

Urban food markets in Africa—Incentivizing food safety using a pull–push approach

Closing workshop report

Guy Ilboudo¹, Michel Dione¹, Brice Ouedraogo¹, Assèta Kagambèga² and Theodore Knight-Jones³

¹ International Livestock Research Institute (ILRI), Burkina Faso

² University of Joseph Kizerbo of Ouagadougou (UJKO), Burkina Faso

³ International Livestock Research Institute (ILRI), Addis Ababa, Ethiopia



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Patron: Professor Peter C. Doherty A. C, FAA, FRS

Animal scientist, Nobel Prize Laureate for Physiology or Medicine—1996

Box 30709, Nairobi 00100 Kenya
Phone +254 20 422 3000
Fax+254 20 422 3001
Email ilri-kenya@cgiar.org

ilri.org
better lives through livestock
ILRI is a CGIAR research centre

Box 5689, Addis Ababa, Ethiopia
Phone +251 11 617 2000
Fax +251 11 667 6923
Email ilri-ethiopia@cgiar.org

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1 Introduction

The ‘Urban food markets in Africa—Incentivizing food safety using a pull–push approach (Pull–Push) Project’ is a project implemented by the International Livestock Research Institute since 2019 in partnership with the Institute for Research in Applied Sciences and Technologies (IRSAT), the Institute of Environment and Agricultural Research (INERA), Joseph Kizerbo University (UJKO), the Centre for the Analysis of Economic and Social Policies (CAPES) as well as the state technical services in charge of livestock, agriculture, health, trade as well as the municipality of Ouagadougou. Funded by the Bill & Melinda Gates Foundation, the UK’s Department for International Development (DFID) and the CGIAR Agriculture’s for Nutrition and Health (A4NH) research program, this research project aimed to improve food safety in urban informal markets in Burkina Faso (and Ethiopia) and more particularly those of poultry and vegetables. After 5 years of implementation, this project is coming to its end. It is in this context that from 02–03 October 2023, the closing workshop of the Pull–Push project was held at Bravia Hotel in Ouagadougou, Burkina Faso.

2 Objectives of the workshop

The main objective of this workshop was to share the results of research conducted as part of implementing the Pull–Push project with all stakeholders involved in food safety. Specifically, these were to:

- present and discuss the research results generated by the project with the stakeholders;
- discuss issues relating to food safety in Burkina Faso;
- identify prospects for possible future initiatives.

3 Opening ceremony

The opening ceremony of the workshop was chaired by Henri Kabore, representative of the Minister Delegate to the Minister of Agriculture, Animal Resources and Fisheries, in charge of Animal Resources. This opening ceremony was marked by:

- the speech of Theodore Knight-Jones, project coordinator, who thanked the project's research team as well as the various implementing partners. He recalled the importance of this project for the sustainable improvement of food safety in Ouagadougou before thanking all the participants in the workshop.
- The opening speech was given by Henri Kabore who thanked all the participants for their attendance. His thanks were also extended to the project coordination team. He did not fail to emphasize the importance of the theme dealt with in the project, which is a topical issue, the issue of hygiene that prevails in the diet of urban populations. He highlighted the large quantities of poultry that are consumed in Burkina Faso. However, the harmful practices often observed in poultry outlets in the city of Ouagadougou pose a risk of contaminating these foods. He also hoped that the results of the work carried out would be disseminated through the various communication channels. As a member of the board of the Ministry's office, he affirmed his availability to support the project in popularizing the results generated. He concluded his remarks by also thanking the participants who are online before declaring on behalf of the Minister Delegate in charge of Animal Resources as well as on behalf of the entire Ministry of Agriculture, Animal Resources and Fisheries declared open the closing workshop of the project '*Urban food markets in Africa—Incentivizing food safety using a pull–push approach* (Pull–Push Project)'.

4 First round of presentations

This series consisted of 6 presentations followed by a discussion session.

4.1 Reminder about the Pull–Push project

The reminder on the project was given by Michel Dione, researcher at ILRI, national coordinator of the project. He started by recalling the context and justification for the initiative of this project. Indeed, with an estimated daily consumption of about 80 thousand chickens in the city of Ouagadougou, in a market dominated by informal actors, the health risks associated with consuming this food are potentially high.

