nd Sept. 2014)

prevalence of aflatoxin, characterization of risks of aflatoxin contamination and exposure, and estimation of economic impact from aflatoxin contamination. In this analysis we used biomarker-based exposures in risk characterization and economic impact estimation. In health assessments, biomarker-based exposure estimation is preferred to food-based exposure estimation because it offers more robust epidemiological interpretations of individual exposure levels by accounting for all possible food sources of aflatoxins. To be able to perform the impact assessment, literature search for other pieces of information such as the prevalence of Hepatitis B in Tanzania was necessary (2). Estimation of the number of cases of hepatocellular carcinoma (HCC) was done using the method of potency and prevalence of Hepatitis B virus (3-5). Health and economic impact were estimated using the number of hepatocellular carcinoma (HCC), the number of DALYs lost and monetization was done using the method of Value of Statistical Life (VSL).

4.2. Health impact assessment

4.2.1. Estimation Biomarker-based exposures in micrograms per kilogram-body weight per day

As hinted above, aflatoxin exposures employed in this report were approximated using biomarker dataset generated and used by Shirima et al. (14). The dataset consisted of 436 measures of aflatoxin-albumin adducts obtained from three geographical distant zones of Tanzania (Figure 4 obtained with permission from Shirima et al. (14)). These data were obtained from a total of 166 children, taken at recruitment, and at the sixth and twelfth month following recruitment. Blood samples were collected and analyzed for plasma aflatoxin-albumin adducts (AF-alb) using ELISA and reported in pg/mg of albumin. These biomarker exposures were converted into exposures in micrograms per kilogram-body weight per day by using methods suggested Shephard (1). Specifically, each reading (pg AFB1/mg albumin) in the dataset was divided by 100 in order to obtain equivalents in 1 μg/kg-bw/day and then each value was converted to equivalents in ng/kg bw/day by multiplying by 1000. In total there were 74 values below the level of detection and 362 detected values.

Figure 4: Regions from which aflatoxin exposure data were obtained (Adopted from Shirima et al. 2015)

The distribution of exposures is shown in Figure 5. The bulk of the data (about 84%, which is 362 readings) was above the level of detection shown by a horizontal line at the 30th-mark on the y-axis. About 16% (74 readings) of data was left-censored (below the level of detection). To estimate the population risk of liver cancer due to aflatoxin exposure data was analysed to account for values below LOD (level of detection). Percentiles of the exposure distribution that accounted for data censoring were obtained and exposures ranged from 5.0 – 10,926 *ng/kg-bw/day.*

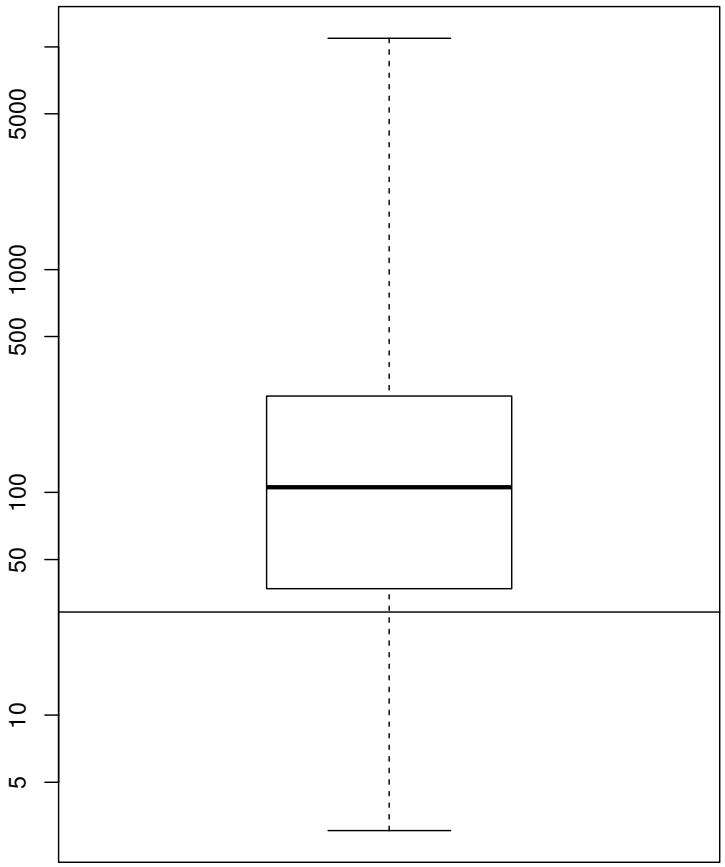

Figure 5: Boxplot of exposure to aflatoxins. The horizontal line at the 30th mark on the y-axis shows the cut-off point between detection and non-detection. About 84% of the data was detected.

The lowest exposure of 5 *ng/kg-bw/day* is similar to the lowest exposure estimated by Abt Associates Inc (2013) for Tanzania. However, the highest exposure of 10,926 *ng/kg-bw/day* is 25 fold higher than the highest exposure of 433 *ng/kg-bw/day* estimated for Tanzania in 2012 by Abt Associates Inc (2013). These exposure estimates are by far higher than the exposures of 0.02–50 ng/kg-bw/day cited by Manjula et al. (2009) for Tanzania. As explained by Abt Associates Inc (2013), variation in exposures may be due seasonal or annual or regional differences in aflatoxin contamination in Tanzania, as different years and regions were used for the estimations. Another possible cause of the variation in estimated exposures among assessments is use of different methodologies. In this assessment biomarker based approach was used whereas in the Abt Associates Inc (2013) and Manjula et al (2009) food based approaches were used. Although biomarker based approaches are more reliable than food

based approaches, it is important to note that Shirima et al.'s study population consisted of young children in three regions of Tanzania, and exposure levels may vary for other age groups and regions.

4.2.2. Estimation of population risk for Hepatocellular carcinoma (HCC)

The population risk for aflatoxin-induced liver cancer or HCC was estimated using the following information/steps:

- Data on aflatoxin exposure in Tanzania as described in section 4.2.1
- Median prevalence of 7% for chronic HBV in Tanzania. The prevalence of chronic Hepatitis B in Tanzania was taken from a study by Liu and Wu (4). In that study the range was given as between 5% to 9%. For the purpose of this analysis, we chose the middle value which is 7%.
- The JECFA advice on how to estimate aflatoxin induced HCC. The 1998 Joint FAO/WHO Expert Committee on Food Additives (JECFA) study which conducted quantitative risk assessment of aflatoxins as described elsewhere (4) provided specification of potency factors for aflatoxins: being 0.01 cases per 100,000 per year per ng/kg-bd/day aflatoxin exposure for individuals without chronic Hepatitis B Virus (HBV) infection and 0.30 corresponding cases for individuals with chronic HBV infection.
- The population of Tanzania in 2014, which was about 47,132,580 persons with 23,864,623 females and 23,267,957 males (15).

4.2.3. Estimation of number of cases of hepatocellular carcinoma (HCC)

In estimating the number of cases due to hepatocellular carcinoma (HCC) an approach based on exposure bins was used in which the exposure data were divided into exposure bins based on exposure quartiles. Table 5 shows the lowest, highest as well as the 5th, 25th, 50th, 75th and 95th quartiles of the exposures distribution used in estimation of HCC cases.

Table 5: Exposures distribution used in estimating the number of HCC cases

Quartile	Min	5th	25th	50th	75th	95th	Max
Exposure Level (*ng/kg-bw/day*)	5	8.95	37	105.5	270.5	1591.5	10926

With an assumption that all people in a given exposure bin were exposed to the same, mid-point exposure level, the entire human population at risk was distributed evenly across the bins. Then

the number of HCC cases for each exposure bin was calculated. The national wide number of HCC cases was the sum of cases over all the bins.

The calculation of the number of HCC cases for one such exposure bin is described here. For each exposure bin representative exposure value as well as the total population per exposure bin were used. The average HCC potency was obtained by using the formula described elsewhere (1). The formula $\left(\text{HBV}^{+}\text{ prevalence}\cdot\text{HCC Potency - HBV}^{+}\right)+\left(\text{HBV}^{-}\text{ prevelance}\cdot\text{HCC Potency-HBV}^{-}\right)$ which provides an average HCC potency for the population at risk was used. Upon obtaining this potency value, which is constant for all the bins, the population at risk was calculated by multiplying the exposure level with the average potency. Finally the number of HCC cases per exposure bin was calculated by multiplying the population risk with the total population at risk in a given exposure bin. Using this method the national wide total number of HCC cases was 3334. The Global Disease Burden Project of 2013 reported the total number of liver cancer as 2,353 (6), considering the widespread underreporting of liver cancer cases in Sub-saharan Africa (7), our estimation could therefore be closer to reality than the officially reported figure.

4.2.4. Estimation of the Disability Adjusted Life Years (DALYs) per capita

In estimating the DALYs per capita updated results from the Global Burden of Diseases Project 2013 (6) were used. The GBD project provides summaries of deaths, Disability Adjusted Life Years (DALYs), Years of Life Lost (YLL) and Years Lived with Disability (YLD) for various locations, diseases and risks on the globe. Data for Tanzania on liver cancer deaths and DALYs lost due to liver cancer were extracted and the total number of liver cancer cases from the reported cancer deaths were estimated.

The all-cancers case-fatality rate in Tanzania is reported to be about 80% (8) while the case-fatality rate for liver cancer can be as high as 95% (9) making the number of deaths (mortality) almost equal to the total number of cases (incidence). This fact was used to estimate the number of cases of liver cancer in 2014 in Tanzania using the reported number of deaths. Upon obtaining these numbers of liver cancer cases the DALYs per capita were calculated by dividing the mean total DALYs with estimated cases of liver cancer. The details of various calculated statistics and the sources or methods are shown in the Table 6.

