

International Livestock Research Institute

Food safety training in East Africa: A review of university courses
with food safety content

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Abbreviations and acronyms

EAC	East African Community
FAO	Food and Agriculture Organization of the United Nations
GHP	Good Hygienic Practices
GMP	Good Manufacturing Practices
HACCP	Hazard Analysis and Critical Control Point
IUCEA	Inter University Council for East Africa
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KIU	Kampala International University
SEKU	South Eastern Kenya University
SUA	Sokoine University of Agriculture
USD	United States dollars
WHO	World Health Organization
WTO	World Trade Organization

Introduction

Food safety is attained when foods are handled, processed and stored in a manner that effectively reduces the risk of exposure of an individual to hazards capable of causing foodborne illness. Hazards are things that can harm human health and are classified as biological, chemical or physical. These may cause illnesses that range from physical harm to diarrhoea to cancers with different health outcomes.

Foodborne gastro-intestinal infections cause at least 550 million diarrhoeal illnesses and at least 230,000 deaths yearly¹. A similar burden results from non-diarrhoeal illness. The burden is not equally distributed. Children under five years of age bear about 40% of the global burden of foodborne diseases.

The cost of foodborne diseases in low- and middle-income countries, in terms of both productivity and treatment, is estimated at 110.3 billion United States dollars (USD)² a year globally and USD 16.7 billion of the global sum is the cost borne by countries in sub-Saharan Africa. This cost is high considering that these countries are struggling to improve socioeconomic development. It excludes non-tangible costs that are difficult to quantify. Lack of food safety constrains health, tourism and trade, and makes it difficult to meet the United Nations Sustainable Development Goals. Food safety is an integral part of food security and nutrition. Of the 17 Sustainable Development Goals, seven cannot be achieved without addressing food safety. The African Union Malabo Commitment³ of increasing food trade by 2025 is likely to be unachieved if food safety is not addressed.

Building trust in food safety systems, and especially those involving domestic markets (informal markets and cross-border trade), requires a strong food safety culture. This is underpinned by stakeholders who understand the importance of food safety, take pride in reducing the risks of foodborne diseases and are committed to do all it takes to ensure safety in entire value chains⁴. One of the characteristics of a trustworthy food safety system is competency (skills, knowledge, attitudes and behaviour) of its actors to identify risks and institute appropriate controls. This competency requires a new cadre of professionals who are specifically trained to address food safety challenges in both informal and formal markets, and who would be involved in future capacity development work. Given the difficulty of enforcing regulations in many low- and middle-income countries, it is also important to understand how incentives and consumer demand can be leveraged for safer food.

East Africa is a sub-region with a high burden of foodborne diseases. Informal markets, which dominate food marketing, are perceived to be a concern for food safety. This classification emanates from lack of data on absolute and relative foodborne risks from such markets along with observations of poor infrastructure and hygiene. The lack of good data means the true food safety situation is not known and this makes it hard to prioritize actions needed to address the challenges. Food safety professionals equipped with the right food safety skills (those who would be trained in improved programs) would be needed to support the transformational changes of these markets to improve the health and socioeconomic development of the region.

Universities in the East African Community (EAC) member states offer a range of programs. Some aspects of food safety are already incorporated in some of these programs. A review was planned to capture data on this, specifically to (1) review current programs, focusing on those with content on food safety though not taught with a food safety lens and (2) analyse gaps that would need to be filled to enrich and equip the new professionals for the task. Such would form the basis of development of a food safety curriculum for the region. It is envisaged that a new program or course on food safety and its subsequent adoption by the universities would strategically position the EAC partner states to reap the benefits not only from regional trade but also from the new Africa Continental Free Trade Area and global world trade in foods which was, in

2017, estimated at USD 1,460.9 billion⁵. Box 1 gives a summary of the steps that are undertaken to develop or review a curriculum.

Box 1: Steps to develop or review a curriculum

1. Justify the need for a program or course.
2. Hold a stakeholders' workshop to get buy-in.
3. Develop the content.
4. Hold a validation workshop.
5. Submit the draft curriculum for quality assessment by the body mandated to approve programs for the region. For EAC, this would be the Inter University Council for East Africa (IUCEA).
6. Submit the draft to the respective University organs for approval.
7. Submit the approved curriculum for accreditation by the National Commissions for Higher Education.
8. Mount the accredited curriculum in the respective university.
9. Universities review the curriculum with stakeholders after every five years.