He then returned to the methodological approach used in the project. This is the ‘Pull–Push’ approach focused on the consumer with the aim of providing the consumer with the necessary information to change their purchasing behaviour for chicken and vegetables. Consumers will then demand healthy food when buying meat, chicken or vegetables. The approach also considered the capacity building of the value chain actors to meet the consumer demand by providing quality food products. Finally, the project considered strengthening the capacities of the actors in charge of food control for a harmonized understandings of food safety priorities and for an improved control of foods.

The project was implemented through their 7 components:

- Component 1: Estimating the burden and economic cost of foodborne illnesses in Burkina Faso;
- Component 2: Understanding poultry and vegetable (tomato) value chains;
- Component 3: Quantitative risk analysis and cost-effectiveness analysis of proposed interventions;
- Component 4: Capacity building and motivating regulators;
- Component 5: Capacity building of value chain actors;
- Component 6: Designing and implementing a consumer campaign;
- Component 7: Analysis of the impact of interventions.

4.2 Estimating the burden and economic costs of foodborne diseases in Burkina Faso

This presentation was given by Arie Havelaar, Professor of Global Food Safety and Zoonoses in the Animal Sciences department, the Global Food Systems Institute and the Emerging Pathogens Institute of the University of Florida. The presentation consisted of first the presentation of the working methodology used. Indeed, the study focused on three main pathogens generally found in food, including poultry and tomatoes such as *Campylobacter* spp, *Escherichia coli* and *Salmonella enterica*. After presenting the data collection and analysis methods, the results of the study were presented. As such, some disease burden indicators such as incidence, mortality and disability adjusted life years (DALYs) were calculated. Cost indicators were calculated in international dollars.

In 2017, it was estimated that there were about 1 million cases of illness caused by the three pathogens, resulting in about 2,000 deaths. Approximately 140 thousand years of healthy life were lost, representing 1% of total healthy life expectancy. The total burden of foodborne illness was at least twice as high in 2017 as in 2010.

Children under 5 years old, although they make up 18% of the population, bear a disproportionate share of the burden of illnesses related to *S. enterica* (30%) as well as *Campylobacter* spp and enterotoxigenic *E. coli* (ETEC) (73%).

The key results of the study showed that, statistically, in 2017, the value of a life was equivalent to USD 56,456. Thus, one year of statistical life was equivalent to USD 1,857. In addition, the estimated economic burden of the 3 pathogens on all food was USD 391 million in 2017, equivalent to 3% of Burkina Faso's gross domestic product (GDP). This economic burden was divided between productivity losses of approximately USD 275 million, willingness to pay in case of mortality, which amounted to approximately USD 112 million and willingness to pay in case of suffering, which amounted to USD 4 million.

The study also found that among the three pathogens studied, nontyphoid *S. enterica* was responsible for the highest disease burden, particularly with respect to invasive salmonellosis. Considering these findings, it was suggested that further efforts could be made to reduce the prevalence of foodborne diseases with the aim of improving Burkina Faso's public health and economy.

4.3 Knowledge, attitudes and practices of grillers, vegetable sellers and detecting pesticide residues in Ouagadougou

This presentation was made by Guy Ilboudo, researcher at ILRI. The first part of the presentation was focused on assessing the knowledge, attitudes and practices (KAP) of poultry grillers in Ouagadougou. This is a descriptive cross sectional study conducted in June 2021 among 100 poultry outlets.

The results of the study showed that among grillers, relatively poor hygiene practices in poultry outlets in the process of slaughtering, scalding, eviscerating, cooking and serving chicken. Poor transport and storage conditions of carcasses were also found in the study. For example, poultry is slaughtered on the ground in 80% of the cases. More than 60% of vendors transport carcasses in plastic bags at room temperature from the point of slaughter to the point of sale.

Poor practices are mainly the result of the lack of training of the grillers and the misperception of the importance of hygiene in improving the activity by the grillers. In fact, almost 90% of those interviewed had not previously received hygiene training and only 4% of grillers believe that consumers are concerned about hygiene at the outlets. The study also found that the authorities do not regularly inspect their workplaces. Half of those surveyed had not yet received an inspection from the authorities in charge of hygiene issues. When asked about the possibility that consumers would pay more if safety practices in their restaurants are improved, most respondents said they did not think this was applicable. In the tomato samples, pesticide residues were largely found.

The second part of the presentation focused on pesticide residues in tomatoes. The study surveyed 328 tomato vendors in 23 markets in Ouagadougou. The pesticides sought were Lambda cyhalothrin, deltamethrin, permethrin, Dichlorodiphenyltrichloroethane (DDT), chlorpyrifos and acetamiprid. Out of a total of 656 samples collected, 62% contained at least 1 detectable pesticide, of which 61% had residue levels above the European Union (EU) maximum residue limit (MRL) and 21% had residue levels above the Codex Alimentarius Commission (CAC) MRL.