Table 6: Details of calculations of DALYs per capita

	Females (All ages)	**Males (All ages)**	**Both Sexes (All ages)**	**Source**
Cases from Liver Cancer in 2013	1356	997	2353	Calculated by assuming the case-fatality rate of liver cancer is 95% (9)

Deaths from Liver Cancer in 2013	1288	947	2235	Global Burden of Disease Project 2013 (6)
Mean Total DALYs lost in 2013	36580	31599	68179	Global Burden of Disease Project 2013 (6)
DALYs lost per capital in 2013	27	32	29	Calculated by dividing the mean total DALYs with estimated cases of liver cancer

The analysis estimates 3334 cases of liver cancer and about 3167 deaths It is important to note that the numbers of cases in the Global Burden of Disease Project were those officially reported and there is underreporting of cancer cases in Sub-saharan Africa. The calculated number of cases assumes that all possible liver cancer cases are timely diagnosed and recorded which may explain the difference between the two estimates. Another reason for discrepancy could be the wider range of the exposure distribution of the data used in this analysis. In using the data it was assumed that these are representative for Tanzania. Nonetheless the following caveats of this assumption are worth noting:

- The data were obtained from young children. Although a study in Uganda (Asiki et al., 2014) found no significant difference in aflatoxin levels among children and adults, Shirima et al. (2014) noted that children may have higher intake of aflatoxin than adults, relative to their body size,
- The data were obtained in three regions that are located in different agro-ecological zones where previous studies showed co-occurrence of aflatoxins with fumonisins in maize (Kimanya et al. 2008). The estimates may not be relevant for other regions in Tanzania, where AFB1 may occur less or more frequently.

4.2.5. Total DALYs lost

From the total number of HCC cases due to aflatoxin contamination and the DALYs per capita calculated as explained in 4.2.4, the total DALYs lost due to aflatoxin contamination was calculated to be 96686 DALYs. This is the estimated amount of DALYs lost due to aflatoxin contamination in Tanzania in 2014 as based on the available biomarker data used in this analysis.

4.3. Estimation of the Economic Impact

The economic impact was estimated using the method of Value of Statistical Life (VSL). VSL expresses the value of risk reductions by dividing the individual willingness to pay for small risk change in a defined period by the risk change (10). Despite the fact that these risks are small at

an individual level they become significant when aggregated into these so-called statistical lives over the larger population affected. Since exposures to aflatoxin are examples of small risks at an individual level this method is appropriate for estimating their economic impact.

Published studies to estimate VSLs are virtually nonexistent in low-income countries including Tanzania. Therefore this analysis used estimates available elsewhere to estimate the VSL for a death from HCC in Tanzania. A base VSL estimated for mortality valuation in the OECD countries which was $2.9 million(11) was obtained. Since this value was estimated using 2005 US dollars it was converted to its equivalent in year 2014 by taking into consideration the inflation between the two time points. The inflation rate was calculated using the method of Consumer Price Index where indices were obtained from the US Bureau of Labor Statistics(12). Specifically, the index in 2005 was 195.3 and in 2014 it was 236.736. Inflation was calculated using the formula:

$$\text{Inflation rate} = \left(\frac{\text{Index in 2014}}{\text{Index in 2005}} - 1\right) \cdot 100\%$$

Then the 2014 VSL equivalent of 2005 VSL was obtained by multiplying the value in 2005 by $\left[1 + \text{Inflation Rate}\right]$. Finally this 2014 VSL estimate for the OECD countries was converted into its equivalent value for Tanzania in 2014. To achieve this the 2014 income per capita of the two countries using the Gross National Income (GNI) per capita data from the World Bank (13) was firstly obtained. Then the following conversion formula suggested by Hammitt and Robinson(10) was used to obtain the 2014 VSL estimate for Tanzania;

$$\text{VSL}_{\text{Tanzania, 2014}} = \text{VSL}_{\text{OECD,2014}} * \left(\frac{\text{GNI}_{\text{Tanzania, 2014}}}{\text{GNI}_{\text{OECD,2014}}}\right)^{\text{Elasticity}}$$

Elasticities of 1, 1.5 and 2 were used to obtain various VSL estimates for Tanzania. The methodology, values and sources of various data are shown in the Table 7.

Table 7: Details of calculation of the VSL for Tanzania in 2014

Row ID	Component	Value	Source
A	Base VSL (year 2005)	$2.9 million	VSL estimate developed for mortality valuation in the OECD countries, which is based on a global meta-analysis of VSL estimates(11)
B	Inflation adjustment factor to convert from 2005 dollar year to 2014 dollar year	1.2122	U.S. Bureau of Labor Statistics (12)
C	Current VSL in 2014 nominal dollars	$3.52 million	Own calculation, [A] × [B]
D	Income per capita at Purchasing Power Parity for Tanzania in 2014, in current USD	$920	World Bank (13)
E	Income per capita at Purchasing Power Parity for the OECD countries in 2014, in current USD	$38,883	World Bank (13)
F	Income elasticity of VSL	1, 1.5, 2	Hammitt & Robinson(10)
G	Transferred VSL	$83,286.25 (at elasticity 1), $12,811.17 (at elasticity 1.5), $1,970.62(at elasticity 2)	Own calculation: [C] ×([D]/[E])^[F]

4.3.1. Monetized Economic Impact

The monetized economic impact of aflatoxin ranges from about $6 million to about $264 million per year (Table 8).

Table 8: VSL values for different levels of elasticity

	High (Elasticity = 1)	Medium (Elasticity = 1.5)	Low (Elasticity = 2)
VSL Amount ($)	$263,767,554	$40,572,960	$6,240,969

Therefore, with a strong assumption that the biomarker dataset was representative of the population of Tanzania, we estimate that in 2014 there were about 3,334 cases of hepatocellular carcinoma (HCC) and that 95% (3167 persons) of those cases ended up in deaths. These deaths led to a loss of 96,686 DALYs. The economic impact resulting from such illness and loss of life ranged from $6 million to $264 million. These results show quantitatively the amount of illness and deaths that could be avoided, the DALYs that could be averted and money that could be saved by strengthening measures to curb aflatoxin contamination in Tanzania.

5. REVIEW OF THE TANZANIA POLICIES THAT RELATE TO FOOD SAFETY

5.1. Introduction

The review of the Tanzania Food Safety Policies aimed at updating the analysis of Tanzania's existing food safety systems in section 7.4 of the 2012 country aflatoxin assessment. It involved identification of areas for improvement, if any, as well as policy statements for which implementation strategies can be incorporated in the TAFSIP to ensure operationalization of the policy. This chapter presents the review of the Tanzania policies that relate to food safety. These are the National Agriculture Policy (NAP) of 2013 and the Agricultural Products Marketing Policy of 2008. It also reviewed two documents of policies under development/review. These are the Tanzania National Food and Nutrition Policy and Tanzania Food Safety and Quality Policy.

5.2. The National Agriculture Policy of 2013

5.2.1. Introduction

The Tanzania NAP of 2013 is an updated version of the National Agriculture and Livestock Policy (NALP) of 1997. The background information of the NAP shows that review of the NALP was necessary to take cognizance of different policy changes taking place at the global, regional and national levels that have impact on the development of the agricultural sector. The changes at the national levels that are identified in the background information are implementation of Tanzania Development Vision 2025, the Poverty Reduction Strategy Paper (PRSP), National Strategy for Growth and Reduction of Poverty Long-term Perspective Plan and Five Year Development Plan. In the rationale and justification for reformulation of the NAP, it is noted that there were a number of reforms such as KILIMO KWANZA Resolve, the Tanzania Food Security Investment Plan (TAFSIP), Southern Agriculture Growth Corridor of Tanzania, Feed the Future Programme and Bread Basket Initiative, which were initiated to complement speedy implementation of the Agricultural Sector Development Plan (ASDP). The initiatives are linked to the Comprehensive African Agriculture Development Programme (CAADP) and the African Union initiative for revamping agricultural development in Africa through the New Partnership for Africa's Development (NEPAD). Another issue considered was the need to seize trade opportunities brought about by trade integration in the EAC and SADC regions, which require harmonization of standards and regulations. The policy is therefore viewed as a vehicle through which Tanzania can facilitate harmonization of standards and mutually recognize certification marks or other means of quality conformity assessment that facilitate intra-regional trade.

Having reviewed the main sections of the policy (vision, mission and objectives; policy issues and policy statements; regulatory framework and institutional framework), the areas that have provision that related to food safety and which can be addressed to mitigate the impacts of aflatoxins on human health and economy, were recommended as follows:.

5.2.2. Vision, mission and objectives

Although aflatoxin or food safety controls are not specifically mentioned, there are specific objectives through which food safety and aflatoxin controls can be achieved:

1. Enhance national food and nutrition security and production of surplus for export
2. Improve agricultural processing with a view to add value to agricultural produce and create jobs;
3. Enhance production of quality products in order to improve competitiveness of agricultural products in the domestic, regional and international markets
4. Strengthen inter-sectorial coordination and linkages to increase efficiency and effectiveness

5.2.3. Policy issues and Policy statements

Strategies for implementation of the following policy statements, made under different policy issues, targeting food safety assurance and control are necessary:

1. The Government shall strengthen sanitary and phytosanitary, quarantine and plant inspectorate services
2. Commodity standards to meet national and international market requirements shall be promoted and regulated
3. Food imports that are consistent with internationally acceptable safety and quality standards shall be regulated;
4. The Government shall strengthen and expand food storage structures to enhance food stability
5. Mechanisms for continuous monitoring and assessment of food security, safety and nutrition at all levels shall be strengthened
6. Capacities of agricultural marketing actors shall be enhanced in meeting quality, grades and standards for the domestic, regional and international markets
7. The Government, in collaboration with farmers, farmer groups, associations and cooperative societies, shall enforce regulations governing utilization of designated buying posts and centers for agro-products
8. The Government shall ensure quality control, enforce standards in processing, packaging and transportation of agricultural produce
9. Regulatory framework for urban and peri-urban agriculture shall be developed; and

10. Good Agricultural Practices for urban and peri-urban agriculture shall be promoted.

5.2.4. Legal framework

Under this section the policy requires review and harmonization of different agricultural related laws, legislations and regulations. It is stated that the existing legal and regulatory framework does not provide the necessary provisions to ensure the development of a modern, efficient and competitive sector.

