



ILRI Discussion PAPER

A review of the food safety architecture in the East African Community

Animal-source foods, fruits and vegetables



RESEARCH
PROGRAM ON
Agriculture for
Nutrition
and Health

A review of the food safety architecture in the East African Community

Animal-source foods, fruits and vegetables

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Abbreviations/acronyms

A4NH	CGIAR Research Program on Agriculture for Nutrition and Health
AFA	Agriculture and Food Authority
AfCFTA	Africa Continental Free Trade Area
ANAGESSA	National Agency for Food Security Stock Management
ASF	Animal-source foods
ASTGS	Agricultural Sector Transformation And Growth Strategy
AU	African Union
BBN	Burundi Bureau of Standards and Quality Control
CAADP	Comprehensive African Agricultural Development Programme
CAK	Competition Authority of Kenya
COVID-19	Coronavirus disease 2019
CRP	CGIAR Research Program
CSO	Civil society organizations
DALYs	Disability-adjusted life years
DVS	Directorate of Veterinary Services
EAC	East African Community
EAFF	East Africa Farmers Federation
ENSI	East African Nutritional Sciences Institute
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	Food and Agriculture Organization Statistical Database
FBD	Foodborne diseases
FSMS	Food Safety Management System

FV	Fruits and vegetables
GAP	Good agricultural practices
GCLA	Government Central Laboratory
GDP	Gross domestic product
GFSI	Global Food Safety Initiative
GFSP	Global Food Safety Partnership
GHP	Good hygienic practices
GMP	Good manufacturing practices
HACCP	Hazard Analysis Critical Control Point
HCDA	Horticulture Crop Development Authority
IECT	Information, education, communication and training
ILRI	International Livestock Research Institute
ISO-QMS	International Standards Organization Quality Management System
KDB	Kenya Dairy Board
KDPA	Kenya Dairy Processors Association
KeCPAC	Kenya Consumer Protection Advisory Committee
KEPHIS	Kenya Plant Health Inspectorate Service
KFDA	Kenya Food and Drug Authority
LMICs	Low- and middle-income countries
LNR	National Reference Laboratory
MAAIF	Ministry of Agriculture, Animal Industry and Fisheries
MALF	Ministry of Agriculture, Livestock and Fisheries
MALFI	Ministry of Agriculture, Livestock, Fisheries and Irrigation
MINAGRI	Ministry of Agriculture and Animal Resources
MINEAGRIE	Ministry of Environment, Agriculture and Livestock
MINICOM	Ministry of Trade and Industry
MoA	Ministry of Agriculture
MoH	Ministry of Health

NAEB	National Agricultural Export Development Board
NESCRA	National Environment Standardization Coordination and Regulatory Authority
NFCS	National food control systems
NFDA	National Food and Drug Authority
NIRDA	National Industrial Research Development Agency
NSQPIP	National Standards and Quality policy Implementation Plan
NTS	Non-typhoidal salmonella
PCPB	Pest Control Produce Board
PNIA	National Agricultural Investment Plan
PNSAN	Multi-sectoral Platform for Food Security and Nutrition
PSMSAN	Multi-sectoral Strategic plan of Food and Nutritional Security
RAB	Rwanda Agricultural and Animal Resources Board
RALIS	Rwanda Agricultural and Livestock Inspection and Certification Services
RBC	Rwanda Biomedical Centre
RSB	Rwanda Standards Board
RW-FDA	Rwanda Food and Drugs Authority
SDG	Sustainable Development Goal
SGS	Société Générale de Surveillance
SME	Small and Medium Enterprises
SSNBS	South Sudan National Bureau of Standards
STEC	Shiga Toxin producing Escherichia coli
TAMPRODA	Tanzania Milk Producers Association
TANLITS	Tanzania Livestock Identification and Traceability System
TBS	Tanzania Bureau of Standards
TDB	Tanzania Dairy Board
TFDA	Tanzania Food and Drug Authority
TMB	Tanzania Meat Board
TMDA	Tanzania Medicines and Medical devices Authority

UDPA	Uganda Dairy Processors Association
UNBS	Uganda National Bureau of Standards
VMB	Veterinary Medicines Board
WASH	Water Sanitation and Hygiene
WHO	World Health Organization
ZBS	Zanzibar Bureau of Standards
ZFDA	Zanzibar Food and Drug Agency

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Executive summary

In the 1996 World Food Summit, governments reaffirmed the right of everyone to have access to safe and nutritious food, consistent with the right to adequate food and the fundamental right of everyone to be free from hunger. They pledged to work together and eradicate hunger. 'Zero hunger' is one of the United Nation's Sustainable Development Goals (SDG). Safe food is important and should be considered in attempts to ensure a world that has adequate food and is hunger free. Globally, unsafe food is estimated to cause over 600 million cases of illness and 420,000 deaths annually, resulting in a burden of 33 million disability-adjusted life years (DALYs). Attention given to food safety is increasing, due to the evidence on the health and economic burden of foodborne diseases (FBD), and acceleration of drivers causing unsafe food. Governments are mandated to ensure available food is safe for human consumption. They can do this by developing and/or strengthening national food control systems (NFCS). Assessing NFCS in any country is one way to evaluate the state of food safety in the country. The findings can be used to define areas that need to be improved for better protection of consumers.

Food safety experts from each of the six partner states in the East African Community (EAC), namely Burundi, Kenya, Rwanda, South Sudan, Tanzania and Uganda, were trained on food safety, through two workshops that ILRI organized in 2019. Although the training focused on risk assessment, participants were also introduced to the concept of a NFCS, its components, and usefulness in ensuring good health, protecting consumers, and for economic development (ILRI 2019). As a follow up to the training, participants from each country, led by a team leader, were expected to, working as a team, assess the food safety situation in their country. The reports from countries were reviewed and key data extracted and summarized to give this report, which combines information on EAC countries. The reviews focused on safety of two value chains, which are most often implicated in FBD and are essential for nutrition in the EAC, namely animal-source foods (ASF) and fruits and vegetables (FV). Components of NFCS include food law and regulation, food control management, inspection, laboratories, and information, education, communication and training (IECT).

Both public and private stakeholders play a major role in ensuring the safety of these products. The public stakeholders identified included ministries of agriculture, health and trade that are tasked with formulation and implementation and enforcement of policies, legislation and regulations regarding food safety. The private stakeholders in the region are many, starting from primary producers to consumers along the farm-to-fork continuum. This continuum includes consumer lobby groups, farmer organizations, as well as private manufacturing entities. Cooperation between the public and private sector in ensuring food safety was thought to be paramount. The two groups of stakeholders were found to collaborate in executing this mandate.

The partner states in the region do not lack policies, regulations and legislation to govern food safety (as well as emerging and re-emerging) issues. The partner states have each adopted a multi-agency food safety management system, which, given the lack of clear demarcation on the agencies' influence boundaries, has many conflicts, resulting to duplication of tasks, redundancies, lack of prudent financial management, and inadequacy in addressing food safety issues (which leave consumers exposed). It was observed that the agencies are poorly resourced and rarely implement their food safety mandates. Equally, the lack of an effective coordination mechanism contributes to the dismal performance of the agencies in addressing food safety issues.

There are no policies or legislations which explicitly target transformation of informal markets, despite the fact that up to 90% of the population are sourcing their food from informal channels. The perceptions that consider these markets synonymous with unsafe food need to be addressed as it excludes the sector from policies legislations and regulations that could lead to its transformation and improvement. Food inspections assist in assessing the level of compliance with food safety regulations. Inspection and testing were found to be done mostly on foods destined for sale through the formal market chain or export and rarely on those destined for informal markets. Given the role of informal markets in food supply and their popularity in the region, it is critical that the region prioritizes safety of foods sold through these channels, to guarantee safety and consequently minimize the FBD burden associated with unsafe food.

This study has established that none of the six states has a formal food safety surveillance system. To set up such systems will require a cadre of food safety professionals (inspectors) and laboratories that are fit for purpose. The number of inspectors available in the region is inadequate to manage the many food value chains and the complexities associated with these. Accredited laboratories were also found to be few. To deal with human and infrastructural requirements, the partner states need to proactively prioritize food safety including investments such as training programs that ensures a cadre of food safety experts are availed, public education to instil a food safety culture, equipment and personnel to man the laboratories as well as prerequisites (water, electricity, sanitation) to enable food handlers to operate in an appropriate environment. There are also opportunities for tools and approaches that can be used across the EAC.

It was concluded that the biennial review process of the Comprehensive African Agricultural Development Programme (CAADP) on African food safety index provides a good basis for addressing the food safety concerns of the region. The EAC can use the process to better position itself to be able to reap from the African Union (AU) Malabo Declaration on Accelerated Agricultural Growth and Transformation for Shared Prosperity and Improved Livelihoods Commitment 5(a) on tripling intra-African trade in Agricultural commodities and services by 2025 and the African Continental Free Trade Area.