4.4 Pathogen prevalence studies in tomatoes in the city of Ouagadougou

This presentation was made by Bertrand Tiendrebeogo, a PhD candidate at the UJKO working in implementing the project. In his speech, he presented the importance of the study as well as the reasons that led to its implementation. The aim was to determine the presence and concentration of *E. coli* and *Salmonella* spp, two types of pathogenic bacteria commonly associated with foodborne infections, in the tomato samples collected. Following their physical presentation, tomatoes were grouped into 3 categorized tomatoes namely, intact tomatoes, damaged tomatoes level 2 (D2) and damaged tomatoes level 4 (D4). Out of a total of 198 samples collected, 68% had the presence of flies and 77% were visibly dirty. The results showed that the D4 tomato category had safety issues (dirt and the presence of flies). Evaluating the total mesophilic Aero Flora shows that category D4 has the highest amount of flora. The prevalence of *E. coli* and *Salmonella* were 75% and 23%, respectively, across all categories. Category D2 had a prevalence of *E. coli* compared to the other two categories.

4.5 Studies of the microbiological quality of grilled chicken carcasses sold on the streets of Ouagadougou

This presentation was made by Kagambega Assèta from UJKO and consisted of verifying the prevalence of *Salmonella* as well as *E. coli* in the carcasses of grilled chickens in the street restaurants of Ouagadougou. It was conducted by sampling grilled chicken carcasses at sites selected as part of the Pull–Push project. At the same time, a survey was carried out on the conditions under which chicken was sold.

The results indicated that handwashing with water was observed in 57% of cases. After laboratory analysis, it was found that 82% of chickens and 80% of chili peppers contained *E. coli*. In addition, a prevalence of 1.47% *Salmonella* was detected. The *S. typhi* strain was found on one carcass, but subsequent testing revealed that it did not originate from the animal's digestive tract.

This study revealed that grilled poultry carcasses can still be a source of contamination for humans. She reported that good hygiene practices are not followed when handling these carcasses. Therefore, it is important to have education, training and awareness programs in place for those who prepare grilled chicken as well as consumers.

4.6 Quantitative analysis of microbiological risks of chicken dishes from vendors

James Ssemanda from the Wageningen University made this presentation during which he presented the sources of the data and the methods for identifying the risks. Microbiological risks were assessed along the chain (transport of poultry or carcasses, market, consumption). Next, the cost effectiveness of food safety interventions was assessed along the poultry value chain. The main interventions evaluated are: (i) improved biosecurity by switching to an intensive poultry farming system, (ii) hygiene and good slaughter practices, (iii) combined efforts at the poultry outlet, (iv) use of dedicated utensils at the restaurant and (v) improved handwashing at the poultry outlet.

The results showed that the incidence rates of *Campylobacter* are 6,512 cases per 100 thousand population, while those of *Salmonella* are 2,723 cases per 100 thousand population. Disability adjusted life years (DALYs) are 165 per 100 thousand population for *Campylobacter* and 1,216 per 100 thousand population for *Salmonella*.

The study also found that improving biosecurity through the transition to an intensive farming system can lead to a reduction in disease risk of more than 50%. In addition, combined interventions in the market and at the outlet of prepared poultry can lead to a significant reduction in diseases (more than 90%). In the short-term, the focus should

be on relatively effective and easy to implement interventions, such as proper handwashing and using dedicated utensils. Finally, One Health interventions can consider several pathogens that cause foodborne illness.

4.7 Discussion session

At the end of the presentations, a series of interventions took place and offered the opportunity to the participants of the workshop to present their points of view and their questions on the various papers made. For example, the following questions were raised as showed in the discussion sessions in section 6.5:

In addition to the questions, comments, suggestions and recommendations were summarized by some stakeholders, summarized in the following sections:

- the concept of ‘One Health’ was not sufficiently mentioned in the first round of presentations
- take greater account of the issue of antimicrobial resistance (AMR) in future studies
- promote the use of water from scalding and carcass washing for composting
- strengthen collaboration between the different sectors of One Health
- disseminate the results of the research so that the department's technical services can put them to good use
- expand hygiene and food safety training to consumers
- leverage the national One Health platform in disseminating results and raising awareness

5 Second round of presentations

This series consisted of seven presentations followed by a discussion session.