5.2.5. Institutional framework for implementation of the NAP 2013

The policy is very exhaustive on identification of ministries and institutions which have different roles to play in its implementation. It states that Agricultural Sector Lead Ministries (ASLMs) shall oversee its implementation. The ASLMs are identified in the policy as the ministry responsible for Agriculture; the ministry responsible for Livestock and Fisheries Development; the ministry responsible for Industries, Trade and Marketing; and the President's Office-Regional Administration and Local Government (PO-RALG)

The roles of the ASLMs are outlined as follows:

1. Providing and supervising the implementation of regulatory services for sector development;
2. Monitoring the performance of private and public agricultural sector support services with the aim of improving their quality to ensure competitive markets;
3. Formulating and reviewing sectorial policies and monitoring the overall performance of the agricultural sector;
4. Contributing to the development and promotion of improved agricultural practices;
5. Promoting private sector's role in primary production, processing, marketing and the provision of support services; and
6. Promoting farmer organizations for empowering farmers, developing their advocacy and lobbying capacity and participating in service delivery and resource mobilization.

The policy, however, recognizes that the ASLMs are constrained by several factors which may impact on aflatoxin problem management including:

1. Inadequate manpower and skills for policy formulation, analysis, monitoring, evaluation, enforcement of policies, standards, laws and regulations;
2. Inadequate performance standards and a framework for assessing performance of service providers;
3. Lack of facilities for enforcing standards and regulations

4. Inadequate mechanisms for institutional coordination among various ministries, and between central ministries and Local Government Authorities ; and

5. Shortage of financial, human and technical capacity to generate, manage and disseminate accurate information on agriculture

The NAP 2013 recognizes further that there are other ministries such as that responsible for health which has specific roles for development of the agricultural sector. The policy also recognizes that there are Public Institutions such as Research Institutions, the Tanzania Bureau of Standards (TBS) and Tanzania Food and Drugs Authority (TFDA) which shall play important roles in its implementation. Such roles include:

1. Setting, monitoring and enforcing standards for the quality of agricultural inputs, machinery and products to ensure safety of humans and environment;

2. Conducting research as guided by the National Agricultural Research Agenda, and implementing outreach programmes as one way of disseminating research results;

3. Providing advisory services to the Government and the private sector through consultancy and other means;

Roles of Agricultural Commodity Boards which are also established under the Ministry of Agriculture, Food Security and Cooperatives are similar to those of TFDA which is under the ministry Responsible for Health. The policy establishes the following roles, among others, for agricultural commodity boards:

1. Formulating and implement development strategies for their respective industries

2. Providing regulatory services to promote good quality products;

It is clear from the review that the division of roles as stated in the NAP may lead to duplication and overlap of the regulatory roles of different ministries and public institutions. Unfortunately, the policy does not categorize food safety regulatory issues among cross cutting issues for which there is a clause which states that The Prime Minister's Office shall be responsible for the coordination of government business including policy issues that cut across ministries and institutions.

5.3. The Tanzania Agricultural Marketing Policy

5.3.1. Introduction

The Agricultural Marketing Policy (AMP) was formulated in 2008 to address the major agricultural marketing constraints that were identified at that time. These are constraints

identified in the AMP as inadequate institutional, legal and regulatory framework; poorly developed and maintained marketing infrastructure; limited agro-processing and the need to enhance quality and standards; weak entrepreneurial skills; limited access to finance as well as inadequate inter-institutional coordination.

The policy recognizes that agriculture is a mainstay sector of the economy as it contributes significantly in terms of aggregate growth and exports. It is clearly stated that approximately 80 per cent of the population is mainly engaged in farming activities for their livelihoods and that between 1999 and 2006 the crop and livestock sub-sectors contributed approximately 35 percent of foreign exchange earnings. According to the situation analysis reported in the policy document, the reported foreign exchange earnings would have been higher if an appropriate policy for marketing of agricultural products were in place. Policies that were in place at that time but considered to be inadequate for growth of the agricultural products sector are enlisted in the document. The list include the Sustainable Industrial Development Policy of 1996 – 2020; Agriculture and Livestock Policy, 1997; Cooperative Development Policy, 2002; Rural Development Policy; National Trade Policy 2003; Small and Medium Enterprises Development Policy, 2003; Agricultural Sector Development Strategy 2001; and, Agricultural Sector Development Programme (ASDP), 2005. Therefore the Government, through the AMP, formulated and made policy statements addressing the challenges facing agricultural marketing in Tanzania with expectation that their implementation will improve competitiveness of agricultural products in the domestic, regional and international markets.

5.3.2. Challenges facing agricultural marketing

The policy identifies challenges facing agricultural marketing. Of the identified challenges, those that impact directly on aflatoxin management are:

1. Inadequate value addition in agricultural produce;
2. Inadequate adherence to grades, standards and quality in agricultural products marketing;
3. Weak legal and regulatory framework on agricultural marketing;
4. Weak institutional set-up dealing with agricultural marketing;
5. Underdeveloped and improperly managed agricultural marketing infrastructure.

These challenges are addressed through the AMP policy vision, mission and objectives.

5.3.3. Vision, mission and objectives of the policy

The vision, “to have a competitive and efficient marketing system for the agricultural commodities leading to a rapid and broad based economic growth”, Mission, “to develop agricultural marketing systems that influence agricultural production plans which respond to domestic and foreign market dynamics” and overall objective “to facilitate strategic marketing of

agricultural products while ensuring fair returns to all stakeholders based on a competitive, efficient and equitable marketing system" are consistent with the rationale for formulation of the policy.

Ten specific objectives were set to achieve the overall objectives. Of these specific objectives, five are considered to be of direct relevance to aflatoxin management. These are as follows:

1. Stimulate diversification and value addition in agricultural products in response to increasing and changing market demand;
2. Promote adherence to quality, standards and grade in agricultural products to meet domestic, regional and international markets requirements;
3. Reform the legal and regulatory framework that guide the agricultural marketing systems to take advantage of the opportunities available in the multilateral trading system and regional trading arrangements;
4. Empower, promote and support the formation and development of agricultural marketing institutions;
5. Promote investments in agricultural marketing infrastructure and agro-business;

In order to direct ways and means to achieve the objectives, the policy defined the critical areas for which the government commitment was necessary. These areas are presented as policy issues and the commitments as policy statements.

5.3.4. Policy issues and statements

In the section of policy issues and statements, eleven policy issues with respective policy statements are presented. Given the scope of our task we concentrated on five of the policy issues namely; Value addition, Agricultural products quality and standards, Legal and regulatory framework, Institutional framework, Agricultural marketing infrastructure.

Value addition: The issue presented under value addition is the fact that majority of crops in the country are marketed in their raw forms, losing opportunities for higher earnings. The importance of application of good practices along the value chain is emphasized. The value chain segments identified in the policy are land management, production, harvest, post-harvest operations, processing (small scale/large scale), transport, storage and marketing. The following policy statements are made:

a) Primary agro-processing and value addition will be promoted and strengthened;
b) The Government will put in place special programmes and incentives to investors in agro-processing firms;

c) Consumption of locally processed agricultural products in the domestic market will be promoted; and

d) Investment in research and development for agro-processing will be promoted.

These commitments clearly provide for adoption of good management practices that prevent aflatoxin contamination along the food chain. The remaining challenge is setting up an investment plan for implementation of the policy statements.

Agricultural products quality and standards: The problem of poor safety and quality of agricultural products is well stated and, though not explicitly mentioned, the problem of aflatoxins is covered. The policy indicates that agricultural products in Tanzania, to a large extent, are characterized by inadequate adherence to the set safety and quality standards. In addition, it states that there is an inability to adhere to food hygiene and sanitary and phytosanitary requirements, which limits participation in global markets and regional markets. It touches on the weaknesses of inspectorate services by stating that there is inadequate product quality and standards inspectorate mechanism at various levels, including buying posts. The following policy statements are made:

a) Capacities of the agricultural marketing actors will be enhanced in meeting quality, grades and standards for the domestic, regional and international markets;

b) The Government, in collaboration with the private sector, will strengthen mechanisms for accreditation, testing, monitoring the quality, grades and standards of locally produced and imported agricultural products;

c) The Government, in collaboration with farmers, groups, association and cooperative societies, will enforce the regulations governing utilization of designated buying posts and centers for agro-products; and,

d) The Government, in collaboration with other stakeholders, will develop and harmonize standards, quality and grades in agricultural marketing.

The Government commitments are excellent. The challenge is that the policy does not state explicitly who will do what; the government ministries responsible for ensuring implementation of these policy statements are not stated. It is, therefore, important to formulate strategies that assign responsibilities and accountability to government ministries and agencies. Possibly this drawback can be addressed through the TAFSIP review.

Legal and regulatory framework: The issues stated under legal framework are common in most regulatory frameworks of Tanzania. The policy states that, despite the opportunities emerging from liberalization and globalization processes, there is limited legislative and regulatory guidance to enhance agricultural marketing at the local, regional and international market levels. It further outlines the benefits of a legislation system that promotes marketing as

ensuring fair play among stakeholders, increasing consumers' confidence, protecting farmers/consumers against health risks associated with food. The following statements are made to ensure fare practices in agricultural products marketing:

a) The Government, in collaboration with key stakeholders, will put in place legal and regulatory framework for efficient, effective and transparent system governing agricultural marketing at different levels; and,

b) The Government will facilitate and encourage private sector participation in the development and management of legal and regulatory reforms.

As previously stated, the challenge is on establishment of a regulatory mechanism that can be respected by all government players. Such a mechanism is not prescribed in this policy. A cross reference of another policy containing such a prescription would have been more informative.

As for the private sector, a clear guidance on what the private sector should do is necessary. A policy statement to task the private sector to formulate associations or cooperative societies that can act as a middle man between private sector and government regulatory authorities is necessary. Such a privately managed body can advocate for compliance with standards among its members and negotiate with the government for better and economically friendly standards.

Institutional framework: Under institutional framework, the policy identifies problems facing both government and private institutions. It states that public institutions involved in management of agricultural products are facing challenges in dealing with agricultural marketing. These challenges include inadequate coordination among them; lags in institutional reform process; inadequate financial resources and low institutional capacities in terms of staffing, technical and managerial skills.