Methodology

The review of food safety training courses was done in 2019 in all the six EAC partner states in universities that are accredited members of the IUCEA. The membership now stands at 127 universities, including public and private colleges and universities (Table 1). The review was done in collaboration with senior professors from the respective universities. The websites of universities offering degree and or diploma programs were accessed. The search considered courses on veterinary medicine, agriculture, food science and technology, animal health and production, nutrition and dietetics, nursing, hotel catering and management, food safety and environment health. The programs were offered at diploma, undergraduate or graduate levels. An additional desk review was carried out to identify some of the challenges and opportunities related to graduate employment in East Africa specifically for food safety graduates.

Description of findings

In most universities, we did not get the full curriculum of the programs but we received courses that our country contacts thought had a food safety focus. There was a feeling of mistrust and long bureaucratic processes to be able to get a full curriculum for the chosen programs. Relevant to population size, Burundi and Rwanda were best covered and South Sudan least.

Table 1: Membership of the Inter University Council for East Africa, as at July 2021

Country	Population (million)	Number of public universities and colleges	Number of private universities and colleges	Total number of universities and colleges
Burundi	11.6	5	9	14
Kenya	52.2	17	19	36
Rwanda	12.8	1	16	17
South Sudan	13.2	1	1	2
Tanzania	61	14	19	33
Uganda	45.8	9	21	30
Total	196.6	47	85	132

Source: <https://www.iucea.org/general-information>

Figure 1 shows the number of universities in EAC partner states offering programs with food safety content (with the exception of South Sudan where only one university was listed as a member of the IUCEA). Of the total universities, Uganda (76%; 22/29) and Kenya (44.4% 16/36) had a high number of programs with some food safety focus.

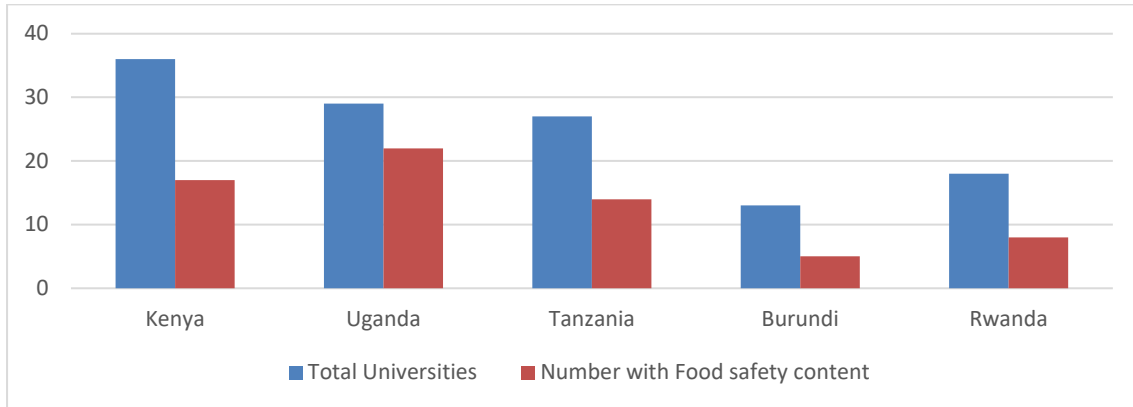


Figure 1: Universities in the East African Community partner states offering programs with food safety content.

A follow up of country-by-country analysis was done and the results are presented in Figures 2 to 6, showing the universities having programs with food safety content as at 2020.