I. Background

When food is safe, we can be assured that, if eaten as intended, it will not cause harm to human health. Harm is the result of foodborne hazards, which can be biological, chemical or physical. Foodborne diseases (FBD) can be, at best, unpleasant, and at worst, fatal. There are other consequences of FBD, which include damage to trade and tourism, loss of earnings, unemployment and litigation. FBD are a result of action or inaction by stakeholders along the farm-to-fork continuum.

An estimated 60% of human infections are caused by pathogens shared between human and animals (Taylor et al. 2001). There is little good evidence on the foods associated with this burden in low- and middle-income countries (LMICs) but several studies have suggested that animal-source foods (ASF) and fruits and vegetables (FV) are responsible for most of this burden (Grace 2015). Another study based on modelling estimated at least 35% of the burden was due to ASF (Li et al. 2019), and Hoffmann et al. (2017) suggested FV account for 60-80% of illnesses based on expert elicitation. These FBD are a consequence of contamination with foodborne hazards along the farm-to-fork chain, especially bacterial and parasitic hazards. Vegetables may also be contaminated with parasites (e.g. ascarids, *Echinococcus* spp., *Entamoeba histolytica*, *Giardia* spp. and *Cryptosporidium* spp.) and parasites in animal hosts are also an important cause of disease.

It is estimated that over 200 diseases are caused by eating contaminated food. Foodborne contaminants are numerous and include bacteria, viruses, parasites, chemicals, toxins and allergens that cause a wide range of conditions (WHO 2015). Diarrhoeal diseases are the most frequent manifestation of FBD (Gibb et al. 2019), mainly caused by norovirus, *Campylobacter* spp., Enterotoxigenic *Escherichia (E.) coli* (EHEC), and non-typhoid *Salmonella* spp. (NTS). Common foodborne hazards found in meat include *Campylobacter* spp., shiga toxin-producing *E. coli* (STEC), NTS, *Brucella* spp., *Toxoplasma (T.) gondii*, *Taenia solium*, *Trichinella* spp., *Clonorchis sinensis*, intestinal flukes, *Opisthorchis* spp. and *Paragonimus* spp (WHO 2015).

The health burden of a disease is usually measured in disability-adjusted life years (DALYs), meaning the sum of the years of life lost due to premature mortality in the population and the years lost due to disability for incident cases of the health condition. One DALY can be thought of as one lost year of “healthy” life and the burden of disease as a measurement of the gap between current health status and an ideal situation where everyone lives into old age free of disease and disability’ (Kirk, 2008). According to a World Health Organization (WHO) study, which is our best guide to the burden of FBD, the Africa region ‘E’ (AFRE) that includes EAC countries has one of the highest shares of FBD. An initial study looked at just 31 hazards for which there was reasonable data and estimated a burden of 1,179 DALYs/100,000 population (WHO 2015). Another part of the same study looked at the health burden from four heavy metals in food. It estimated an additional burden of 152 DALYs/100,000 people in 2015 (Gibb et al. 2019) (Table 1).

Table 1: Disability Adjusted Life Years (DALYs) lost to foodborne disease in the Africa region (E) per 100,000 people

Foodborne hazard	Common name for disease	DALYs lost per 100,000
Non-typhoidal <i>S. enterica</i>	Non typhoidal salmonellosis (NTS)	193
<i>Taenia solium</i>	Cysticercosis	176
<i>Vibrio cholerae</i>	Cholera	143
Enteropathogenic <i>E. coli</i>	Toxigenic <i>E. coli</i> disease	138
Enterotoxigenic <i>E. coli</i>	Toxigenic <i>E. coli</i> disease	105
Lead	Lead poisoning	82
Norovirus	Norovirus diarrhoea	76
<i>Campylobacter</i> spp	Campylobacteriosis	70
<i>Salmonella Typhi</i>	Typhoid	52
<i>Shigella</i> spp	Shigellosis	37
Methylmercury	Mercury poisoning	37
<i>Mycobacterium bovis</i>	Zoonotic tuberculosis	34
<i>Toxoplasma gondii</i>	Toxoplasmosis	20
Hepatitis A virus	Hepatitis	18
Arsenic	Arsenic poisoning	14
<i>Cryptosporidium</i> spp	Cryptosporidiosis	12
<i>Salmonella Paratyphi A</i>	Paratyphoid	12
<i>Entamoeba histolytica</i>	Amoebiasis	5
<i>Ascaris</i> spp	Roundworm infection	5
Aflatoxin	Aflatoxicosis	3
Cassava cyanide	Tropical ataxic neuropathy and konzo	3
<i>Listeria monocytogenes</i>	Listeriosis	1
Cadmium	Cadmium poisoning	1

Source (WHO 2015): Only hazards resulting in a loss of one or more DALYs per 100,000 people were included. Thirty-one hazards study (Havelaar et al. 2015) and four heavy metals study (Gibb et al. 2019).

Li et al. (2019) estimated the global health burden of the diseases caused by hazards attributable to ASF to be 168 DALYs /100,000 population from the same data collected in 2010. In the estimate for AFRE, the burden was 459 DALYs/100,000 population, and was mainly due to non-typhoidal salmonellosis (163/100,000) and *Taenia solium* (176/100,000). This estimate is higher than that reported for regions outside Africa. These FBD attribution data are based on very inadequate data and can be considered only approximates.

Hoffmann et al. (2017) estimated the proportion of foodborne diseases attributable to specific foods, in different regions. For vegetables in the region that includes EAC, the proportion was 0.06, 0.05, 0.09 and 0.16, for *Campylobacter* spp., NTS, STEC and *T. gondii*, respectively. For fruits and nuts, the proportion was 0.04, 0.05 and 0.03, for NTS, STEC and *T. gondii*, respectively. These FBD attribution data are based on very inadequate data and can be considered only approximate.

Food safety is a public good that is best led by national governments for the individual diseases in their local context, the types of foods eaten and locally predominating diseases. Understanding the governance and public health problems regarding animal and vegetable value chains is a first step to developing strategies to address food safety in East Africa.

2. Methodology

In 2019, the International Livestock Research Institute (ILRI) facilitated two workshops on food safety for stakeholders in the EAC (ILRI 2019). The objective was to build the capacity of the countries to deal with emerging and re-emerging food safety challenges in the region. Participants were drawn from the six EAC partner states and Ethiopia. In each country, a contact affiliated to a local university was identified and asked to suggest experts who would, in turn, be invited to attend the workshop. They were to be drawn from public health, agriculture (specialist in horticulture), the national bureau of standards, veterinary public health, and milk and meat regulatory authorities. Five to seven participants from each country attended the workshop. The following topics were covered during the training: global food safety perspective, qualitative and quantitative risk analysis, food safety management (Hazard Analysis Critical Control Point [HACCP] and industry standards), and development of policy papers (see Annex 1). Following the training, participants from each country worked together to develop a situation analysis report that summarized the food safety governance (stakeholders, policies and regulations) and food safety problems in ASF and FV value chains. A framework that had been used in a previous food safety project (i.e. Safe Food Fair Food¹) was adopted. Data was collected from online resources including consulting databases of the Food and Agriculture Organization of the United Nations (FAO). Because of the coronavirus disease 2019 (COVID-19) it was not possible to implement some of the planned activities such as face-to-face interviews with key stakeholders and workshops to validate study findings. Instead, each country team recruited a local food safety expert who reviewed the draft report and provided feedback. Additional reviewing was done by scientists at ILRI and Purdue University. The main findings from the individual country reports are consolidated in this report, to provide a summary that is representative of the food safety situation in the EAC region.

¹ ILRI-led research on food safety in informal markets since 2006: <https://www.ilri.org/products/safe-food-fair-food>

3. Contribution of animal-source foods, fruits and vegetable value chains

3.1 Livestock sector

Meat, eggs, milk and fish are the main foods derived from livestock. Beef, pork, poultry and small ruminants are the main types of meat consumed in East Africa. The livestock sector's contribution to the national gross domestic product (GDP) in the region varies by country. For example, the contribution is 5% in Uganda (FAO 2005b), 12% in Kenya (Republic of Kenya 2019), and 14% in Burundi (De 2011). Fisheries contribute 0.5% of the Kenya's GDP (FAO 2015b), 12% of Uganda's agricultural GDP (FAO 2019), 1% of Rwanda's GDP (MINAGRI 2013), 1% in Burundi (FAO, 2005a) and 2.9% in Tanzania (FAO, 2007).