For the private sector the policy states that producers' organizations are generally weak and not well developed. It states that smallholder farmers are not well organized in associations, cooperative societies and groups that provide fora for discussion, negotiations, and strengthening bargaining power. Specific policy statements made to address the problems are:

a) Consumers' cooperatives development, advocacy, lobbying and negotiation skills for the private sector will be strengthened

b) The Government, in collaboration with other stakeholders, will put in place a framework to address anti-competitive practices, including cartels and monopolistic tendencies;

The government statements/commitments provide for establishment of strong institutions to deal with marketing of products. However, these can only be realized if appropriate strategies are worked out and implemented.

Agricultural marketing infrastructure: Problems facing the agricultural product marketing infrastructure are described in this part. Among those problems, the policy identifies lack of marketing structures, poor linkages within the marketing, processing and production chains, poor market-orientation and inadequate processing facilities leading to high levels of produce wastage. As a way to address the problems, the following policy commitments are made:

a) Key and strategic agricultural marketing infrastructure will be developed;

b) The Government will put in place enabling and conducive environment for private sector and other stakeholders' investment in the agricultural marketing infrastructures; and,

c) Communities' involvement in developing, operating and maintaining agricultural marketing infrastructure will be promoted

These commitments can only be realized if a strategy is put in place for their adoption.

Proposed strategies: The AMP is comprehensive enough to provide for regulatory and institutional frameworks which are needed for effective and efficient promotion of the agricultural sector. Policy development alone is not enough to achieve its objective. The government in collaboration with development partners should make efforts to formulate strategies for implementation of the AMP.

However, one of the challenges is mobilization of resources for formulation and implementation of an AMP strategy. Inclusion of these commitments in the TAFSIP may help attract donors to support formulation and implementation of the AMP. The impact of implementing this policy is obvious; stimulating agricultural growth with ultimately improved livelihood in at least 80% of the Tanzanians who rely on.

5.4. The draft Food Safety Policy

5.4.1. Introduction

The draft policy recognizes that despite existence of several laws and regulations with provisions that relate to food safety control in Tanzania, there is an urgent need for a National Food Safety Policy. It is in this regard, the draft food safety policy was formulated under leadership of the Ministry of Health and Social Welfare. The Ministry of Health and Social Welfare is viewed by food safety stakeholders as the one with the obligation of ensuring that food for human consumption in the country is safe. The draft food safety policy provides guidelines on managing the food safety system in the country and indicates that all the existing laws and regulations addressing food safety issues will be reviewed and improved in accordance with the policy. The draft policy states further that the existing food safety coordination mechanism is inadequate and creates overlaps of mandates and consequent inefficiencies in food safety control.

The contents of the Draft Food Safety Policy are as follows:

1. Current situation of food control in the country
2. Importance of a national food safety policy
3. Vision, mission and objectives of the food safety policy
4. Policy issues, aims and statements
5. Institutional framework
6. Legal framework

5.4.2. The current situation of food control in the country

Under this section the draft policy recognizes that safe food is that food which is free from chemical, biological and physical contaminants. It also states that the importance of food safety extends beyond health importance in that it is an important factor in enhancing food trade. It gives an analysis of strengths and weaknesses of the existing legal framework, institutional framework, inspection and surveillance systems, laboratory service and information, education and communication program and risk assessment systems.

5.4.3. Importance of the National Food Safety Policy

This section summarizes the need for a National Food Safety Policy. In short it states the needs as protecting the health of the public from risks of food-borne diseases, prescribing roles and responsibilities of every stakeholder in food safety protection and promotion, providing for coordination and proper supervision of food safety services with the aim of avoiding overlaps and duplication of mandates/functions between ministries, government agencies and other stakeholders; and encouraging and promoting production and businesses of high standard foods nationally and internationally.

5.4.4. Vision, mission and objectives of the National Food Safety Policy

This is a short section in which the Policy Vision is stated as "To have a society that has access to safe food for health and development." And the Policy Mission as "To coordinate and provide improved food safety and quality services to protect the consumers and public from the risk of unsafe food". The broad objective of the policy is stated as "To ensure high standard of food safety and quality from production to consumption to protect the health of the consumers and public from risk of food borne diseases and for economic growth". Whereas the section on importance of food safety policy seems to be broad enough to also cover the need for trade promotion, the vision, mission and objective appear to be more focused on the health importance.

5.4.5. Policy issues, aims and statements

This section begins with a statement that the Ministry of Health and Social Welfare is an overseer of food safety and quality services from farm to fork, although it requires that the ministry collaborates with other ministries and stakeholders.

The section covers several issues of importance in food safety and quality including the natural toxins in food, food safety research and food safety services coordination. These three areas are briefly discussed below because they form part of issues for intervention.

Natural toxins in food: Aflatoxins in foods are mentioned as part of natural toxins. This coverage states that poisons like mycotoxins result from the destruction/ deterioration or poor storage of grains and legumes. The following policy statements are made:

1. The Government shall review and formulate regulations, codes of practices and guidelines as necessary to ensure that foods do not contain natural toxins at levels exceeding the maximum regulated or guidance.

2. The government in partnership with stakeholders will build capacity for research and analysis of natural toxins in food.

Food safety research: The policy shows that research on food safety reveals the risks associated with food. It further states that research provides the scientific evidence needed for informed decision and formulation of strategies for safe food production. The following policy statements are made:

a) The Government in collaboration with stakeholders shall formulate or revise and enforce regulations, and guidelines for researches on food safety.

b) The Government in collaboration with stakeholders shall promote and coordinate researches that are aimed at improving food safety.

c) The Government shall base its food safety decisions and plans on findings from researches

d) The Government in collaboration with stakeholders shall facilitate access to food safety research findings

Food safety coordination: The policy recognizes the weakness in coordination of food safety in Tanzania. It states that food safety issues in the country are implemented by various sectors which have not provided sufficient opportunities to the stakeholders to communicate, coordinate and plan together. Therefore the following statements are made to ensure good coordination and collaboration and enhance food safety services in the country.

a) The Government in collaboration with stakeholders will amend laws, regulations and guidelines in order to establish an effective coordination mechanism for food safety.

b) The Government in collaboration with stakeholders shall provide conducive environment for establishment of an effective and efficient food safety coordination and administration system.

5.4.6. Institutional framework

The roles and responsibilities of different ministries and Government agencies, including those responsible for Health, Agriculture and Trade are identified and prescribed under this section. A brief summary of what is covered for these three sectors, the private sector and development partners presented below.

The Ministry responsible for Health: The ministry is vested with powers to oversee food safety related matters in the country, to formulate food safety policy and other legislation and has final say in all the food safety matters. The Tanzania Food and Drugs Authority (TFDA), which is an institution under the Ministry of Health and Social Welfare, is a semi-autonomous body responsible for ensuring that food reaching the consumer is safe. The policy states that TFDA shall coordinate surveillance and provide information on food-borne diseases. Indeed, the food safety responsibilities of the Ministry of Health and Social Welfare are implemented through TFDA.

The Ministry responsible for Industries and Trade: The policy recognizes that food safety is the requirement for promotion of food industry and international trade. Thus, it prescribes the main function for this ministry as far as food safety is concerned as supervision of implementation of WTO/TBT Agreements. The Tanzania Bureau of Standards (TBS) which is a semi-autonomous body under the Ministry of Industry and Trade is set as responsible for formulating and promoting Tanzania food standards. The policy also establishes TBS as a national enquiry point for WTO and focal point for ISO.

The Ministry responsible for Agriculture: In the context of food safety control this ministry is responsible for protection of plant health in order to ensure that food produced from plants is safe for human consumption. Unlike the Ministry responsible for Health where TFDA is established and the Ministry responsible for Trade where TBS is established, the policy does not establish any semi-autonomous agency to deliver on the food safety role on behalf of the ministry responsible for agriculture.

The Private Sector: The role of the Private Sector is prescribed as investing and management for food supply chain from production through processing, transportation, storage to distribution in order to promote marketing of safe food.

Development Partners (i.e. Regional and International): Development partners are described as assisting food sector in developing systems that will ensure production of safe food.

5.4.7. Legal framework

The policy states that Tanzania food safety legal framework is managed by the Government through the Ministry responsible for Health. The policy recognizes that there are several laws with provisions related to food safety and being administered under different ministries. In concluding this section, the policy states that, upon approval of this policy, only laws that comply with provisions of the policy shall survive.

5.4.8. Gaps identified and strategy proposed to address them

In view of the adverse effects of aflatoxin on health and trade as well as the fact that most of measures for prevention of aflatoxin contamination in food are administered through agriculture, key issues were identified in the draft policy and strategies to address them, in Chapter 5.

5.5. The Tanzania National Food and Nutrition draft Policy

5.5.1. Introduction

The review shows that the Tanzania Food and Nutrition Policy (FNP) which was adopted in 1992 is being revised in order to keep pace with several important national and international developments that have emerged since that time. These include the Millennium Development Goals, Tanzania Development Vision 2025, and Sector Reform Programs. Therefore, the FNP is being revised to enhance the impact of nutrition on national development, and optimize opportunities provided for achievement of the goal and objectives outlined in this policy. The review showed further that the Government of Tanzania recognizes that the increasing number of actors in nutrition, including the private sector, civil society organizations and development partners, requires a more appropriate policy mechanism for coordination to enhance impact and sustainability of nutrition interventions. Importantly, the revision is aimed at providing a more appropriate policy mechanism for coordination of nutrition services in order to enhance impact and sustainability of nutrition interventions because nutrition is increasingly being recognized as a cross-cutting issue.

In our review, we clearly found that the draft FNP also provides adequate guidance on nutrition issues, including the increasing problem of over nutrition and associated Diet Related Non Communicable Diseases, HIV and AIDS, gender and the environment which were not addressed in the 1992 policy. Below are the areas we recommend for improvement to make the policy robust enough to address among other issues, the impact of aflatoxins in human health and economy.