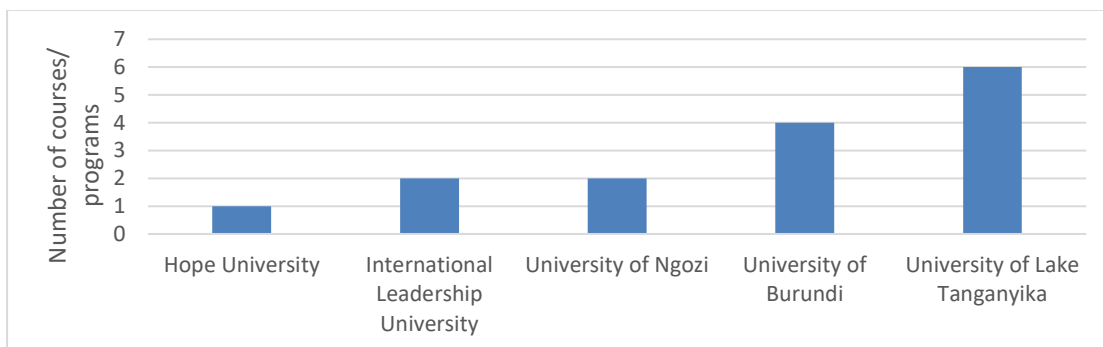


Figure 2: Universities in Burundi offering programs with food safety focus as at 2020.

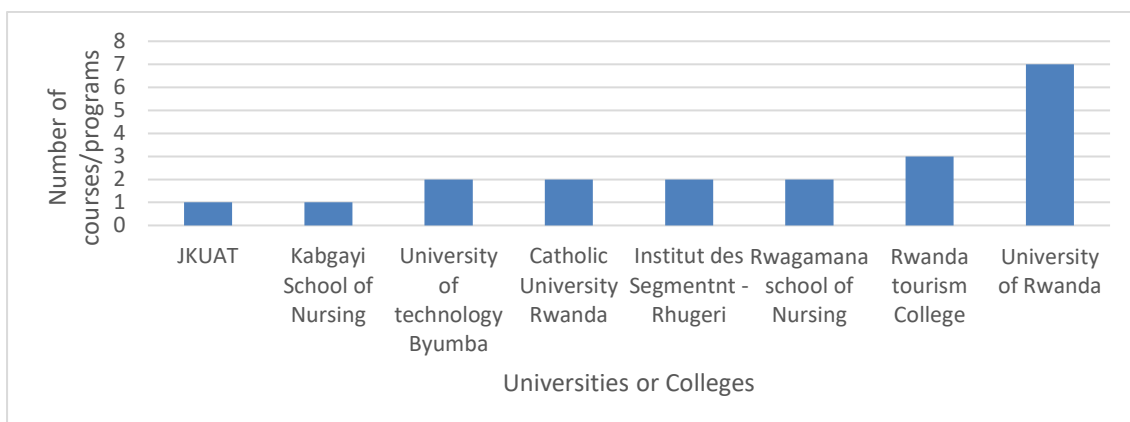


Figure 3: Universities in Rwanda offering programs with food safety focus as at 2020.

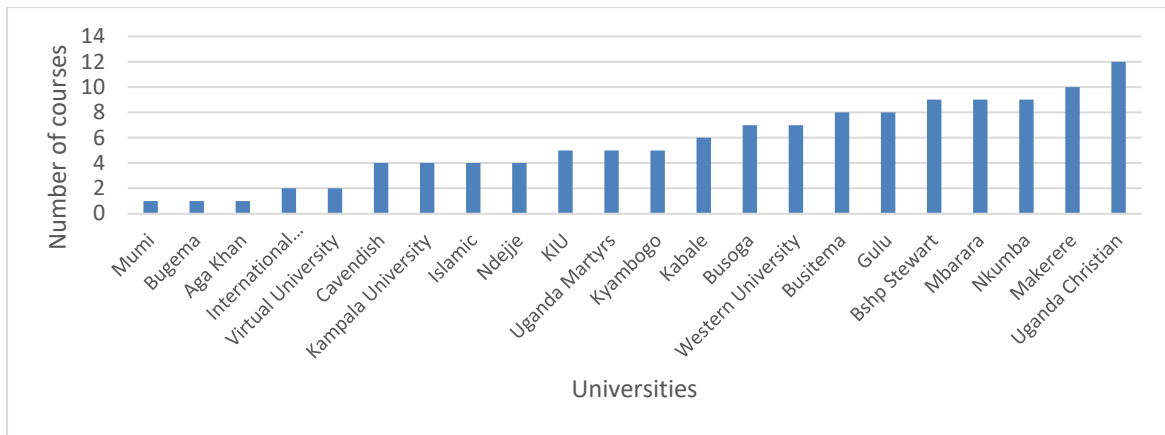


Figure 4: Universities in Uganda offering programs with food safety focus as at 2020.