5.1 Quantitative analysis of microbiological risks of tomatoes sold in Ouagadougou markets

The presentation was given by Claudia Ganser of the University of Florida. She presented the risk analysis, management and communication approach and then indicated that in the working method, three categories of tomatoes were considered, namely intact, moderately damaged and damaged. The risks of contaminating these tomatoes by *E. coli* and *S. typhi* bacteria were evaluated. Household incomes have been identified as a factor influencing risks. This is because high income households are less likely to be infected with *E. coli*. This disparity could be explained by the fact that higher income households have more resources to implement practices to reduce risk, such as handwashing and washing food.

The results of the study also revealed that the risk was higher for intact tomatoes, as they are usually eaten raw. In contrast, moderately damaged and damaged tomatoes are usually cooked thoroughly before being eaten. The study also showed that washing tomatoes significantly reduced the concentration of *E. coli*.

In the case of Salmonella, the main risks were related to the way the tomatoes were cooked, the lack of tomato and handwashing, as well as the quantity of pathogens already present in the food at the market level. The higher the quantity of pathogens on tomatoes in the market, the higher the risk of contamination at the household level.

The study recommended that interventions should target all links in the value chain to significantly reduce risks.

5.2 Impact of washing on pathogen prevalence in chicken carcasses

This presentation was made by Michel Dione. This is a study that involved 53 samples of raw chicken carcasses collected from markets in the city of Ouagadougou. For these chickens, a quantification of Salmonella and Campylobacter was made. This quantification was done just after slaughter and after washing. The results of the study showed that a reduction was seen after washing for *Salmonella* and *Campylobacter*.

A significant reduction in Salmonella was observed in poultry neck parts due to washing. On the other hand, for *Campylobacter*, reduced the quantity was not observed after washing.

Other significant results were obtained for Salmonella. For example, chickens slaughtered on the ground had a high Salmonella compared to chickens slaughtered on covered racks. In addition, chickens plucked on tables had fewer burdens than those plucked on the ground. Chickens eviscerated on the floor had a high bacterial burden compared to chickens eviscerated on tables.

5.3 Why a pull–push approach? The key elements of the communication plan and how we decided on them

This presentation was made by Harette Snoek, a researcher at the Wageningen University. In her presentation, she first explained the context that prevailed in the conduct of her study as well as the objectives of the study, then she presented the model developed for consumer behaviours and finally the key elements of the campaign. Thus, the objective of the study was to help consumers make better choices when buying chicken away from their homes, in the city of Ouagadougou.

The study is based on the previous work carried out by ILRI, but also on the workshops held with the project's stakeholders as well as on the results generated during the meetings. This includes the analysis of consumer behaviour (including gender issues), the food preparation environment, supply chain practices as well as income differences.

In terms of methodological approach, a complex model considering consumer behaviours were used. This model considers the individual, society, the environment and regulations. Similarly, motivation, timeliness and ability have been the factors that can better explain consumer behaviour.

Awareness raising campaigns have been undertaken, highlighting key messages aimed at insidiously raising awareness of the need to be aware of the vulnerability of consumers and the seriousness of the consequences. These campaigns focused on individual responsibility, behaviour control and building self-confidence.

5.4 Consumers communication campaign

This presentation was made by Romaric Sawadogo, from the communication agency Mediacom, partner of the project for this component. He first presented a 5 minute video that summarized the context, the method including the key messages and the tools used. The messages were designed over several months by a multidisciplinary team. The main message around which the communication elements were articulated is 'Bien choisir son Koassa (grilleur) pour bien manger' meaning 'Choosing the right *Koassa* (griller) to eat well'.

The communication tools and channels used were:

- posters for the public on several 12 m² panels and other posters;
- TV commercials in two versions;
- humorous video clips;
- radio spots in French and local languages (Moore and Dioula);
- social networks, including an animated Facebook page;
- a website.

The tools were disseminated for 9 months on communication panels, but also through broadcasts on television, radio and social networks.

Following the video, he made an oral presentation in which he recalled the approach of the communication campaign, which is an innovative consumer centric approach consisting of conveying positive messages. Burkinabe influencers were called upon namely 'Moussa petit sergent', 'Hamidou le doux' and 'Ebony Amaze'. In his intervention, it was also noted that the messages were disseminated in a 360 degree manner with a consumer centred approach. Thus, over the period from May 2022 to January 2023, more than 2,240,000 unique views on radio and television platforms.