The vision, mission and goal of the policy are very clear and broad enough for the intended purpose. In order to achieve the goal, seven specific objectives are set in the policy document. Our view of the specific objectives revealed that there is a need to restate or expand them in order to clearly capture the aim of revising the 1992 FNP. The following issues which were not addressed by the 1992 FNP are not explicitly captured by the specific objectives:

1. Diet Related Non Communicable Diseases (Overweight and obesity)
2. Nutrition in emergencies
3. The environment
4. Nutrition and HIV and AIDS

Eighteen policy issues with respective policy statements are presented under the section of Policy issues, Statements and Objectives. Though not explicitly covered under the Specific Objectives section, Diet Related Non Communicable Diseases (Overweight and obesity), Nutrition in emergencies, The environment and Nutrition for HIV and AIDS are well addressed. We observed specific challenges which we list below with specific recommendations for overcoming them:

1. **Multi-sectorial Coordination of Nutrition intervention**: Through a policy statement the government makes a commitment to strengthen the Tanzania Food and Nutrition Center (TFNC) as a way to support multi-sectorial coordination of nutrition interventions. It should be noted that TFNC is an organ under the Ministry of Health and Social Welfare. The institution cannot attract the political support necessary for coordination of services offered by other ministries. In view of this observation, we suggest the High Level Steering Committee on Nutrition which is under the office of Government Business Coordination (under the Prime Minister's Office) and recently established by the government to address the problem of nutrition coordination be strengthened to act as an autonomous body.

2. **The Environment:** The issues presented under this section include environmental challenges that adversely impact human nutrition. These are mentioned as lack of safe water in many households, poor hygiene and food safety standards, and poor environmental health exacerbated by risky sanitation practices. This is the area where aflatoxin contamination of food and exposure to humans should have been adequately addressed. It is important to address aflatoxin exposure as an issue because recently there have been reports of clear evidences that aflatoxin exposure is associated with impaired child growth implying that the exposure is impacting negatively on nutrition interventions. We suggest that aflatoxin contamination of food and exposure in infants and children be addressed prominently and policy statement(s) to mitigate contamination and exposure be formulated.

Under the section on regulatory framework the draft policy requires amendment of the Act No.4 of 1973 (as amended by Act No. 3 of 1995) in order to provide effective multispectral coordination of nutrition services in Tanzania. The section also identifies other legislations to be reviewed. These include:

1. The National Regulations on Marketing of Breast Milk Substitutes and Designated Products, 1994

2. Code of Hygienic Practices for Foods for Infants and Children

3. Regulation of marketing of food and nonalcoholic drinks to children

5.5.2. Institutional framework for implementation of the food and nutrition policy

Under institutional framework, the policy is very exhaustive on identification of institutions (rather, stakeholders) who have different roles to play in its implementation. We identified the following gaps for which we recommend ways to bridge:

1. **The office in-charge of coordination of Government Business**: The policy identifies this office as a Coordinator of Nutrition Issue at national level. Effective coordination of all nutrition issues in a country can be a challenge to an institution with several other important responsibilities. We suggest establishment of an autonomous body for the coordination responsibility.

2. **Tanzania Food and Nutrition Centre**: TFNC is identified as the technical arm of the government on nutrition and assigned to coordinate a number of specific nutrition issues including nutrition research in the country. TFNC is a body under the Ministry responsible for Health. Unless its placement is changed, it cannot effectively coordinate the stated services. We suggest that TFNC be re-established as a body responsible for nutrition services offered under the Ministry responsible for Health.

3. **National Food Security Division:** The government has established a fully-fledged National Food Security Division, as part of the ministry responsible for agriculture, to coordinate all food security issues in the country (page 16 of the draft National Food and Nutrition Policy of June 2014).

6. OPPORTUNITY TO MAINSTREAM AFLATOXIN STRATEGIES INTO THE TANZANIA FOOD SECURITY INVESTMENT PLAN

6.1. Introduction

As shown in previous chapters, food control services in Tanzania are spread over several ministries and institutions. Those ministries and institutions give different levels of priority to food safety. As a result, in some ministries such as that responsible for agriculture, food safety gets very low priority in budget allocation. This implies that although the Government of Tanzania may be willing to support food safety services, the will may not be reflected in an environment where the Tanzania Food Security Investment Plan does not have clear priorities on food safety control. This chapter presents opportunities to mainstream aflatoxin mitigation actions into the TAFSIP as a way to ensure availability of resources for aflatoxins control.

6.2. Review of TAFSIP

6.2.1. TAFSIP in Brief

TAFSIP is an historic initiative that brings all stakeholders in the agricultural sector both in the mainland and in Zanzibar to a common agenda of comprehensively transforming the sector to achieve food and nutrition security, create wealth, and poverty reduction. Development of the TAFSIP is a product of a broad based collaborative process involving key stakeholders; including national and sectorial institutions from public and private sectors, development partners, members of academia, civil society organizations, Regional Economic Communities (RECs), African Union Commission (AUC), NEPAD- CAADP Pillar Institutions and the National CAADP Task Force comprising representatives of all relevant stakeholders, IFPRI and other regional and international bodies. It addresses the core national problems of poverty and food insecurity in rural areas and on how to promote agricultural growth and food and nutrition security in Tanzania under the framework of the CAADP.

TAFSIP is a ten-year investment plan which maps the investments needed to achieve the CAADP target of six per cent annual growth in agricultural sector. The goal of the TAFSIP is to contribute to the national economic growth, household income and food security in line with national and sectorial development aspirations. This objective embodies the concepts of allocating resources to invest more, produce more, sell more, nurturing the environment, and eliminating food insecurity; all of which are embodied in various national policy instruments.

6.2.2. Agricultural importance of aflatoxins

Aflatoxin contamination during crop development and maturity depends on environmental conditions that are optimal for the growth of fungi. During crop development, damage by pests (birds, mammals, and insects) or the stress of hot, dry conditions can result in significant infections. Drought stress (elevated temperature and low relative humidity) increases the number of Aspergillus spores in the air, increasing the chance of contamination. In addition, other

stresses (e.g., nitrogen stress) that affect plant growth during pollination can increase the level of aflatoxin produced by the Aspergillus fungi. The impact of drought on aflatoxin contamination is further exacerbated by the fact that drought stress can reduce the ability of crops to resist the growth of aflatoxin-causing fungus. At the time of harvest, high moisture and warm temperatures can increase the risk of aflatoxin contamination. Inadequate drying and improper storage also increases the risk of aflatoxin contamination. Countries such as Tanzania that are located between 40ºN and 40ºS latitude offer suitable growing conditions for the fungi, subjecting their populations to risk of exposure. Therefore, in order to control contamination mitigation factors must address these favourable factors for their growth and proliferation.

6.2.3. Agricultural development with food safety focus

Within TAFSIP, holistic approaches towards achieving national food security through increasing production and productivity along value chains are undertaken. A value chain (Figure 9) is a chain of value added activities; products pass through the activities in a chain, gaining value at each stage. In most cases, the more value you create, the more people will be prepared to pay a good price for your product or service, and the more they will keep on buying from you. Increasing production should not just be viewed as increased quantities; rather it should be judged from the safety and quality characteristics. Currently, however, it is now understood that unsafe food impacts on food availability, trade, health and general livelihoods (Figure 10). Unsafe food will cause harm to consumers and be rejected by the market, hence the objective of increased production will not be achieved. Therefore, within the TAFSIP holistic approaches towards achieving national food security through increasing production and productivity along value chains aspects of food safety should feature very clearly. Safe food ensures good health of the population that will lead to sustainable production. A well-nourished population is a healthy, hardworking and productive workforce resulting into increased productivity. However, under-nutrition significantly reduces labour productivity in agriculture. Stunting, wasting and high infant and under five mortality rates as well as poor educational achievement and low productivity in adulthood will persist if the quantity and quality of food produced in the country is not improved. The effects of malnutrition are magnified by unsafe drinking water, poor food safety standards and poor hygiene.

With sustainable production of demanded/marketable products, local as well as export market is stimulated. Stimulated market leads to growth and hence reduction of poverty which results in improved livelihoods. Improved livelihoods situation such an access to better health services, affording better education and shelter in turn leads to a health population that becomes more productive.

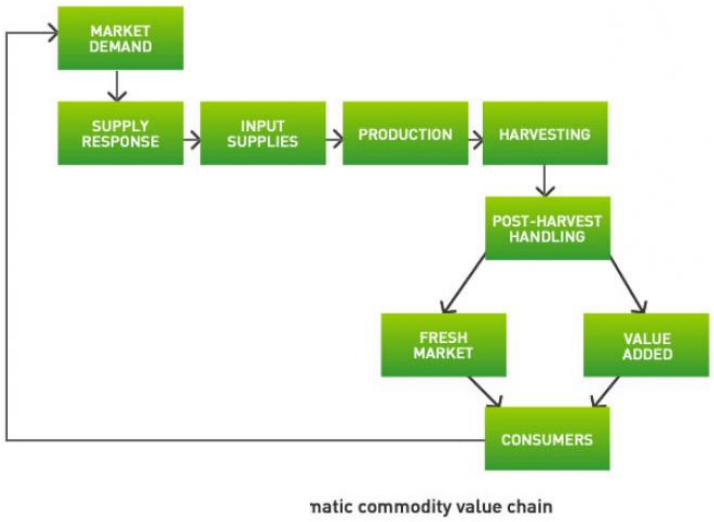

Figure 6: Schematic commodity value chain

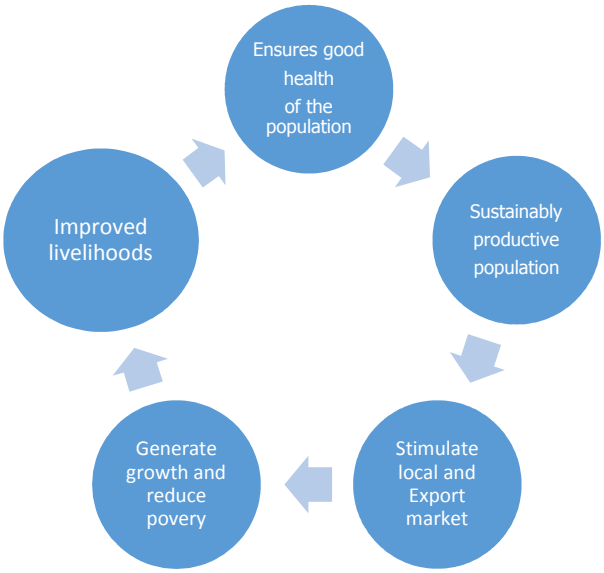

Figure 7: Agricultural development with food safety focus

6.2.4. TAFSIP approach in achieving agricultural growth

In order to achieve the TAFSIP objective, i.e. to "contribute to the national economic growth, household income and food security in line with national and sectorial development aspirations". The investment plan is expressed in terms of seven thematic program areas each with its own strategic objective and major investment programmes. The main themes/investment areas are:

- Irrigation Development, Sustainable Water Resources and Land Use Management

- Production and rural Commercialization
- Rural Infrastructure, Market Access and Trade
- Private Sector Development
- Food and Nutrition Security
- Disaster Management, Climate Change Adaptation and Mitigation
- Policy Reform and Institutional Support

Tanzania is an emerging economy with high growth potential. However, despite solid economic growth recorded, Tanzania has not been able to achieve significant reductions in poverty or shown some improvements in nutritional status. Food security has been fluctuating between years of surplus in good season and years of deficit in poor rainfall season. It is within TAFSIP that holistic approaches towards achieving national food security through increasing production and productivity along value chains are undertaken.

There is an apparent disconnection among economic growth, poverty and food security outcomes. Some of the factors attributed to this situation included low investment in agriculture sector, market constraints, and under nutrition and malnutrition resulting in low productivity in the smallholder sub-sector. TAFSIP has identified the reasons for the generally slow pace of agricultural sector development to include:

- low application of improved farm inputs resulting into low productivity
- the modest rate of improvement in agricultural service delivery, particularly extension
- limited knowledge about new technologies
- low level of private sector participation in service delivery and commercial activities
- limited efforts to strengthen client oriented technology development and dissemination
- low levels of investment in the sector especially irrigation development
- weak market linkages which affect commercialization opportunities;
- inadequate agro-processing and value addition facilities;
- post-harvest losses;
- poor rural infrastructure, especially feeder roads and storage facilities; and
- disasters mainly driven by climate shocks resulting into droughts and floods is the

- most frequent natural disaster, especially in central and northern areas.

Although factors related to food safety issues are mentioned in many cases, the Plan does not explicitly mention food safety or to be more precisely, aflatoxin problem. A closely related priority investment area (Pillar III) that was identified in TAFSIP is about Food and Nutrition security whose strategic objective is enhanced household and national food and nutrition security. A key policy issue is to ensure that significant numbers of beneficiaries graduate from chronic food insecurity to enable them to advance towards becoming small-scale semi-commercial farmers. The need for better integration of dietary diversification and nutrition behavior change into all agricultural sector programs has been taken into account. Other aspects of food and nutrition policy include food safety and food fortification. However, under the Key Results section (under Foods and Nutrition Security thematic area) the need for Food Safety and Quality Policy is listed as a Policy and Institutional Consideration.

Some of the key issues raised under various categories that have bearing on food safety are listed in Table 9:

Table 9: Key issues raised and their bearing on food safety

Area of intervention	**Key issue(s)**
Agricultural productivity	High crop losses due to pest and disease and poor post-harvest management. Damage caused by pests and diseases, both pre- and post-harvest.
Agricultural commercialization	Poor product quality due to limited awareness of consumer demands and food safety standards and poor/inadequate good storage, transport and communication facilities. Inadequate skills in agricultural business, value chain development, value addition etc. Low quality marketing infrastructure, combined with inadequate grades and standards and weak inspection mechanisms. Low fish quality and standards due to poor fishing technology, handling, post harvest losses and underdeveloped fish value chain. Inadequate quality control infrastructure for fisheries (including laboratories, fish landing sites etc).
Rural infrastructure market access and trade	Weak rural infrastructure including transport, storage, and electricity supply, and consequently high marketing costs.

Area of intervention	Key issue(s)
	Lack of agro-industrial facilities in rural area, which increases transport costs and post-harvest losses. Inadequate storage facilities at household level Weak management of plant, fish and animal health and poor enforcement of food safety controls. Low awareness of food quality issues and how they affect market opportunities and the absence of grading and product standardization protocols. Inadequate market information to support commercial decision-making and improve the bargaining power of farmers and their cooperatives/associations.
Food and nutrition security	High post harvest losses depleting food stocks Low capacity of current food reserve structures Inadequate and poor food storage facilities at household levels Poor and limited rural storage preservation facilities Limited awareness of the requirements for a healthy diet, food hygiene, food preparation and preservation methods, use of fortified food products, and the importance of dietary diversity. The prevalence of other health issues which amplify the impact of poor diet. Low literacy levels among women and girls limit their access to nutrition information. Inadequate capacity to conduct extension, research and training in nutrition and food technology.
Policy and institutional reforms and support	Inadequate Government development funding for research, extension, planning and regulatory functions Inadequate financial, human and technical capacity to generate, manage and disseminate useful agricultural information. Weak communication systems at all levels and the high cost of

Area of intervention	Key issue(s)
	procuring improved information and communication technology. Weak financial and asset management, records, reporting and monitoring and evaluation (M&E). Limited training facilities including farmer training centres and insufficient financing of agricultural training services. Shortcomings in the legal and regulatory framework including enforcement of laws and regulations. Inadequate good statistical base and analytical capacity for policy analysis and decision-making. Inadequate research infrastructure facilities and manpower, poor management of agricultural research information and inadequate linkage between research and extension. An under-resourced extension system with insufficient number of extension officers, lack of facilities and operating expenses, and a low level of private sector participation in extension services.

In view of the adverse effects of aflatoxin on health and the economy and the role of health in agricultural productivity and current and future development of Tanzania there is need to mainstream aflatoxin issues in the TASSIP.

7. EVIDENCE BASED RECOMMENDATIONS FOR MITIGATION OF THE AFLATOXIN PROBLEM IN TANZANIA

7.1. Introduction

This section reports strategic recommendations that were made in the year 2012 and validated by stakeholders as well as additional recommendations made after further analysis of the aflatoxins situation in Tanzania. The recommendations from the two analyses were merged and presented as one set.

7.2. Recommendations from the 2012 assessment

In the 2012 assessment, priority control strategies were identified for the three key sectors namely Trade, Agriculture and Health as well as for crosscutting issues. These strategies were validated and included in the strategic action for mitigation of the aflatoxin problem in Tanzania and are shown in Table 10.

Table 10: Key priority control strategies identified in the 2012 assessment for mitigation of aflatoxin problem in Tanzania

Priority Control Strategies for Agriculture: Pre-Harvest and Post-Harvest
• Measure, test, and assess the scale of the problem for use in public awareness campaigns and to target delivery of control strategies. • Promote and make available good agricultural practices. • Develop bio-control for Tanzania, keeping in mind the cost implications for poorer farmers. • Continue research efforts for breeding maize, groundnuts, and other crops for mycotoxin resistance, for availability in the longer time horizon. • Improve storage facilities at the community level. • Develop and implement good management practices. • Improve the transportation system for food crops and feeds.
Priority Control Strategies for Trade
• Shape the marketplace to improve awareness of the presence and risks of aflatoxin in the food and feed system and create market-based incentives for safer food. • Improve the definition and application of standards relating to aflatoxins in domestic markets and import clearinghouses for aflatoxin-susceptible crops. • Improve policies and procedures for product withdrawal. • Improve suitability for commerce or trade of susceptible products by identifying and making available best practices for preventing or mitigating aflatoxin levels in priority crops (maize, groundnuts and cassava) along the supply chains.

Priority Control Strategies for Agriculture: Pre-Harvest and Post-Harvest
Priority Control Strategies for Public Health
• Promote proper food handling, processing, and preparation to reduce mycotoxin contamination. • Achieve universal vaccinations for HBV since liver cancer risk is 30 times higher in HBV-positive populations. • Address the mycotoxins issue in the Infant and Young Child Nutrition guidelines. • Routinely monitor mycotoxins in cereal-based weaning foods.
Priority Control Strategies for Policy Reforms
• Recommend review and finalization of various policies that are important for food safety and aflatoxin control; National Food Security Policy, National Food Safety Policy, Draft Regulations under Grazing-Lands and Animal Feed Resources Act. • Raise awareness from the community level up to the decision makers, using a coordinated strategy with the trade and agriculture sector. The awareness-raising campaign should include information on control strategies. • Mainstream GAP and other food safety-friendly measures within agricultural extension efforts. • Coordinate with relevant ministries and institutions and propose mycotoxin levels for feed. • Ensure that dairy legislation recognizes the official national standards for mycotoxins • Ensure that priority strategies and action plans are included in the business plans of relevant departments within line ministries. • Support more research to fill the current gaps in aflatoxin prevalence in Tanzania—in the field and in foods—to increase information on producing and consuming aflatoxin-free foods. • Develop and agree on a data collection protocol and require that results from research conducted in Tanzania be shared with the national government and entered into a centralized database, to be managed by the newly formed Secretariat of the National Forum for Mycotoxins Control.

7.3. Recommendations from the 2014 assessment

The analysis of the public awareness and knowledge about aflatoxins, additional data of aflatoxin contamination in maize and groundnut as well as the information from the reviewed Food Safety related policies (in the course of this assessment) led to formulation of additional strategic actions for mitigation of the aflatoxin problem in Tanzania. The strategies and respective rationale are shown in Table 11.