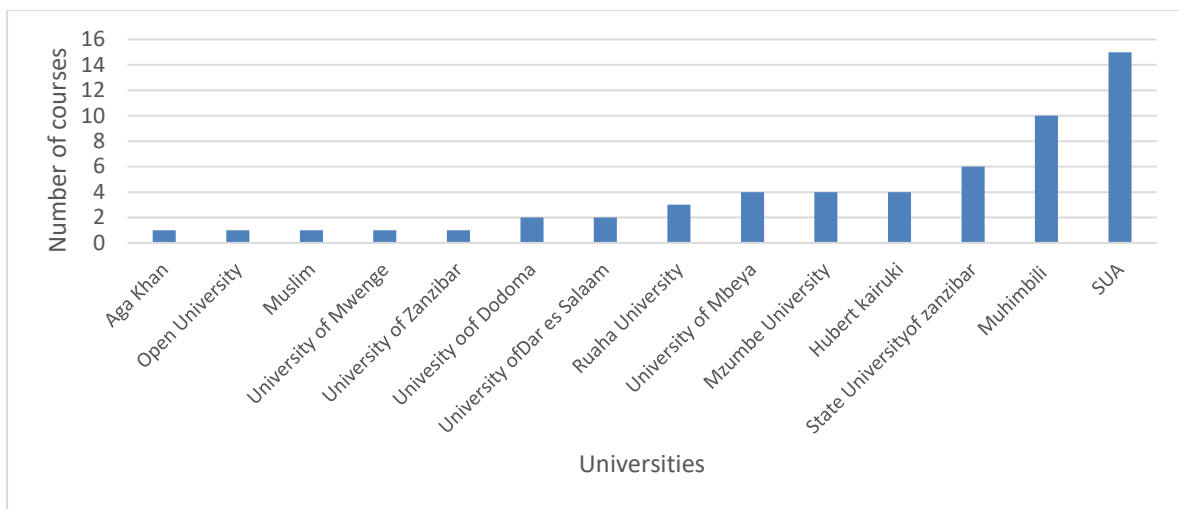


Figure 5: Universities in Tanzania offering programs with food safety focus as at 2020.

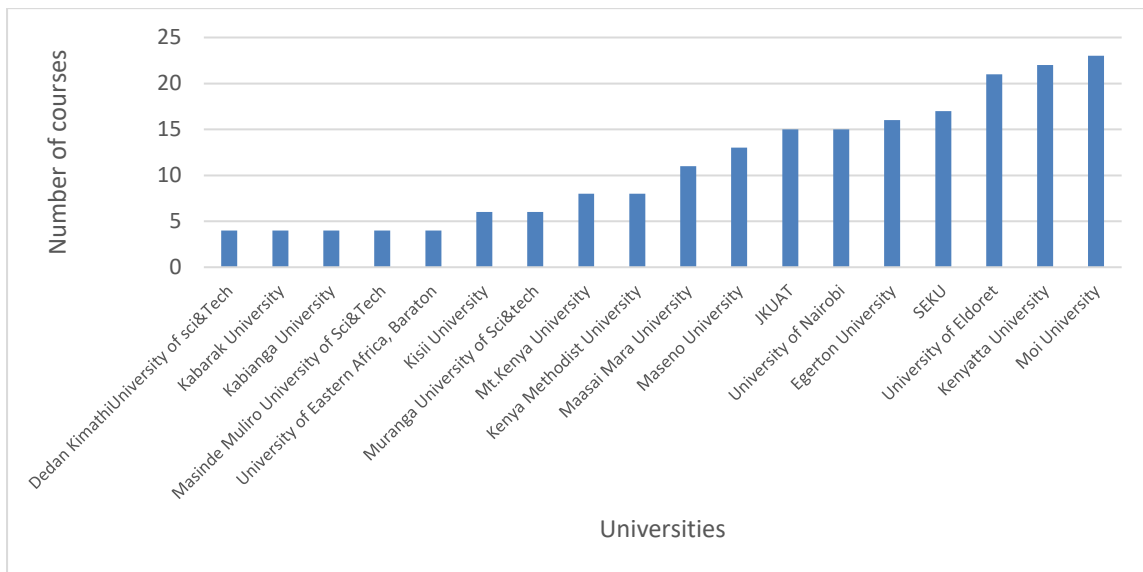


Figure 6: Universities in Kenya offering programs with food safety focus as at 2020.