The sector is one of the fastest growing and is dominated by smallholder farmers. The majority of households keep at least one type of livestock including 60% of the total households in Kenya (FAO 2015a) (KNBS 2019) and 58% of all households in Uganda (FAO 2017). The number of actors (public and private) varies by country, and overall, the sector is not fully regulated. Products from this sector are traded mostly in the informal sector and this makes regulation by state inspectors challenging. The export-oriented private firms are regulated with constant safety audits by various regulatory agencies and this is often driven by the demand of the country or region of export destination. Fish is an important international export from some countries while most other livestock products are less extensively exported.

Table 2 shows the production, domestic supply or consumption (= production + imports – exports) and per capita consumption across the region for ASF. In all countries, milk dominates production followed by beef. Livestock contributes 25–30% of the income of livestock-keeping households (FAO 2019).

3.2 Fruit and vegetable sector

This sector is a major contributor to the GDP of the countries. Several products exist and most are sold in informal markets and consumed locally. Vegetables and fruits are generally produced by small- and medium-scale farmers who grow one or two crops as primary cash crops. Lack of adequate storage at source has great implications on food safety and loss due to spoilage. The actors range from farmers, brokers, aggregators, wholesalers, retailers (vendors) and transporters. At every node, there are actions (and inactions) that can lead to food contamination. About 90–95% of fruits and vegetables produced in the region is sold in informal markets (except in South Sudan where all the FV produced are sold in the informal markets). Production varies across the region. FAO statistics show that Uganda produces more vegetables than other countries in the EAC at 1,037,513 tonnes, while Rwanda has a production of 484,829 tonnes, annually. For fruits, Tanzania is the leading producer with an annual production of 201,618 tonnes (FAOSTAT 2018). Low consumption of fruits and vegetables has been reported in the region (Kabwama et al. 2019). This notwithstanding, the export sector of fresh fruits and vegetables is growing. Kenya, which exports only 5% of the total produce of FV, earned USD 2 million in exports in 2018 (FAOSTAT 2018).

Table 2: Production and consumption of ASF in the EAC region (in tonnes)

ASF ^d	Burundi			Kenya			Rwanda			South Sudan ^c			Uganda			Tanzania		
	Production	Consumption**	Per/Capita/kg*	Production	Consumption**	Per/capita/kg*	Production	Consumption**	Per/capita/kg*	Production	Consumption**	Per/capita/kg*	Production	Consumption**	Per/capita/kg*	Production	Consumption**	Per/capita/kg*
Beef	10,301	ND	ND	652,010	423,055	9.54	32,707	28,760	2.53	227,739	409,078	10.78	238,729	193,512	5.15	329,372	300,129	6.09
Sheep and goat meat	3,185	ND	ND	37,133	82,411	1.86	134	22,755	1.93	47,731	376,210	9.91	41,098	47,026	1.25	43,618	63,219	1.28
Poultry meat	6,980	ND	ND	30,248	20,868	0.47	15,725	15,784	1.34	20,000	47,550	1.25	69,548	56,753	1.51	100,991	90,468	1.84
Pork	6,323	ND	ND	25,389	13,024	0.29	9,310	8,943	0.76	ND	ND	ND	129,195	26,494	3.37	14,981	15,981	0.32
Fish ^a	1,538	ND	ND	1,538	5,090	0.03	2,263	2,344	0.19	34	34	ND	1,004	1,004	0.03	8,766	10,933	0.18
Milk ^b	78,101	ND	ND	4,917,893	4,968,365	89.67	252,013	93,077	4.1	3,263,244	579,879	132	1,730,771	1,475,668	372	1,457,248	2,048,490	23.51
Eggs	3,838	ND	ND	83,552	98,042	1.84	7,800	3,000	0.16	ND	41,296	0.99	45,000	46,277	0.97	108,700	36,121	0.58

Source= *per/capita/ kg milk and fish FAOSTAT 2013; ** Source FAOSTAT 2013; Consumption here is domestic supply (production +import-export), a Fish data =pelagic fish; b Milk = production from cattle, camels, sheep and goats; c=per/capita/kg/yr data for South Sudan refers to data for the former Sudan 2013; d all other data source = (FAOSTAT 2018). ND =No Data

4. Food safety governance

4.1 Food safety stakeholders

Stakeholders² in food safety are either public or private entities. Public stakeholders include regulators responsible for policy, legislation and regulation formulation and enforcement. Private stakeholders include producers, transporters, processors, marketers, retailers and consumers at a small, medium or large scale.

4.1.1 Public stakeholders

Public stakeholders, in the six partner states include the ministries of agriculture (crops, livestock and fisheries), health, and trade and industry. The names of the ministries vary depending on the country and use different acronyms. Within each ministry are directorates/departments and agencies that execute the food safety mandates in the ASF and FV value chains. Table 3 gives a summary of the ministries, agencies and directorates responsible for food safety in the EAC region.

The countries have a similar food safety organizational framework that is vested in a few ministries (agriculture, health and trade). What is lacking is an overarching and coordinating body that is mandated to collect and collate data on food safety from the various agencies/departments/ authorities, analyse and provide evidence-based food safety status reports for the country. Considered even better (but more difficult to implement) is a single agency for food safety. Rwanda was found to be a step ahead of the other countries in the region. Formed in 2018, the Rwanda Food and Drugs Authority (RW-FDA) will have greater food safety mandates than its predecessor, the Rwanda Food and Medicines Authority. Although Tanzania was the first to form a food safety authority, the Tanzania Food and Drug Authority (TFDA), the entity was recently restructured and the food safety mandate was transferred from the TFDA (which functioned under the Ministry of Health), to the Tanzania Bureau of Standards (TBS), which is under the Ministry of Industry and Trade. Uganda also has a National Food and Drug Authority (NFDA) which is supposed to, among other responsibilities, spearhead food safety coordination. It, however, has not demonstrated the leadership that is expected of the organization. Kenya is debating the establishment of the Kenya Food and Drugs Authority (KFDA). A private member's bill is before Parliament for promulgation (Kenya Law 2019). The draft bill provides for an authority with powers to regulate and monitor manufacturing, distribution, warehousing, wholesale and importation of food in Kenya. However, the bill does not give the authority the power to amend and delineate food safety boundaries of the agencies currently regulating and controlling food safety, which would help remove redundancies. If passed, the bill would repeal the Food Drug and Chemical Substance Act, the Pharmacy and Poisons Board Act and sections of the Narcotic Drugs and Psychotropic Substances Act. On foods, the bill focuses only on manufactured foods and does not address production and transportation of fresh foods. It fails to regulate quality and safety of informal food markets, which are the predominant sources of fresh foods for the majority of citizens.

In their implementation across the countries, each public regulator targets certain nodes of the value chain. Directorates or departments within the animal production and crop protection sectors focus on regulating production at farm level, while the focus of veterinary services agencies is both at the farm and other nodes of the value chain. Establishing clear jurisdictions with no overlapping mandates but coordinated communication is important for food safety regulation.

² Stakeholder is a person group or organization that has interest or concern in an entity and can affect or be affected by decisions, policies, actions made by or about the entity.

Table 3: Public stakeholders with mandates touching on food safety in the EAC partner states

Country	Ministry	Department/directorates involved	Value chain (s)	Responsibilities
Burundi	Ministry of Environment Agriculture and Livestock (MINIAGRIE)	Crops	Fruits and vegetables	Safe pesticide use
		National Agency for Food Security Stock Management (ANAGESSA)	All foods	Maintenance of safe strategic food reserve
		Livestock	Livestock, wildlife and bees	Control of zoonotic disease at all production levels, ensure safety at production
		Fisheries	Fisheries	Coordinating safety and quality in fisheries and aquaculture
	Office of First Vice President	Multi-sectoral Platform for Food Security and Nutrition (PNSAN)		Sectoral policy constituency for food security and nutrition security
	Office of Second Vice-President	PAMSAN–Multi-sectoral platform on food Security and Nutrition	All	Coordination of food security of all value chains
	Ministry of Trade	Burundi Bureau of Standards and Quality Control (BBN)		Food fortification, standards setting and quality control
	Ministry of Public Health and Aids Control	Public health	Processing of foods	Food fortification to ensure nutritional security
		Public health	All foods at markets	Ensure food safety. Inspection at stalls, shops, markets, hotels
Ministry of Higher Education	East African Nutritional Sciences Institute (EANSI)		Capacity development at all education levels	
Kenya	Ministry of Agriculture, Livestock, Fisheries and Irrigation (MALFI)	Crops (AFA)	Fruits and vegetables	Plant health: Kenya Plant Health Inspectorate Service (KEPHIS). Safety at production and storage: Horticultural Crop Development Authority (HCDA). Safe pesticide use and control: Pest Control and Produce Board (PCPB)
		Livestock production	Meat, milk, eggs	Safety at production by offering extension services
			Milk–Kenya Dairy Board (KDB)	Milk quality and safety from production to marketing
		Directorate of Veterinary Services (DVS) and Veterinary Medicines Board (VMB)	Meat, milk, eggs, fish	Animal health, safety at slaughter, transport hygiene and inspection, export of livestock and livestock products
		Fisheries service	Fish and fisheries products	Safety in production of fish and fishery products
	Ministry of Health	Public health	Animal-source foods, fruits and vegetables	Food safety and quality control, surveillance, prevention and control of foodborne diseases/illness
	Ministry of Trade Commerce and Industry	Kenya Bureau of Standards	All	Standards setting and quality control of all foods, domestic and for export markets
	Office of the President	Regional and county governments	ASF and FV	All devolved functions in agriculture and health in regard to food quality control and safety of ASF and FV