Table 11: Strategic actions (interventions) formulated in this assessment and their rationale

Area of intervention	Intervention strategy	Rationale
1. Food Safety Coordination	Transform TFDA to establish an autonomous food safety body, with a multi-sectoral board, mandated to coordinate food safety and quality from farm to fork.	Reliance on TFDA (a semi-autonomous body under the Ministry of Health and Social Welfare) as the agency responsible for food safety from farm to folk is unrealistic. The TFDA Director General and Ministerial Board are appointed by the Minister responsible for health. This strong alignment to the ministry responsible for health does not give it the authority it deserves to be able to oversee implementation of food safety issues under other ministries such as Trade and Industry and Agriculture.
		The current composition of the Ministerial Board for TFDA does not have representatives from key ministries for food safety regulation, namely the ministry responsible for agriculture, the ministry responsible for livestock and the ministry responsible for trade and industry. A high level multi-sectorial board mandated to advise on food control services in the country is important as part of the TFDA. A good example of such as board is what was established under the then Food (Control of Quality) Act, 1978, which was

Area of intervention	Intervention strategy	Rationale
		composed of, among others government officials, the Managing Director of TFNC, Director General of TBS, the Government Chemist, and the Director of Crop protection
2. Private Sector engagement	Support and recognize any voluntary mechanisms for self-regulation of food safety and quality	Self-regulation is more reliable and possible, particularly for food processors and distributors. In Tanzania Food processors and distributors do not have any voluntary mechanisms for self-regulation of safety and quality. In places where private regulation is in place, the need for government control is minimum.
3. Strategy for implementation of policies	Formulate strategies for implementation of food safety related policy statements of the National Agricultural policy (2013) and Agricultural Marketing Policy (2008).	This review showed that although the NAP and AMP are comprehensive enough to provide for regulatory and institutional frameworks needed for effective and efficient regulation and promotion of the safety and quality of agricultural products, strategies for their implementation are yet to be developed.
4. Improve and finalize the Food Safety Policy	Improve Food Safety Draft Policy by including policy statements for improving food safety risk assessment, management and coordination as recommended in this report.	If accepted by all stakeholders, a food safety policy will possibly address all issues necessary for food safety risk analysis (Risk Assessment, Risk Management and Risk Communication)
5. Finalize the Tanzania National Food and Nutrition Policy draft	Finalize the National Food and Nutrition draft policy in order to provide for the establishment of an autonomous body for	The current coordination mechanism under TFNC which is under the ministry responsible for health and may not have the full mandate to oversee implementation of nutrition

Area of intervention	Intervention strategy	Rationale
	coordination of Food and Nutrition Intervention Activities in Tanzania	interventions in other ministries.
	Finalize the National Food and Nutrition draft policy in order to include clauses and policy statements on the mitigation of aflatoxin contamination in food and exposure in infants and children.	The following issues which were not addressed by the 1992 FNP are also not explicitly captured by the specific objectives in the reviewed policy draft: 1. Diet Related Non Communicable Diseases (Overweight and obesity) 2. Nutrition in emergencies 3. The environment 4. Nutrition and HIV and AIDS
6. Food risk assessment	Establish an autonomous Food Risk Analysis body with the following responsibilities: • to conduct risk assessment for the commodity value chain focusing on potential sources and factors for aflatoxin contamination • to recommend practical value chain management- pre and post-harvest management and processing • to conduct surveillance and testing that will continuously monitor prevalence and	Tanzania does not have a well-established food risk assessment body. There is a Food Analysis Department under the Directorate of Food Safety of TFDA but this department does not have capabilities and mandate to cope with growing challenges in food safety. As a result, currently, TBS formulates standards without a strong scientific basis

Area of intervention	Intervention strategy	Rationale
	exposure to aflatoxin • to provide effective communication mechanisms to create awareness of impacts and interventions that will solve the problem • Stimulate and support research and capacity building initiatives to support food safety risk assessment.	
7. Aflatoxin regulation	Formulate specific mandatory standards and regulations for aflatoxins in food and feed	This may set a clear framework for regulation of aflatoxins in food and feed and direct attention to this problem. A good example is the formulation of food fortification and salt iodation regulations which has stimulated increased efforts to address the problems in Tanzania
8. Resource mobilization for food safety	Set a mechanism for resource mobilization for food safety activities.	As shown previously, food safety control services in Tanzania are spread over several ministries and institutions. Those ministries and institutions give different levels of priority to food safety. As a result, in some ministries such as that responsible for agriculture, food safety get very low priority in budget allocation. This is, logically, because of the challenge of finding a balance between food security and food safety.

7.4. Comprehensive evidence-based recommendations for aflatoxin mitigation

Based on the priority mitigation measures identified by 2012 assessments and the additional measures/interventions identified in 6.3, a comprehensive set of recommendations was developed. The recommendations were validated by different fora; the National mycotoxin Steering Committee on 15 April 2015, the Stakeholders workshop on 20 and 21 May 2015, A

Management team of the Ministry of Agriculture, Livestock and Fisheries on 21 March 2016, Agricultural Sector Consultative Group on 22 March 2016, Business/donors Meeting on 12 May 2016 and CAADP Country Team on 31 May 2016. The attendees reviewed and adopted the situation analysis and action plan with minor changes. In the light of the real threats that aflatoxin poses to the region in terms of food security, trade, health and overall livelihoods, and given that aflatoxin begins in the fields and in crop value chains, stakeholders recommended that the action plan be mainstreamed into the Agriculture Sector Development Plan (ASDP II) through which TAFSIP is implemented.

As opposed to the recommendations formulated by Abt Associates Inc (2013), these comprehensive recommendations are categorized into more than three groups; namely Agriculture and Livestock, Trade and Industry, Health and Nutrition, and Education, Science and Technology. The recommendations are shown in Table 12.

Table 12: Strategic action plan for mitigation of the aflatoxin problem

SN	Intervention	Action
Agriculture and Livestock Sector		
1: Enable Farmers to prevent aflatoxin contamination of foods		
1.1	Strategies for implementation of food safety related policy statements of the National Agriculture Policy (2013)	Conduct advocacy and sensitization meetings with Management of the Ministry of Agriculture, Livestock and Fisheries
		Develop and present the strategies to the stakeholders for validation
1.2	Good Agricultural Practices (GAP) and Good Animal Husbandry Practices (GAHP) guidelines and codes for prevention of aflatoxin contamination	Formulate codes for prevention of aflatoxin contamination during preharvest and posthravest operations for food crops and feeds
		Integrate aflatoxin control measures in the GAPs, and GAHPs, for all cereal crops and oil seed produce
1.3	All districts agricultural extension officers and phytosanitary inspectors trained on new GAPs and GAHPs Guidelines, into which aflatoxin measures have been incorporated.	Conduct workshops to disseminate the GAPs and GAPHs for at least 30 districts agricultural extension officers and phytosanitary inspectors, annually

SN	Intervention	Action
1.4	Newly developed GAPs and GAPHs guidelines with aflatoxin measures incorporated, available at district levels	Support delivery of GAP and GAHP Guidelines to all districts
1.5	Models of improved Post Harvest Handling and storage facilities (e.g. improved threshing, drying and storage technologies) for use at community level	Design regional friendly models of improved Postharvest Hnadling and storage facilities for all agro ecological zones
		Develop a regional friendly model of improved storage facilities for all the agro ecological zones
		Deploy models of improved storage facilities to each agro-ecological zone
1.6	Bio-control products for Tanzania, developed keeping in mind the cost implications for poorer farmers	Conduct trails for identification and formulation of Bio-controls for maize and groundnuts
1.7	Capacity for evaluation of effectiveness and efficacy of bio-control products	Train at least two staff for evaluation of effectiveness and efficacy of bio-control products
		Develop guidelines for evaluation of effectiveness and efficacy of bio-control products
		Monitor released Biocontrol products
1.8	Prevent aflatoxin contamination in animal feeds through Strengthening the regulatory framework for animal feeds	Facilitate meetings for formulation and validation of specific regulations for Aflatoxins in feed
		Build capacity for and monitoring of aflatoxins in animal feeds
Trade and Industry Sector		
2: Enable Processors and traders to comply with aflatoxin regulations and improve access to markets		
2.1	Market-based incentives for production of safer food made available	Develop Market-based incentives for production of safer food

SN	Intervention	Action
		Disseminate market-based incentives to all international markets in Tanzania (e.g. Kibaigwa) for maize millers and groundnuts processors
2.2	Guidelines on application of Good Manufacturing Practice (GMP)/ Hazard Analysis Critical Control Point (HACCP) plan for Aflatoxins control in agroprocessing industries	Develop Guidelines on application of GMP/HACCP plan to control Aflatoxins in manufacture of cereal and oil seed based food and feed
		Conduct workshops for Quality control managers from all the cereal and oil seed based products on application of the Guidelines for Good Manufacturing Practices (GMP)/ HACCP plan for Aflatoxins control
2.3	Strategies for implementation of food safety related policy statements of the National Agricultural Marketing Policy (2008)	Conduct advocacy and sensitization meetings with Management of the Ministry of Industries, Trade and Investments (MoITI)
		Present the strategies to the stakeholders for validation
2.6	A voluntary mechanism for self-regulation of food safety and quality	Advocate and sensitize the private sector stakeholders to facilitate establishment of a self regulatory mechanism
		Support set up of a voluntary mechanism for self-regulation of food safety and quality
2.7	Cooperatives to enable processors and traders acquire improved produce handling technologies	Conduct sensitization meeting with the private sector to advocate for establishment of, at least, two farmers' cooperative societies
Health and Nutrition sector		
3: Enable Consumers to minimize the risk of aflatoxin exposure and effects		
3.1	Infant and Young Child Nutrition guidelines contain aflatoxin avoidance measures and available at all levels	Incorporate aflatoxin avoidance measures in the Guidelines on Infant and Young Child Nutrition

SN	Intervention	Action
		Distribute the new guidelines on Infant and Young Child Nutrition to all districts,
		Conduct a workshop to train all district nutrition officers on aflatoxin issues and aflatoxin measures contained in the infant and young child Nutrition
3.2	Dietary diversification as one of the measures to minimize aflatoxin exposure	Develop information and communication materials on dietary diversification
		Air at least one radio program weekly, on the importance of dietary diversification as one of the measures to minimize aflatoxin exposure
3.3	Capacity for, and monitoring of, aflatoxin exposure in humans	At least one referral hospital in each of the five zones equipped with facilities for screening patients for aflatoxin exposure
		At least two staff in each referral hospital in each of the five zones trained on how to screen patients for aflatoxin exposure
		Monitor aflatoxin exposure in at least 500 individuals annually
3.4	Achieve universal vaccinations for HBV	Conduct advocacy to the Management of the Ministry of Health and Social Welfare on the synergistic effects between aflatoxin exposure and Hepatitis B Virus (HBV)
		Procure materials for universal vaccinations against HBV annually
4: Risk Assessment Institutional framework established		