For Kenya, the review found majority of food-safety related courses to have been offered at undergraduate and diploma levels (Figure 7).

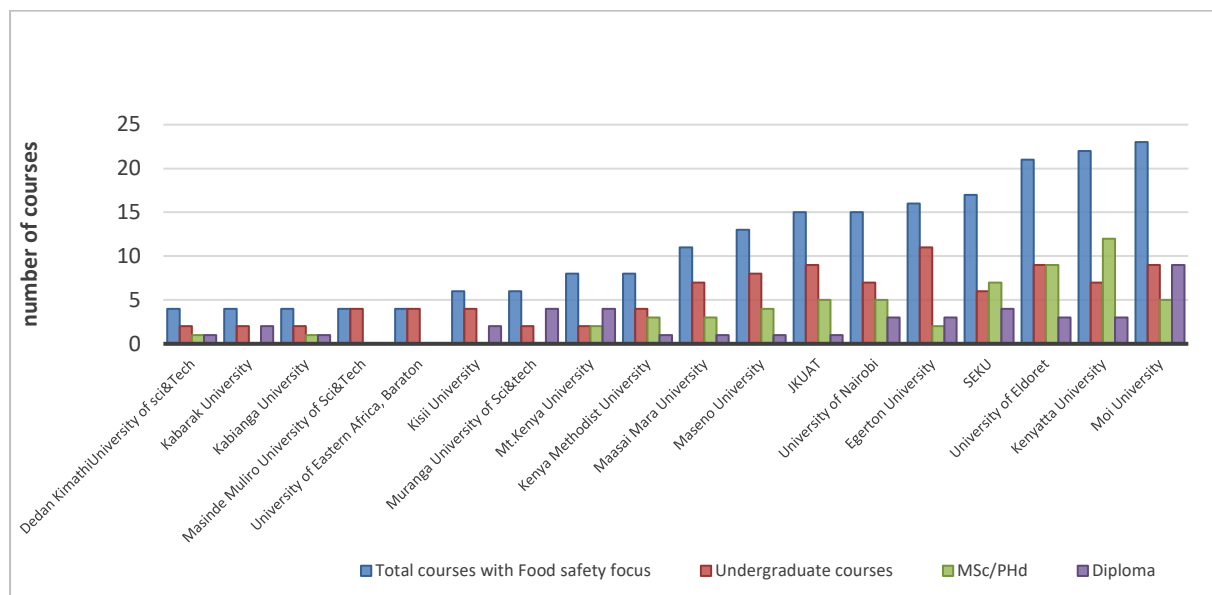


Figure 7: Universities in Kenya offering diploma, undergraduate and graduate programs with food safety focus as at 2020.

Comparison of the programs in sampled universities

From each partner state, up to two universities offering bachelor’s degree programs in veterinary medicine, food science and technology, and animal health and production were selected and the programs described in detail. Degree programs with food safety content were compared across the countries to discern their commonality and outline gaps that exist.

Bachelor of Veterinary Medicine

In the Bachelor of Veterinary Medicine program, a great similarity in the courses taught and content was observed (Table 2). However, some universities did not provide content details and in some instances the outlines were not very clear on the depth of the content taught. For instance, Makerere University indicated it taught food quality control and gave the example of Hazard Analysis and Critical Control Point (HACCP), but it was not clear if other programs such as Good Manufacturing Process (GMP), Good Hygienic Practices (GHP), risk analysis and total quality management were considered. In addition, it was difficult to determine if private food safety programs like GLOBALG.A.P. of Consumer Goods Forum were taught. In other instances, there was no mention of food safety content such as food spoilage, preservation etc.

Tables 2, 3, 4 and 5 show that the topics covered are nearly all technical, either related to health or food processing. No university appeared to have a course on economics, behaviour change communication or gender. In the chosen sample programs, economics, communication skills and gender are taught but there has been no linkage of these courses to food safety. Research has found that understanding of these areas is essential to assessing, communicating and managing food safety. Only one university gave training which covered participatory methodologies which are central to conducting development programs.

Only the University of Nairobi considered informal markets but this was only introductory and meant to raise awareness among the learners. Of the three sample universities, none considered food safety in fruits

and vegetables because their mandate is in food safety associated with animal-source foods (other aspects are thought to be offered by relevant departments). However, fresh produce is an important cause of foodborne disease and many of the hazards in fresh produce originate from animals.