Country	Ministry	Department/directorates involved	Value chain (s)	Responsibilities
Rwanda	Ministry of Agriculture and Animal Resources (MINAGRI)	Rwanda Agriculture and Livestock Inspection and Certification Services (RALIS)	Plant and animal	Ensure sanitary and phytosanitary measures are enforced and regulates, control and safe use of agrochemicals
		Rwanda Agriculture and animal resource Board (RAB)	Plant and animal	Implements measures to control plant and animal diseases, monitors movements to prevent introduction of animal and pest diseases
		National Agricultural Export Development Board (NAEB)	Plant and animal	Quality control of plant and animal products for export
	Ministry of Health	Rwanda Food and Drugs Authority (RW-FDA)	All foods	Food safety and quality control (hygiene, foodborne disease prevention, diagnosis, control, information gathering, food recalls)
			Foods and drugs	Regulates and controls quality of veterinary drugs and agrochemicals, food fortifiers and supplements
		Rwanda Biomedical Centre (RBC)	Foods	Testing for safety and quality of foods by the National reference Laboratory (LNR)
	Ministry of Trade and Industry (MINICOM)	Rwanda Standards Board (RSB)	Foods	Create awareness on value of standards, products quality certification services and reference quality testing laboratory
		National Industrial Research and Development Agency (NIRDA)	Agriculture and food processing	Technology development –must provide safe food at production, harvesting, processing
	Ministry of Higher Education	Universities		Create, disseminate knowledge-food safety
	South Sudan	Ministry of Agriculture and food Security	Directorates plant production, quarantine and protection,	Fruits and vegetables
Ministry of Livestock and Fisheries		Directorate of Animal Production	Livestock and fisheries	Regulations on safe production
		Directorate of Veterinary Services	Livestock	Animal health, prevention and control of zoonotic diseases, animal-source foods safety
Ministry of Health		Drug and Food Control Authority	Animal value chains	Control and proper use of veterinary medicines, control of food supplements
		Public Health Laboratory	Animal-source foods and fruits and vegetables	Assurance of food safety and quality control
Ministry of Trade and Industry		South Sudan National Bureau of Standards (SSNBS)	All foods	Assurance of quality control- inspection at ports of entry and local markets
Ministry of local government at State levels		Juba City Council	ASF and FV	Food safety of all marketed produce
Office of the President		Food Security Council		Identify food security gaps and make recommendations to combat any food insecurity.
Ministry of Higher Education and Science and Technology	Several universities		Create, knowledge, educate and train the academic and build capacity needs of the country.	

Country	Ministry	Department/directorates involved	Value chain (s)	Responsibilities
Tanzania	Ministry of Agriculture	Directorate of Crop Protection	Plant protection	Phytosanitary measures, pesticide safe use and registration
	Ministry of Livestock and fisheries development	Tanzania Meat Board (TMB)	Meat and meat products	Meat and meat products regulation
		Tanzania Dairy Board (TDB)	Milk and milk products	Ensure milk quality and safety along farm to fork continuum.
		Fisheries	Fish and fisheries products	Ensure fish and fishery products quality and safety
		Directorate of Veterinary Services (DVS)	Animal health, meat value chain	disease control (zoonosis), meat inspection, abattoir hygiene
	Ministry of Trade and Investments	Tanzania Bureau of Standards (TBS)	ASF and FV value chains	Develop standards to ensure safety and quality of products, monitoring the compliance with quality and safety of the products on sale
	Ministry of Health, Community, Development, Gender, Elderly and Children	Government Chemist Local Authority (GCLA)		Offer laboratory services on contaminants, heavy metals and toxins (including aflatoxins) related to foods
	Office of the President	Regional Administration and Local Government	All foods ASF and FV	Inspection of food establishments and enforcement of food hygiene and control
Ministry of Higher Education	Universities	ASF and FV	Capacity development for food safety and quality control	

4.1.2 Private stakeholders

Several actors fall under the private stakeholder's category: producers, transporters, processors, marketers, retailers and consumers at a small-, medium- or large-scale, and in informal and formal settings. The level of awareness of these stakeholders on the importance of food safety and quality control along the value chain determines the safety and quality of products reaching the consumer.

These stakeholders are sometimes organized into groups that facilitate access to markets. For producers, good examples include the Eastern Africa Farmers Federation (EAFF) (www.eaffu.org) and the Tanzania Milk Producers Association (TAMPRODA). These producer organizations can easily develop their own private standards aligned to government standards and certification schemes that can help improve on product quality and safety. Although the standards and certification schemes are poised to benefit producers, alone they cannot deliver on safety and quality but need a favourable environment to have a sustainable impact (Oya et al. 2017). The Kenya Dairy Processors Association (KDPA) and the Uganda Dairy Processors Association (UDPA) are key processor actors. Large processing companies dominate the ASF processing landscape. They are more prominent in the dairy, poultry and pork value chains. The established ones include Farmers' Choice for pork in Kenya; Ugachick and Kenchic for poultry in Uganda and Kenya, respectively; and for milk, Brookside in Kenya and Azam Dairy, Dar Fresh, and Tanga Fresh in Tanzania. Some of these large processing firms have enlisted contract farmers who maintain the production biosafety measures that the companies approve for their products. Constant audits are done, by Kenchic and Farmers' Choice for example, to ascertain the quality and safety of the product.

Although consumers are the most important stakeholders in the value chain, they are rarely organized. Their needs are mostly articulated by civil society organizations (or consumer organizations) who may not be knowledgeable of the risks unsafe food pose to consumers. In a study in Tanzania, 25.5% of the 157 consumers studied by Hasler et al (2018) had consumed raw milk, and were not aware of the health risks posed by such practice. Producer, marketer, processor, and to a lesser extent consumer organizations have good linkages with their clientele and serve as good vehicles for delivering extension services to the stakeholders and can be used to a great effect in enhancing food security (FAO, 2010).

4.2 Food control management

4.2.1 Policy

Policy is defined as the process by which governments translate their political vision into programs and actions to deliver outcomes. Within a policy document, there could be a number of pertinent issues addressed in order to deliver outcomes. It is worth noting that few EAC partner states have developed food safety policies as stand-alone documents. Instead, food safety is addressed under food security and nutrition (often inadequately) or under sectoral policies like animal production, milk, meat, trade and public health. In most cases, the work of ensuring food safety falls under different agencies depending on the mandates given. Table 4 shows the policies addressing food safety in the EAC partner states and agencies with mandates to deliver food safety outcomes.

Table 4: Food safety policies reported in the EAC partner states

Country	Policies ³
Burundi	National Agricultural Investment Plan (PNIA) 2017–2022
	National Health Policy 2005–2015
	Multi-sectoral Strategic Plan of Food and Nutritional Security (PSMSAN) 2014–2017
Kenya	Vision 2030
	Constitution of Kenya, 2010
	Agriculture, Livestock and Fisheries Strategic Plan 2013–2017
	Veterinary Services Strategic Plan 2018–2022
	Veterinary Policy 2015
	National Action Plan (NAP) on Containment of Antimicrobial Resistance 2017–2022
	Agricultural Sector Transformation and Growth Strategy (ASTGS) 2019–2029
	Kenya Environmental Sanitation and Hygiene Policy 2016–2030
The National Food Safety Policy 2013	
Draft National Livestock Policy 2019	
Rwanda	National Agriculture Policy (MINAGRI, 2018)
	Rwanda National Dairy Strategy (MINAGRI, 2013)
	Strategy and Investment to Strengthen the Poultry Industry in Rwanda (MINAGRI 2012)
	Strategy and Investment Plan for the Small Animal Industry in Rwanda (MINAGRI 2012)
South Sudan	South Sudan National Livestock Development Policy, Juba, South Sudan 2019
	Fisheries Policy for South Sudan 2012–2016
	South Sudan National Quality Policy, 2016
	Water, Sanitation and Hygiene (WASH) Sector Strategic Framework
Tanzania	National Fisheries policy 2015
	Livestock Policy 2006
	National Agriculture Policy 2013
	National Health Policy 2003
Uganda	Uganda Food and Nutrition Policy 2003
	The National Agricultural Policy 2000

4.2.2 Legislation and regulations

Legislation and regulations are used by governments to operationalize policies. These legal instruments determine the rights and responsibilities of individuals and authorities affected by the legislation. Laws and regulations have many objectives – to sanction, to restrict, to regulate, and to enable procedures and practices etc. Laws have effect only if

³ The listed policies were extracted from the country food safety situation analysis reports done by a team of food safety multidisciplinary team from each country.

they are enforced. The laws and regulations on food safety in the region, which vary by country and value chain, are summarized in Table 5.