A website hosted over two years and social networks also served as online platforms for distributing the designed audio and video spots.

5.5 Capacity building for regulators and chicken sellers

This presentation was given by Michel Dione. In his presentation, he outlined the training modules designed for the different training courses of regulators. There were 8 modules and they included:

- Module 1: General information on microbiology
- Module 2: Foodborne diseases
- Module 3: Food contamination pathways
- Module 4: Hygiene and quality of raw materials and ingredients
- Module 5: Hygiene of premises, preparing equipment and sales
- Module 6: Personal hygiene, methods and practice in the food sector
- Module 7: Water management in the food preparation and sales process
- Module 8: Regulation and control of food sales.

At the end of the training, a visit was made to some field sales outlets and the laboratory at UJKO. The visit to the poultry outlet led to developing a guide for evaluating the food hygiene practices of poultry outlets.

Another training was carried out and concerned the sellers themselves. This training was provided by a multidisciplinary team of experts called 'Food safety Champions'.

The training approach was participatory for each outlet, with the owner and an employee trained in separate groups. At the end of the training, a package of equipment and a training certificate were offered. A total of 200 chicken grillers, including 123 owners and 70 employees, took part in the training.

A total of 11 training modules were delivered. These are:

- Module 1: general: importance of good hygiene practices—impact of poor hygiene in food handling
- Module 2: knowing micro-organisms of the outer surface
- Module 3: managing live chickens at the chicken outlet (onsite slaughter)
- Module 4: slaughtering (bleeding—scalding—plumage—evisceration)
- Module 5: offsite carcass management
- Module 6: preparing and cutting
- Module 7: seasoning and serving
- Module 8: personal and clothing hygiene/health status
- Module 9: environmental health and sanitation
- Module 10: general plenary discussions on food safety regulation (sanitation services)
- Module 11: managing businesses

Part of Dione's presentation was made by Ouedraogo Agnès from the General Directorate for the Promotion of the Rural Economy, one of the trainers (champions). The aim was to explain how the modules were presented in a practical way to the different participants. The modules presented in the form of slides mostly contained images and videos that were discussed by the participants. At the end, the good practices to be adopted were presented to them as key messages to be remembered.

5.6 Evaluating the impact of the consumers communication campaign

This presentation was made by Donya Madjdian, researcher from the Wageningen University. The purpose of the study was to assess the impact of the 9 months awareness campaign and the key elements of the population's behaviour in relation to the purchase and willingness to consume chicken in Ouagadougou's informal markets. The specific objectives were to assess the level of coverage of awareness campaigns and the behaviour of stakeholders in relation to health as well as the key behaviours and then to assess the importance of the different media channels in changing behaviours.

Surveys were therefore conducted among 1,062 consumers before and after the campaign in March–April 2022 and March–April 2023, respectively.

The results of the study showed that the campaign reached a large audience with a reach rate of around 60%. Consumers have responded positively to the campaign. The awareness generated by the campaign was linked to an increased perception of access to food safety information, increased knowledge and perceived health benefits. Participants had strong intentions to practice food safety behaviours. Although overall improvements were observed in food safety behaviour over time, these improvements were not directly related to awareness of the campaign, which could be due to recall bias or underreporting. A narrowing of the gap between the intent and implementing the advice received was noted, indicating the importance of outreach during the campaign. In addition, online outreach, especially those aimed at emotional attractiveness, appeared to be more effective than traditional media based on a rational approach. Finally, the study highlighted the importance of the socio-economic and nonbehavioral factors in understanding the impact of the campaign on food safety behaviour.

5.7 Evaluating the impact of chicken vendor training

This presentation was also made by Donya Madjdian. The objective of the study was to assess the impact of training for vendors (Koassa) of ready to eat chickens on the outlets on their food safety behaviour and on the main determinants of this behaviour.

A random sampling of 162 grillers was carried out and divided into two groups of sellers. The treatment group consisted of 72 grillers who received the training and the control group consisted of 90 grillers who did not receive treatment. The survey was conducted before and after the training in September 2022 and February–March 2023, respectively.

The results showed that the training and toolkit were highly appreciated and the participants had a high level of trust in the trainers and materials. They also had strong intentions to put into practice what they had learned. The training was successful in increasing knowledge, motivation, as well as several behaviours related to food safety. Participants also perceived business benefits, including increased profitability and an increase in the number of customers. Opportunities have been identified, such as the use of social media to transfer skills to other vendors. However, obstacles remain, particularly related to infrastructure and financial resources, which are insufficient to implement good food hygiene practices.