Table 2: Course outlines with a food safety lens in the program of Bachelor of Veterinary Medicine in four East African Community premier universities

Course outline	Sokoine University of Agriculture	Makerere University	University of Nairobi	University of Rwanda
General microbiology	X	X	X	X
Veterinary parasitology	X	X	X	X
Food microbiology and spoilage (meat, milk, fish, eggs and products)	X	X	X	
Foodborne diseases (intoxications and infections)	X	X	X	
Zoonoses	X	X	X	X
Epidemiology: prevention and control of zoonoses	X	X	X	X
Meat, fish milk and eggs hygiene	X	X	X	X
Food control systems: laws, regulations and standards	X	X	X	X
Food preservation	X	X	X	
General epidemiology	X	X	X	X
Food safety programs, prerequisites (GMP, GHP), HACCP, risk analysis, participatory risk analysis	X	X	X	X
Informal markets and food safety			X	

Bachelor of Food Science and Technology

This program is taught mostly in the Faculty or School of Agriculture. In most universities, it falls in the department that offers programs in nutrition. Most of the courses are similar, reflecting the fact that universities that offered these programs early had influence in the drawing of curriculum for universities that started to mount the programs later. For instance, University of Nairobi started its food science and technology program earlier than Sokoine University of Agriculture.

Table 3: Course outlines with food safety focus in the Bachelor of Food Science and Technology offered by sample universities in the East African Community

Course outline	Sokoine University of Agriculture	University of Nairobi	University of Burundi	University of Juba
General microbiology	X	X		X
Food microbiology	X	X	X	X
Food spoilage	X	X		X
Foodborne pathogens and diseases	X	X	X	X
Food preservation	X	X		X
Food quality control management	X	X	X	X
Food processing and effects on quality	X	X		X
Food hygiene (meat, milk, fruits, vegetables)		X	X	
Food legislation and standards		X	X	X
Plant hygiene and food safety	X	X		
Human nutrition			X	

Bachelor of Nutrition and Dietetics

Table 4: Course outlines with food safety content in Bachelor of Nutrition and Dietetics offered by sample universities in the East African Community

Course outline	University of Nairobi	Moi University	University of Rwanda
Food hygiene and safety	X	X	X
Food microbiology	X	X	X
Food biotechnology	X	X	X
Nutrition epidemiology	X	X	
Food preservation	X	X	X
Parasitology		X	
Food security and safety			X
Food quality and safety management			X
Food laws and legislation			X
Food culture			X

Master of Science in Food Hygiene and Safety

Table 5: Course outlines with food safety focus of the Master of Science in Food Hygiene and Safety or Food safety and Quality or Food Quality, Safety Assurance

Course outline	Sokoine University of Agriculture	University of Nairobi	Moi University
Epidemiology	X	X	X
Food microbiology	X	X	X
Food processing and preservation	X	X	X
Food inspection	X	X	X
Food laws	X	X	X
Food hygiene and sanitation	X	X	X
Consumer behaviour and food safety		X	
Hazards in foods	X	X	
Foodborne diseases surveillance, control and notification	X	X	X
Food quality assurance and management	X	X	X

Graduate education in Africa

There has been a policy shift in funding of higher education. Major international donors started to fund university education and this resulted in increased enrolment between 2000 (2,344,000) and 2010 (5,228,000)⁶. This rapid growth rate is necessary for Africa, given the link between knowledge and skills development and economic growth. The challenges facing graduates from higher education institutions are many, including unemployment, which can lead to great social and political consequences, as exemplified by the 'Arab Spring' in North Africa, and hamper much needed economic development⁷. Institutions of higher learning are faced with lack of human resource, infrastructure and ability to provide practical training⁸. Further, graduates lack the necessary knowledge and skills in information and communication technology, business, team working and problem solving for the job market⁶.

In response to the employability challenge, Africa has centred on revising curricula in a number of ways including aligning them to market needs, expanding work placement programs and introducing entrepreneurship courses. The impact of these initiatives, however, is not yet known⁶.