SN	Intervention	Action
4.1	A Food Safety and Quality Policy in which Risk Assessment administration is clearly separated from risk management.	Conduct meetings with the MoHCHGEC Management and Prime Minister's Office to advocate for establishment of a Risk Assessment framework under the Food Safety Policy
		Perform situation analysis and prepare background paper and present it to relevant organs
		Support formulation of a legal instrument for establishment of an autonomous food risk assessment body
4.2	Staffing for a Food safety Risk Assessment body	Employ at least six individuals
4.3	Office space and facilities for the Food Safety Risk assessment body	Equip the Risk Assessment body
4.4	Human capacity for risk assessment for Aflatoxins	Support short course training on risk assessment for at least 6 staff
4.5	Aflatoxin risk assessment protocol for Tanzania	Formulate a protocol for aflatoxin risk assessment
5: Improve regulatory system for Aflatoxins in food		
5.1	Transformation of TFDA to an autonomous body, with a multi-sectorial food safety board, mandated to coordinate food safety from farm to fork.	Conduct meetings with MHCDGEC officials and Parliamentary Social Services Committee to advocate for transformation of the Tanzania Food and Drugs Authority (TFDA) board
		Conduct a stakeholders meeting to validate amendment of the Tanzania Food Drugs and Cosmetics Act to establish a multisctoral Advisory Board
5.2	Set a mechanism for resource mobilization for food safety activities	Review the Fees and Charges Regulations

SN	Intervention	Action
		Conduct a stakeholders meeting to validate amendment of the Tanzania Fees and Charges Regulations
5.3	Support operations of the multi-sectorial Aflatoxins advisory committee (National Mycotoxin Steering Committee)	Equip the coordination office
		Support travel and operations for committee meetings
5.4	Improved regulations and procedures for product withdrawal, including alternative uses for contaminated food	Review the Treatment and Disposal of Unfit food regulations being enforced by TFDA
		Conduct a stakeholders meeting to validate amendment of The Treatment and Disposal of Unfit food regulations
5.5	Regulations for control of Aflatoxins contamination in maize and groundnuts	Draft specific regulations for control of Aflatoxins in food
		Conduct a stakeholders meeting to validate the regulations
5.6	Work out innovative systems and pilot regulatory enforcement for the informal internal market	Engage consultants to advise on the informal sector regulation
		Draft regulations for enforcement of aflatoxin standards in the informal internal market
		Design and set up a mechanism, for monitoring implementation of the informal sector regulations
		Conduct a stakeholders meetings to validate regulations for enforcement of aflatoxin standards in the informal internal market
5.7	Monitored status of Aflatoxins in cereal- and groundnut based weaning foods and national grain reserves	Routinely monitor Aflatoxins in cereal and groundnut based foods in the market
5.8	Zonal laboratories for Aflatoxins screening in the country	Establish aflatoxin screening capacity in at least two zonal offices of TFDA, annually

SN	Intervention	Action
5.9	A full time coordination office for aflatoxin regulatory activities	Employ and retain three staff, expert in aflatoxin issues in TFDA, TBS, and MALF and an administrative secretary
Education, Science and Technology sector		
6: Enhance research on aflatoxin prevention strategies		
6.1	Independent health risk assessment for crops produced using the bio-control technology, taking into account all bio-control technologies	Assess the risk of CPA contamination and exposure from bio control produced maize and groundnuts, annually
6.2	Independent environmental risk assessment for crop production using the bio-control technology	Assess impact on environment, of atoxigenic fungi bio control application
6.3	Continuous update of the risks of Aflatoxins contamination and exposure in Tanzania	Determine hot spots and risk factors of aflatoxin contamination and exposure in all regions of Tanzania, on continuous basis
6.4	Cost effective alternative uses of aflatoxin contaminated produce	Research for alternative uses of aflatoxin contaminated produce
6.5	Continued research efforts for breeding maize and groundnuts with aflatoxin resistance for availability in the longer time horizon	Support breading for aflatoxin resistant maize and groundnut varieties
6.7	Home based substitutes (food crops, products and formulations) for aflatoxin susceptible foods	Determine on annual basis at least two crops and proportions that can be used to substitute for maize and groundnuts in complementary foods and incorporate them in the national nutrition guidelines
7: Enhance knowledge on Aflatoxins		
7.1	Aflatoxin related aspects incorporated in agriculture and health subjects taught at primary and secondary schools	Conduct meetings with relevant authorities to advocate for incorporation of aflatoxin aspects in the primary and secondary school levels

SN	Intervention	Action
		Prepare and present information to be incorporated in curricula for schools
7.2	Improved capacity of teachers, on aflatoxin knowledge and communication	Train at least 30 Science teachers of primary and secondary level education , annually, on food safety issues, including Aflatoxins
7.3	Curricula for certificate, diploma, undergraduate and graduate programs on agriculture and health incorporate components of aflatoxin prevention and control	Sensitize the SUA and MuHAS Management and support review of Curricula for undergraduates
		Sensitize NM-AIST and SUA Managements and support review of postgraduate programs
7.4	Improved Knowledge for processors, traders, stockists and produce dealers in quality control and assurance with respect to aflatoxin contamination	Conduct two week course, annually, to processors and produce dealers in quality control and assurance with respect to aflatoxin contamination, annually
7.5	Improved district extension workers capacity for training farmers on management of Aflatoxins	Conduct two week course, annually, to at least 30 district extension workers on food safety and aflatoxin control.
7.6	Improved Knowledge for health practitioners (doctors, nurses and laboratory technologists) on how to test for aflatoxin exposure, provide counselling and recommend early testing and referral of patients.	Conduct a two week course to at least 30 health practitioners, annually
7.7	Improved knowledge on aflatoxin risk assessment and management in Tanzania	Support two higher Education institutions to improve aflatoxin risk assessment training capacity
		Train at least 30 undergraduates on risk management for Aflatoxins
		Train at least 15 post graduates on aflatoxin risk assessment and management
8: Enhance awareness on aflatoxin issues		

SN	Intervention	Action
8.1	A communication strategy for aflatoxin matters	Develop a strategy for communication of the aflatoxin problem and mitigation measures
8.2	Information and Knowledge for communication personnel on the economic and health risks of aflatoxin exposure and best practices for aflatoxin control for information dissemination to farmers.	Provide a short course, on annual basis, to Communication personnel from all key sectors for aflatoxin management
8.3	Information, education and communication materials for all proposes	Develop Leaflets, posters and feature stories to suit various needs
8.4	Programs for advocacy about Aflatoxins	Conduct two advocacy campaigns, annually, for policy makers and politician
8.5	Continuous programs for raising public awareness about Aflatoxins	Conduct Seminars, workshops, meetings, exhibitions, Road shows, 10 radio , 10 TV programmes and 20 cinema shows on Aflatoxins, annually
8.6	Annual scientific forum for sharing aflatoxin information	Conduct a forum involving at least 30 participants, on Aflatoxins, annually

8. CONCLUSIONS AND WAY FORWARD

8.1. Conclusions

The present aflatoxin situation analysis provided more insights about the magnitude of the aflatoxin problem in Tanzania and identified the strengths and weaknesses of the food safety control systems of Tanzania. The analysis and review of the Tanzania Food Security Investment Plan identified opportunities for developing workable strategies for mitigation of the aflatoxin problem in the country. Although the level of awareness about the aflatoxin problem was found to be low, the process of assessing the situation and planning for mitigation measures provided another opportunity for raising awareness about the problem.

The situation analysis confirmed that aflatoxins are prevalent in maize and groundnuts grown and consumed in Tanzania. It also confirmed that over 40% of maize samples from the Eastern and Western regions of Tanzania contain aflatoxins at levels that exceed the national regulatory limit of 10ppb. It also showed that aflatoxins levels in over 18% of groundnut exceed the regulatory limit of 5ppb set for aflatoxin B1.

Another important observation is that over 80% of infants and young children in Iringa, Kilimanjaro and Tabora were found to have aflatoxins in their blood. Based on these data this assessment estimated that, annually, about 3334 cases and 3167 deaths of hepatocellular carcinoma (HCC) result from aflatoxin exposures leading to a loss of 96,686 DALYs, annually. The annual financial impact resulting from such illness and loss of life ranges from $ 6 million to as high as $ 264 million. Assuming that the biomarker data used in the health impact assessment represent the situation in the entire country, these quantitative figures show the number of illnesses and deaths that can be prevented, the number of DALYs that can be averted and the amount of money that can be saved if aflatoxin mitigation measures are successfully implemented in the country. The review of policies revealed that there is a poor institutional framework for food safety control in the country. The review of the TAFSIP document showed that although factors related to food safety issues were mentioned in many areas it does not explicitly mention food safety or specifically, the aflatoxin problem.

8.2. Way Forward

On the basis of the aflatoxin and food safety system situation, strategic actions were formulated and incorporated into the ASDP2 under development. During the Business Planning Meetings, a commitment to prioritize on aflatoxin mitigation actions was provided by the government should these actions be included in the ASDP2. Also participants expressed their commitment to strengthening collaboration among themselves in order to ensure successful implementation of the Action Plan. As a way to improve coordination, TFDA was advised to reconstitute the National Mycotoxin Steering Committee in order to include representatives of NGOs, the Media and Donors.

Hopefully the Government of Tanzania will approve the ASDP2 in the near future and allocate resources for its implementation. It is also expected that if the coordination office and mechanisms established at TFDA are improved as proposed by stakeholders, Tanzania will be informed on regular basis of all aflatoxin works taking place in the country, including those being unilaterally implemented by universities and research institutions.

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