Ministries responsible for the enforcement of food safety laws and regulations are few, and in most of the countries, their mandates overlap in their regulatory oversights. Currently only Rwanda has a functional overarching body to regulate food safety. Other forms of coordination could be tried without having to remove the mandates from the existing entities or creating institutional conflicts.

Table 5: Laws and regulation on food safety in animal-source foods, fruits, and vegetables, EAC partner states

Country	Value chain	Laws and regulations governing food safety
Burundi	Milk, meat, eggs, fish and honey	Law No. 1/28 of 24 December 2009 relating to the sanitary policing of domestic, wild and aquaculture animals and bees
	Fish	Law No. 1/017 of 30 November 2016 on the organization of fishing and aquaculture
	Fruits and vegetables	Law No.1/08 of 11 May 2018 on the management of pesticides
	General ⁴	Decree No. 100/31 of 18 February 2014, creation, organization and functioning of the steering committee for food security and nutrition Decree-Law No. 100/68 of 18 March 2015 regulating food fortification Decree-Law No. 100/018 of 28 February 2018 establishment, organization and operation of the East African Nutritional Sciences Institute (EANSI) Decree-Law No. 100/047 of 5 May 2018 establishing a National Agency for Food Security Stock Management (ANAGESSA) Decree-Law No. 1/16 of 17 May 1982 on the Public Health Code
Kenya	General	Public Health Act, Cap 242
		Animal Diseases Act, Cap 364
		Standards Act, Cap 496
		Food Drugs and Chemical Substance Act, Cap 254
		Fertilizer and Animal Feedstuff Act, Cap 345
	Crops (fruits and vegetables)	Agriculture and Food Authority Act of 2013 Pest Control Products Board Act, Cap 346 Plant protection Act, Cap 324 Crops Act of 2013
Fish	Fisheries and Management and Development Act of 2016	
Meat	Meat Control Act, Cap 356	
	Meat Regulations No 10 of 2010	
Milk	Dairy Industry Act, Cap 336	

⁴ This law applies to value chains other than animal-source foods and fruits and vegetables.

Rwanda	General	Law No. 50 /2013 of 23 August 2013 establishing the Rwanda Standards Board Law No. 61/2013 of 23 August 2013 establishing the National Standards, Inspectorate Competition and Consumer Protection Authority Law No. 003/2018 of 9 February 2018 establishing the Rwanda Food and Drug Authority
	Meat	Ministerial Order 013/11.30 of 18 November 2010 regulating transport and trade of meat
	Milk	Ministerial Order 001/11.30 of 10 February 2016 regulating collection, transport and selling milk
	Bees	Law No 25/2013 of 10 May 2013 on bee keeping
	Crops	Law No. 30/2012 of 1 August 2012 Ministerial Order 001/11.30 of 15 February 2013 Ministerial Order 002/11.30 of 14 July 2016 on agrochemicals Law No. 16/2016 of 10 May 2015 on plant health
South Sudan	Meat	Meat and Slaughtering Inspection Board Bill of 2013
	General	National Bureau of Standards Act, 2012 National Bureau of Standards Regulations of 2017 Proposed Draft National Bureau of Standards Food Safety Act of 2019 Import and export guidelines for foods and food products, March 2018
Tanzania ⁵	Meat	Meat Act of 2006 regulating and export of meat and meat products Inspection of meat industry stakeholder activities regulations of 2009
	Dairy	Dairy Industry Act of 2004 Regulations on treatment and disposal of unfit milk, 2007 Regulations on raw milk transportation, 2007 Regulations on import and export of milk and milk products, 2012 Regulations on raw milk grading and minimum quality and safety, 2007
	Fisheries	Fisheries Act of 2003 Regulations on licensing vessels fishers and fishery dealers 2018 Regulations on fish quality control 2000
	Plants	Plant Protection Act of 1997 Plant protection regulations, 1998
	General (animals)	Livestock Identification and Traceability Act of 2010 Animal Diseases Act of 2003 Regulations on animal and animal products movement of 2018

4.3 Inspections

Ensuring food safety and quality is the responsibility of all actors in the value chain - producers, processors, consumers and the government. They all benefit from handling high-quality and safe food. Governments have constitutional obligations to ensure that the food on the market is safe and of required quality. They ensure this by formulating policies and enacting laws and regulations. However, without effective enforcement, the best legislation, regulations and policies on food safety will come to naught. Regular food safety inspections and audits are central to the enforcement actions.

⁵ Zanzibar has enacted a number of laws and regulations including the Zanzibar Standards Act, 2011; the Zanzibar Food, Drugs and Cosmetics Act, 2006; the Fair Trading and Consumer Protection Act, 1995 and the Plant Protection Act, 1997 among others.

Legislation (national laws) gives the implementing agencies powers to not only enforce food safety standards but also formulate regulations that among other roles authorize inspectors to enter premises, seize materials, collect samples, dispose products, detain and prosecute individuals, and order closure of operations where there is evidence of non-compliance. The same legislation empower food inspectors to inform, educate and allow time for businesses to comply. Inspections ensure quality and safety of products, ensure the premises and personnel adhere to hygiene standards and that their actions and practices do not compromise on food quality and safety. Equally important is monitoring, which entails data gathering, collecting and analysing samples as well as collating and reporting the results, to update on the status of food quality and safety.

It was observed that inspection by the government agencies in the region, for both products and processes, is restricted to the formal sector, although governments have mandates to cover all parts of the value chains. We found that informal markets in the region are not under the radar of the government inspecting units, rather inspection is skewed towards the formal nodes of the value chains. For instance, in Tanzania, while formal value chain nodes are inspected 50-90% of the time, the informal nodes were reported to be inspected only 10-40% of the time (and this is likely an overestimate, the actual percent could be smaller). The same is true in the country's smallholder dairy sector, which produces the bulk of the milk in Tanzania, but only 10 out of over 4 million farmers are inspected in a year. Interestingly, on reaching the collecting centres and processing plants, the milk is inspected 90% of the time. Estimated probabilities of inspection of different food products in some of the countries is given in Table 6. ASF and FV destined for informal markets are more likely to be uninspected (probability of 0 and 1:1000). This indicates that those who shop at these outlets are likely to buy food that is contaminated and are therefore at a higher risk of contracting foodborne illnesses. However, products destined for the formal value chain – supermarkets, export and high-end eateries are more likely to be inspected (probability of 1:100 and 1:1).

Conflicts in the mandates between enforcement agencies, where certain value chains are inspected by more than one agency and at different times, were reported in all countries. In Kenya, the milk marketing outlets are inspected and licensed by both the Ministry of Health and the Kenya Dairy Board (which is in the Directorate of Animal Production, Ministry of Agriculture, Livestock, Fisheries and Cooperatives). In South Sudan, transporters of processed animal meat are inspected by the South Sudan National Bureau of Standards, Drug and Food Control Authority and the city councils. In Tanzania, prior to recent changes, both the TFDA and TBS had responsibilities for food safety regulation. The government has since restructured the TFDA and transferred the responsibility of food safety regulation to the TBS.

The number of food inspectors vary across countries. In South Sudan, the number of inspectors is estimated at 1,500 persons with 500 seconded to local governments. Rwanda has 124 at the national level and 474 at the districts. These numbers are inadequate to assure safety of the many food value chains and the multiple nodes that need inspection. Food inspectors in all the six countries are appointed by their respective governments and seconded to the counties or local councils. They are mostly graduates of food science.

The regulatory agencies do not use quantitative risk assessment to prioritize risk. Assessments are mainly qualitative and are based on historical occurrences, and for regulatory purposes. As for other food products, standards for ASF and FV are set by the respective national bureaus of standards. The standard-setting process involves a request for standard by the industry or stakeholder, drafting of the standard by the bureau of standards and a review by the respective food industry standards committee and interested parties. After consensus, the draft is published for public review and a revised version is presented to the national food standards committee for approval and final gazettelement.