Despite these challenges, there are opportunities for graduate employment. For example, demand for higher education will continue to grow fuelled by a rapidly increasing population and high number of secondary school graduates. In addition, there is increasing demand for animal-source foods; for instance, in Kenya, demand for milk and meat is expected to grow by 175% by the year 2050 (from a baseline of 2017). This translates into 13 billion litres compared to 5.2 billion litres of milk now and 1.3 billion kilograms of beef compared to 467 million kilograms now⁹. Animal food products are known sources of about 65% of human infections¹⁰. This situation will demand more trained food safety graduates. Another factor that is increasing employability of graduates is the growth of the private sector and increase in foreign direct investment.

The niche of food safety personnel

Food safety graduates have many potential career paths:

- Formal private sector: food production, processing and retail in quality assurance, product development or sale and marketing
- Entrepreneurship: starting businesses in food safety
- Import and export: trade in food products
- Public service: food inspectors, hygiene officers, regulatory affairs
- Academia: teaching, training, research
- Non-governmental organizations: implementing development programs

The global trade in food was estimated at USD 1,468.1 trillion in 2017. In EAC, total merchandise in food trade in 2017 is shown in Table 6. In addition, there is substantial informal trade in agricultural products across porous borders. It is evident that trade in food is big business for the EAC partner states, accounting for about 2.4% and 24.3% of the total merchandise trade in Burundi and Kenya, respectively (counting only formal trade). For this to grow, the food traded must be safe. The trained personnel in food safety will find a niche in regulation and capacity building of actors involved in food trade to ensure its safety.

Table 6: Total merchandise trade and merchandise trade in food flow in the East African Community in 2017

Country	Total merchandise trade (million USD)		Merchandise trade in food flow (million USD)	
	Export	Import	Export	Import
Kenya	6,086	17,260	2,762.7	3,154
Uganda	3,088	6,574	1,648	836
Tanzania	3,853	8,803	1,669.8	798
Rwanda	1,108	2,588	1,108.3	271
Burundi	161	812	82.7	141

Source: WTO (2018) international trade and market access data⁵

Informal domestic and cross-border markets play an important role in providing social safety nets in employment, household food security, income and health. Over 90% of the population in urban areas purchase their fresh food from informal markets, while in rural areas, the populations are producers as well as consumers of animal-source foods, fruits and vegetables. For instance, most milk is informally traded (70% in Kenya and 97% in Tanzania), while 95% of fruits and vegetables produced in Kenya are sold informally. The informal markets are not effectively regulated, hygienic practices are often observably low and the markets are perceived to be risky. It is in the interest of EAC partner states to start to transform these

markets to have comparable hygienic standards to those attained by the export market sector. This will help reduce the high health cost associated with foodborne diseases estimated at USD 1 billion and USD 0.8 billion annually in Kenya and Tanzania, respectively². Trained food safety personnel will be competent to address food safety in formal and informal markets and will be enlisted by the national and local/county governments to work to improve the hygienic standards of the informal markets.

Agriculture is considered as the driver of human development, food and nutrition security and shared prosperity in Africa. This requires improvements in agricultural production and value addition. Small and medium micro-enterprises are key in this agricultural manufacturing-led revolution (agribusiness). Food safety experts will be vital in the production of goods that meet international food safety standards and push the tripling of intra-Africa trade in agricultural goods and commodities by 2025, as envisioned by the 2014 Malabo commitments of the African Union¹¹.

Key observations

1. None of the universities had a program that offered food safety at undergraduate level.
2. A few universities have Master of Science programs in food safety.
3. Similar degree programs have comparable course outlines.
4. Courses are predominantly oriented towards biosciences and technology.
5. The depth of the content taught was not established in most cases because only course outlines were available for review.
6. Food safety issues in informal markets have been almost totally ignored in the existing curricula at both undergraduate and graduate programs.
7. The human resources to cover the content taught in the current courses is available because as per the requirements, they cannot mount the programs without competent persons.
8. Mainstreaming of food safety into the existing undergraduate programs would be easy to adopt, as the program may not necessarily have to undergo national quality accreditation as for a new program. However, this does not prejudice the establishment of a degree program on food safety.
9. Programs at undergraduate and graduate levels will require development of minimum core curriculum guidelines/benchmarks to allow for each institution to add areas they consider of interest. The programs thus developed will undergo quality vetting by IUCEA and the respective national commissions for higher education.

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