4.4 Regulation and control: Private sector

The private sector is involved in the process of setting national standards. No country has reported any self-regulation, industry-led ASF or FV standard. This is not to mean they do not follow any standards as many are using international guidelines such as the Good Agricultural Practices (GAP), Hazard Analysis Critical Control Points (HACCP), Consumer Goods Forum (CGF) of the Global Food Safety Initiative (GFSI), and the Brand Reputation Consumer Goods Standards (BRCS). Rwanda and Tanzania reported greater use of HACCP, and the International Standards Organization (ISO)

quality management system (QMS) for food safety compared to the other countries. Although majority of the small and medium enterprises (SMEs) are still following the Good Hygiene Practices (GHP), Good Manufacturing Practices (GMP) and GAP, in Rwanda and Tanzania, only about 6% have adopted HACCP, ISO QMS standards at food processing sites, commercial farms and fish landing sites.

There is need for the public and private sector and other partners to provide a framework for how SMEs (including informal, traditional enterprises) can achieve good food safety standards based on audits and certification that allows them to upgrade their services and get recognized. Rwanda has a novel compliance maturity program, an approach which is worth mentioning. The RBS has developed the 'Zamukana Ubuziranenge' program, which prepares and supports SMEs to attain various standards and certification. The program has grades from a standard of '0' (non-compliance) to '5' (an outstanding Food Safety Management System [FSMS]). This way of certifying SMEs in the food business, helps them to grow and develop a food safety culture.

4.5 Regulation and control: Civil society organizations

Consumer lobby groups include civil society organizations (CSO) with interests in food safety. Rwanda and Kenya have policies and Acts of Parliament aimed at protecting consumers: The competition and consumer protection policy in Rwanda and the Consumer Protection Act, No. 46 of 2012 in Kenya. These allow for the setting up of consumer lobby organizations and an advisory committee that is funded by the exchequer. In Rwanda, two organizations are funded by government through the Ministry of Commerce (MINICOM). In Kenya, five organizations are privately funded through grants and two are funded by the government. They include the Kenya Consumer Protection Advisory Committee (KECPAC) and Competition Authority of Kenya (CAK). Funding by the government may have implications for the independence of CSOs. Tanzania has two consumer organization groups which drive their existence from the United Republic of Tanzania Constitution of 1977 articles 11, 14, and 18 that recognize the rights of consumers. Burundi has had one body for the last 27 years, which has made inroads and earned respect in its fight for consumer rights.

The potential role of CSOs is to make the voice of the consumer heard and to advocate for support by asking authorities to provide safe food products. In practice, many are not very active. Most of these have their offices at the capital cities but may have membership from all the regions, limiting the support they offer their members. The privately funded organizations (or lobby groups such as Kenya Consumer Organization (KCO), Association Burundaise des Consommateurs, Transparency International Burundi, and Association pour la defense des Droits Consommateurs au Rwanda) are at times constrained in their operations because of limited finances.

Description of the food item	Burundi	Rwanda	South Sudan	Tanzania
Animal-source foods (ASF)				
ASF in street foods	0	0	0	1 in 1,000
Animal-source foods sold in small rural villages	1 in 100	1 in 100	0	1 in 100
ASF sold in pastoralist areas	1 in 1,000	1 in 100	0	0
ASF sold in open markets	1 in 100	1 in 1	1 in 1,000	1 in 1,000
ASF hawked door to door	1 in 1,000	1 in 100	0	1 in 1,000
ASF at celebrations, feasts, events (by definition, these cannot be inspected regularly)	1 in 100	1 in 100	0	1 in 1,000
ASF in remote areas	1 in 1,000	1 in 100	0	0
1 in 1 animals killed for home consumption	0	0	0	1 in 1,000
ASF in institutions (hospitals, schools, canteens)	1 in 100	1 in 1	1 in 100	1 in 100
ASF sold in supermarkets	1 in 100	1 in 1	1 in 1	1
ASF sold in eating places- i) established hotels	1 in 100	1 in 1	1 in 100	1 in 100
ii) kiosks	1 in 1	1 in 1	0	1 in 100
iii) streets	0	1 in 1	0	1 in 100
ASF exported	1 in 100	1 in 1	1 in 100	1 in 1
Fruits and vegetables (FV)				
Street foods	0	0	0	0
FV sold in small rural villages	0	1 in 1,000	0	0
FV sold in pastoralist areas	0	1 in 1,000	0	0
FV sold in open markets	1 in 1,000	1 in 100	1 in 1,000	0
FV hawked door to door	0	1 in 1,000	1 in 1,000	0
FV at celebrations, feasts, events (by definition, these cannot be inspected regularly)	1 in 1,000	1 in 1,000	0	0
FV in remote areas	0	1 in 1,000	0	1 in 100
FV harvested for home consumption	0	0	0	1 in 100
FV in institutions (hospitals, schools, canteens)	1 in 100	1 in 100	1 in 100	1 in 100
FV sold in supermarkets	1 in 100	1 in 1	1 in 1	1 in 1
FV sold in eating places-	1 in 100	1 in 100	1 in 100	1 in 1,000
i) established hotels				
ii) kiosks and streets	0	0	0	0
FV exported	1	1 in 1	0	1 in 1

1 in 1 = every item of food has almost certainly been individually inspected; 1 in 100 = of every 100 items sold around one will have undergone at least individual visual inspection; 1 in 1,000 = of every 1,000 items sold around one will have undergone individual visual inspection and 0 = it is unlikely that an item of food has been inspected.

5. Foodborne diseases, detection and management

Foodborne disease hazards have been shown to cause over 600 million cases of illness and 420,000 deaths, resulting in a loss of 33 million DALYs (WHO 2015). Additional losses were reported by Gibb et al (2019): ingestion of arsenic, methylmercury, lead and cadmium result in more than one million illnesses, over 56,000 deaths, and more than 9 million DALYs. Foodborne diseases impact negatively on national economies because of loss in productivity and cost of treating the diseases. In sub-Saharan Africa, the cost has been estimated to exceed USD 24 billion annually (Jaffee et al. 2020).

Some of the foodborne hazards listed in the Food Disease Burden Epidemiology Reference Group (FERG) report (WHO 2015) that are also recognized internationally, were observed in all east African countries. None of the countries ranked the hazards as either high (in the first top 20) or medium (between 21 and 100) or low (above top 100 common hazards). The data came from published research papers, hospital records or surveys in government records (grey literature). The foodborne pathogens that are responsible for food scares were listed as bacterial (*Bacillus anthracis*, NTS, *Shigella* spp., *Brucella abortus* and *V. mellitensis*, *M. bovis*, *V. cholerae* / *V. parahaemolyticus*, *L. monocytogenes*), parasitic (*T. solium* / *T. saginata*, *Giardia* spp., *T. gondii*, *E. histolytica*), viral (avian influenza H5N7, Rift Valley fever, hepatitis A) and chemical (sodium metabisulphite). All countries listed cholera and typhoidal salmonellosis as foodborne illnesses. This may indicate that sanitation measures, previously relied on to control waterborne diseases, are not adequate. The problem is likely to persist until these illnesses are recognized as foodborne, and prioritized, and measures appropriate for their control are employed, in combination with sanitation.

The FERG report list of diseases were not ranked the same in all the countries but were considered either as very important or important (Table 7). Four of the six countries were able to present data on the hazards groups they considered as 'most important' in ASF and FV value chains. Despite the varying ranking, the same hazards were ranked important and very important by the four countries.

The ranking and testing of the hazards in the FV value chains revealed that among the hazards ranked as most important were pathogenic bacteria of animal and human origin and foodborne viruses. These were regularly tested for in fruits and vegetables in South Sudan and Rwanda. Other hazards although known to be prevalent were not tested for.

Adulteration is not a hazard group but serves to introduce hazards in the ASF and FV.

Foodborne hazard	Country and frequency of testing				
	Burundi	Kenya	South Sudan	Tanzania	Rwanda
Pathogenic bacteria of animal origin	2R	1E	2R	2E	2R
Pathogenic bacteria of human origin	2R	1R	2R	2R	2R
Foodborne viruses		1E		2NT	2R
Chemicals	2E	2E		2NT	2E
Radioactive contaminants			2NT	2NT	
Deliberate poisoning			2E		
Antibiotic residues	2NT	1R		1E	1E
Pesticide residues		2R		1E	
Parasites	1R			1R	
Mycotoxins	2NT	2R		2E	1E

I=Very important, 2= Important, R = Regularly tested, E= Episodically tested, NT= Not tested

The experts also gave their opinion on proportions of ASF and FV sold through the formal and informal channels. The proportions are different based on the value chains. For fruits and vegetables, only a small proportion of the total turnover (~5%) is purchased through the formal markets and the bulk is informally traded. In Kenya and Rwanda 95% of the FV were purchased in informal market, while in Tanzania 90% of FV were traded in informal markets. For ASF, informal outlets accounted for 97–98% of good sold in Tanzania, 70–90% in Kenya, and 100% for South Sudan, while Rwanda's ASF market was reported to be 100% formal. In Rwanda, slaughter slabs and butcheries are registered and inspected.

Despite some hazards being ranked as 'important' or 'very important', their testing was said to be episodic or not at all in many countries. This may reflect the inadequate capacity of the testing laboratories in the region, in terms of personnel and equipment, yet these are key for surveillance and planning. The World Bank Global Food Safety Partnership (GFSP) report on food safety investments in sub-Saharan Africa found that the donor food safety investments were overwhelmingly focused on supporting access to overseas and formal markets rather than on the domestic and informal markets (GFSP 2019) leaving local consumers exposed. Of the 518 projects analysed by GFSP in Africa, funded by different donors and targeting food safety, only 14 projects (about 2.7%) were related to informal markets, of which five focused on the capacity of national control systems and nine involved some aspect of knowledge generation (GFSP 2019). If food safety is to be improved in the EAC partner states, intentional high investments in infrastructure and human capital are required with special targeting of the traditional informal sector, which is the source of ASF (70-90%) and FV (95%) for most of the population. The fact that hazards are regularly tested and ranked important or very important but not consistently in all the countries reflects the endemicity of foodborne disease in the region. The lessons learned across the EAC should be shared and new strategies of combating the negative effects of these hazards drawn, agreed on and implemented by partner states to improve health and reduce the health burden.

6. Traceability

Traceability is important in addressing safety issues along food value chains. It ensures removal of non-compliant products from the market. For ASF, except fisheries, countries have a formal traceability system from the county/district of origin to the slaughterhouse (movement permits) and/or collecting centre. However, there is a lot of leakage along the value chain. No further link is made with the butcheries.

A similar observation was made for dairy (whose products have no traceability beyond processing plants). It is only in large export-oriented firms, especially in the poultry and pork value chains, where such trace-back is claimed. In the case of fresh fruits and vegetables, produce destined for export markets is often traceable to farms of origin. Traceability is completely lacking in the informal sector (although this is the market channel that handles majority of the foods), despite the recommendation that traceability systems ought to have been developed in each partner state by 2015 (EAC 2011). At the national level, there is no evidence that any of the countries has implemented this (although some pilot studies have been conducted in Kenya (Matete et al. 2010; Mutua et al., 2018). Tanzania has the Tanzania Livestock Identification and Traceability System (TANLITS), which, by 2019, 70,000 cattle had been registered into the system using uniquely identified electronic ear tags (George et al. 2021).

7. Surveillance

Health surveillance involves continuous collection, analysis and interpretation of data for the purposes of implementing or planning actions related to a public health or food safety issue (WHO 2006). The only health surveillance plan used by the EAC countries is the International Health Regulations (IHR) for cholera, yellow fever and other notifiable diseases. Several challenges are known to hamper implementation of these regulations (Bakari and Frumence 2013). Laboratory confirmation is critical in food safety surveillance. The laboratories must be fit for purpose (i.e. have qualified personnel, equipment and certification/accreditation). The EAC countries have both public (bureaus of standards, public health laboratories, research institutes), private (Société Générale de Surveillance [SGS], industry quality laboratories etc.) and national and international non-governmental (NGO) laboratories, which can be used for sample analysis (e.g., ILRI). Current facilities are inadequate to deal with the sample load if surveillance systems are put in place to address all food products. This shortcoming may be the reason for the lack of urgency by the partner states in instituting a food safety surveillance system. The EAC with the help of World Bank and the United States Agency for International Development (USAID) has been developing centres of excellence (15) under the Inter-University Council of East Africa (IUCEA). These centres could be the nucleus of the surveillance system as they would support its analytical component. Strengthening of the capacity of the countries to carry out food safety surveillance is imperative if the EAC is to address food safety issues.

8. Food safety governance changes in Kenya and Tanzania since 2010

A food safety situational analysis of ASF was conducted in 2010 and involved Kenya and Tanzania (and 4 other African countries). This was an activity under the Safe Food, Fair Food project, led by ILRI. The resulting papers, which were published in 2010, have been compared, to understand what major changes in food safety could have taken place in the intervening period.

Significant changes have occurred in Kenya. These were brought about by the promulgation of the new constitution, which heralded a devolved system of government. The two-tier government required revision of many of the legislations to reflect the responsibilities of the devolved functions to the county governments. The Constitution of Kenya 2010, Article 46, (1) of the Chapter Four on the Bill of Rights, recognizes the right of the consumer to: i) goods and services of reasonable quality; ii) the protection of the consumers' health, safety and economic interests; and iii) compensation for loss or injury arising from defects in goods or services. The activities of the two main actors in food safety (i.e., ministries of agriculture and health) were devolved to the counties. However, this change did not alter the approach to addressing food safety issues. The national government was left to deal with policy and legislation (in consultation with country governments). The counties were allowed to implement the policies and legislation.

The major development was the drafting of the Kenya Food and Drug Authority Bill, a private member's bill, which is yet to be debated in parliament. The bill seeks to repeal the Food Drug and Chemical Substance Act, Cap 254, and the Pharmacy and Poisons Act, Cap 244, and repeal sections 16, 17 and 18 of the Narcotic and Psychotropic Substance Control Act No. 4 of 1994. Second, the Food Safety Policy of 2013 is an important policy move, which has, however, not been implemented. It seeks to: i) maintain an integrated food safety farm-to-fork approach; ii) coordinate inter-agency activities; iii) reduce inter-agency conflict and overlap; iv) protect public safety; and v) ensure trade that is consistent with national and international requirements. A draft Kenya Food and Drugs Authority Bill 2021, to operationalize the policy, is under discussion in the Kenya Parliament.

A number of policy documents with food safety focus have also been developed. These include the National Livestock Policy, 2019; The National Dairy Development Policy, 2013; the Veterinary Policy, 2015 and the Policy on Prevention and Containment of Antimicrobial Resistance, 2018. A number of laws have also been revised and or drafted [pending bills] including the Animal Disease Health Bill 2018, the Veterinary Public Health Bill 2019. Revised legislations include the Public Health Act, Cap 242, revised 2017; the Kenya Plant and Animal Health Act No. 54 of 2012, revised in 2016; the Agricultural and Food Authority Act, revised 2016, the Animal Disease Act, Cap 364, revised 2012; the Fertilizer and Animal Feedstuff Act, Cap 345, revised 2015; and the Cooperative Act No 12 of 1997, revised 2017. Despite these revisions and new legislation, no significant changes have occurred in the food safety space because the changes have not been accompanied by an equal budgetary allocation to implement the laws.

In Tanzania, the main change has been the formation of the Tanzania Food and Drug Authority (TFDA). After functioning as a food safety authority for several years, its mandate has been shifted to the Tanzania Bureau of Standards (TBS). The mandates of both institutions were previously in conflict. Consequently, the TFDA was renamed Tanzania Medicines

and Medical Devices Authority (TMDA), which regulates drugs, medicines and medical devices. TBS has reportedly signed memoranda with food safety agencies in the country including the Tanzania Dairy Board (TDB) and the Tanzania Meat Board (TMB), to ensure they supply safe products under their jurisdictions. The Zanzibar Food and Drug Agency (ZFDA) was established in 2007. The agency operates in accordance with the Zanzibar Food Drugs and Cosmetic Act No. 2 of 2006. Moreover, in 2011, the Zanzibar Bureau of Standards (ZBS) was formed to particularly to regulate safety of locally grown and imported foods into Zanzibar.

It is evident that the main problem in the EAC is not lack of policy or legislations as these abound, but the absence of political will to make adequate budgetary allocations and the independence of the public regulatory bodies to implement and enforce these policies and legislations.

9. Findings, implications and action

It is evident that the ASF and FV value chains in the EAC are dominated by smallholder farmers who produce the bulk of the commodities. The system is rarely regulated and producers fail to adhere to good agricultural practices. Indeed, many regulations targeting these farmers have not borne any fruit. Because of their scattered nature, the farmers are rarely reached through the formal extension system (by governments and NGOs) whose capacity to address the needs of all the farmers is limited. These realities have implications on the safety as products of inferior quality and safety are offered for sale. Capacity development on food safety practices, along with incentives or nudges to foster behaviour change among these smallholder producers is imperative to ensure that products from primary production are safe and of good quality. Organizing farmers and other actors along the value chains will improve the reach of education and training programs to improve food safety.

Though a multi-sectoral regulatory approach was reported in all the countries, best-practice approaches often fail because of mandate overlap resulting in duplication rather than better coordination. A coordination mechanism is needed to help address this challenge. To this end, the EAC had set up a coordination mechanism using the American Food and Drug Authority (FDA) approach. A number of countries in region have food and drug authorities with a mandate on food safety. In Tanzania, the success of this initiative is yet to be seen as the food safety mandate of the TFDA was moved to TBS. Most of the countries, with the exception of Kenya, have a mechanism which could oversee the management of food safety issues. These initiatives are constrained by inadequate budgetary allocation. The implication is that most of the ASF and FV actors and premises are unaudited, which makes the consumers lose faith in the regulatory agencies' capacity to ensure food safety. There is an urgent need for increasing the priority of food safety in the EAC partner states. This should be informed by the impacts of FBD on trade, tourism and health (human and animal). Policies and regulations should be developed that help to remove redundancies and delineate boundaries for efficient working of the agencies involved. This should be accompanied by establishing a coordination mechanism and adequate budget allocation to meet the cost of operations of ensuring food safety. The EAC secretariat has no jurisdiction over the partner states on implementation of the various policy proposals such the Food Security and Nutrition Plan 2018–22. The EAC needs to find ways of making these and other recommendations binding and implementable across the board.

A large proportion of ASF and FV value chains is largely informal but the informal sector is not regulated and there is a perception that products sold through this market chain are unsafe. This is not always true as products in formal and informal sectors may be equally unsafe. The informal sector will continue to dominate the production and marketing of ASF and FV in this region for the foreseeable future. Taking cognizance of this, the EAC partner states should formulate policies and plans to work with the informal sector actors to help them attain levels of operation that afford some degree of food safety. Adaptation of the Rwanda 'Zamukana Ubuziranenge' Program (a staircase approach) with recognition of those who attain various levels of compliance, could help in transforming the informal sector into one which is not synonymous with unsafe food.

ASF and FV value chains have not embraced the use of risk-based approaches to ensure safety of the products. Most of the actors are still using prerequisite or common-sense hygienic procedures. The adoption of participatory risk assessment methods, which are cheaper to implement than conventional risk assessment approaches, would help

identify the hazards, critical control areas and mechanisms to prevent the breaches in food safety. Simple systematic analysis on 'What can go wrong? What can I do? How can I check and what can I do to prevent reoccurrence' would set the informal sector actors on the path to embrace use of risk-based methods to ensure food safety. Strengthening the capacity of the actors, including consumers, to know what is wrong, detect when it goes wrong and know the action to remedy the wrong would help build a food safety culture that is missing.

Ensuring food safety means establishing a surveillance system that provides data of the possible breaches and where they could occur (in value chain and nodes). Such a system requires conscious support by the government because of the infrastructure it requires. For the EAC countries to meet the goals of the Malabo Declaration (by 2025) and participate effectively in the African Continental Free Trade Area (AfCFTA) to accelerate intra-Africa trade, they will have to address the food safety issues and invest in capacity and infrastructure to deliver this. Food safety surveillance is one such infrastructure that would help position the EAC partner states to reap the economic benefits of the AfCFTA.

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Annex I

Training timetable–Food safety, ILRI campus, Addis Ababa, 8–20 July 2019

Time	Days (week 1)					
	Monday 8/7/19	Tuesday 9/7/19	Wednesday 10/7/19	Thursday 11/7/19	Friday 12/7/19 1	Saturday 13/7/19
0800–1000	Arrival, welcome and housekeeping [ILRI]	Global Food Safety Partnership [GFSP]	Risk analysis–risk assessment {Codex} [Nasinyama]	Food safety assurance programs–GHP, GMP, GAP [Kazwala]	Setting up food safety control systems [Kazwala]	Visit to Addis meat and vegetable markets [amenu]
1000–1030		Tea break				
1030–1230	Introduction - Aims and objectives [Kang'ethe]	Foodborne infections –ASF, FFV [Nasinyama]	Risk assessment [Nasinyama]	HACCP, industry programs [Kazwala]	Case study–HACCP [Kazwala]	
1230–1400	Lunch break					
1400–1600	Global food safety view [Kang'ethe]	Foodborne Intoxications [Nasinyama]	Microbiological risk assessment [Nasinyama]	HACCP and Industry programs [Kazwala]	Risk analysis–case study [Mutua/Kang'ethe]	
1600–1630	Tea break					
1630–1730	Global food safety view [Kang'ethe/Mutua]	Introduction to risk analysis [Nasinyama]	Microbiological risk assessment–case study [Nasinyama]	Setting up food safety control systems [Kazwala]	Risk analysis–case study [Mutua/Kang'ethe]	

Time	Days (week 2)					
	Monday 15/7/19	Tuesday 16/7/19	Wednesday 17/7/19	Thursday 18/7/19	Friday 19/7/19	Saturday 20/7/19
0800–1000	Participatory risk assessment [Mutua]	Risk communication [Amenu]	Food safety traceability and recall systems [Kurwijila]	Policy formulations [Kurwijila]	Work on situation analysis [Kang'ethe/ Mutua]	Departure
1000–1030	Tea break					
1030–1230	Conceptual framework models [Mutua]	Risk management–use of multiple factors [Amenu]	Food safety traceability and Recall systems [Kurwijila]		Work on Situation analysis [Kang'ethe]	
1230–1400	Lunch					
1400–1600	Risk assessment–OIE [Amenu]	Risk management–use of multiple factors [Amenu]	Food laws–ASF, FF&V [Kurwijila]	Policy formulations [Kurwijila]		
1600–1630	Tea break					
1630–1730	Risk communication [Amenu]	Risk management–use of multiple factors [Amenu]	Food laws–ASF, FF&V [Kurwijila]	Work On Situation Analysis [Kang'ethe]	Work on Situation analysis [Kang'ethe]	

Training timetable–Food safety

ILRI campus, Addis Ababa, 12–24 August 2019

Time	Days (week 1)						
	Monday 12/8/19	Tuesday 13/8/19	Wednesday 14/8/19	Thursday 15/8/19	Friday 16/8/19	Saturday 17/8/19	
0800–1000	Registration, welcome and housekeeping [ILRI]	[0800 -0900] PACA brief Global Food Safety Partnership [GFSP/ Kang'ethe] 0900-1000	Risk analysis–risk assessment {Codex} [Nasinyama]	Risk assessment–OIE [Amenu]	Risk management– use of multiple factors [Amenu]	Visit to Addis meat and vegetable markets [Amenu]	
1000–1030	Tea break						
1030–1230	Introduction / Global food safety view [Kang'ethe]	Foodborne infections –ASF, FFV [Nasinyama]	Risk assessment [Nasinyama]	Risk communication [Amenu]	Risk management– use of multiple factors [Amenu]		
1230–1400	Lunch break						
1400–1600	Global food safety View-ASF [Kang'ethe]	Foodborne intoxications [Nasinyama]	Microbiological risk assessment [Nasinyama]	Risk communication [Amenu]	Risk analysis–case study [Theo/Kang'ethe]		
1600–1630	Tea break						
1630–1730	Actions to address global good safety issues [Kang'ethe]	Introduction to risk analysis [Nasinyama]	Microbiological risk assessment–case study [Nasinyama]	Risk management– use of multiple factors [Amenu]	Risk analysis –case study [Theo/ Kang'ethe]		

Time	Days (week two)					
	Monday 19/8/19	Tuesday 20/8/19	Wednesday 21/8/19	Thursday 22/8/19	Friday 23/8/19	Saturday 24/8/19
080–1000	DALY calculations [Theo] Participatory Risk Assessment [Theo]	Case study of setting up of NFSCS [Kangethe] Food safety assurance programs-GHP, GMP, GAP [Kazwala]	Food safety traceability and recall systems [Kurwijila]	Policy formulations [Kurwijila]	Work on situation analysis [Kangethe]	Departure
1000–1030	Tea break					
1030–1230	Conceptual framework models [Theo]	HACCP and Industry programs [Kazwala]	Food safety traceability and recall systems [Kurwijila]	Policy formulations [Kurwijila]	Work on situation analysis [Kangethe]	
1230–1400	Lunch					
1400–1600	Setting up national food safety control systems [Kazwala]	HACCP, industry programs [Kazwala]	Food laws–ASF, FF&V [Kurwijila]	Food safety planning in the EAC partner states [EAC Secretariat]	Work on situation analysis [Kangethe]	
1600–1630	Tea break					
1630–1730	Setting up national food safety control systems [Kazwala]	Case study –HACCP [Kazwala]	Food laws–ASF, FF&V [Kurwijila]	Work on situation analysis [Kangethe]	Work on situation analysis [Kangethe]	

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