5.8 Discussion session

At the end of the presentations, a series of interventions took place and offered the opportunity to the participants to present their points of view and their questions on the various communication delivered. These discussions can be summarized in the following points:

- Suggestions to improve communication tools for future initiatives

- Finding mechanisms to better value the training certificates of grillers
- Challenges of engaging grillers during training
- Conducting studies to assess the health risk linked to the handling of coins and silver notes by roasters.

6 Panel of national food safety experts

In the afternoon of the 2nd day of the training, a panel was held under the title ‘What new strategies for sustainable food safety management through a One Health approach in a world facing socio-economic and climate change challenges?’

The specific objectives of this panel were to:

- Gain a better understanding of the food safety context.
- Have shared opinions for sustainable improvement of the food safety.
- Make recommendations to inform policymakers and better guide research and development.
- Explore key challenges in implementing food safety activities.
- Propose innovative and sustainable solutions to improve food safety.

The panel was presented by:

Abdoulaye Gueye, nutritionist in charge of food safety fortification, InfoSan Emergency Focal Point (food safety authority). He is an officer of the Nutrition Directorate of the Ministry of Health and Public Hygiene and a member of the national board of the *Codex Alimentarius*.

Gisele Pare, Veterinarian Specialist in Public Health, Veterinary Inspector, Director of Veterinary Public Health and Legislation at the Ministry of Agriculture, Animal Resources and Fisheries, food safety Focal Point of the World Organisation for Animal Health (WOAH).

Fulbert Nikiema, Microbiologist, Director of Food Control and Applied Nutrition at the National Agency for Environmental, Food, Occupational and Health Product Safety (ANSSEAT).

Prof Zekiba Tarnagda, Director of Research, first teacher of One Health in Burkina Faso, President of the One Health association in Burkina Faso, veterinary researcher at the Institute for Research in Health Sciences (IRSS) at the National Influenza Reference Laboratory in Burkina Faso.

Henri Kabore, researcher at INERA, project manager of the Minister Delegate in charge of animal resources at MARAH and main moderator of the panel.

6.1 Speech by Abdoulaye Gueye

He recalled in his speech that humans are always subject to exposure to multifaceted risks related to food safety. He called for compliance with the basic rules of food safety. In addition to the production method, which is a risk factor, there are the traders who transport contaminated foods.

Modes of contamination can lead to some forms of cancer. The initiatives undertaken by the population to raise livestock force us into certain situations such as the use of antibiotics without respecting the persistence periods. This

promotes antibiotic resistance. Transmission takes place on several levels. Today, we have gone from resistant to multi-resistant micro-organisms.

He noted that four alerts have been received recently by their services, mainly related to the cases of diarrhoea.

Shortcomings were identified in their activities. These are:

- leadership in coordination;
- insufficient coordination of actors;
- the low level of functioning of the entities due to lack of funding.

The panellist suggested:

- identifying focal points in all ministries in charge of food safety.
- establishing a roadmap through the International Health Regulations (IHR) to address the challenges.
- raising awareness among the population and work to discredit those who do not respect or resist awareness against antibiotic resistance.

6.2 Speech by Gisèle Pare

In her speech, she recalled the importance of animal products and products of animal origin in Burkina Faso. She then recalled the responsibilities of her direction in the control of foodstuffs throughout the production and processing process. She noted that Burkina Faso does not currently have enough processing industries.

She presented the challenges they face in their monitoring activities. The major challenge is to be able to federate human, material and financial resources to achieve the struggle. At the end of the day, the consumer is the one who pays the heavy price. She made suggestions summarized below:

- individual responsibility for preserving the health.
- raising awareness among young people to recognize what is right when it comes to food hygiene.
- conducting a risk analysis prior to any intervention so that control must be strengthened in the areas where the risk is highest, given the context.
- establishing a single food safety entity. The entity must have within it all the competences that will enable it to carry out these awareness raising and combating actions. For example, animal health profiles must be considered within ANSSEAT.

Strengthen the legal framework to enable inspectors to carry out their control work without the risk of prosecution.

6.3 Speech by Fulbert Nikiema

In his intervention, he mentioned the glaring phenomenon of street food for which there are difficulties in controlling the possible problems that may affect the food safety. There is also the problem of uncontrolled use of chemical fertilizers and antibiotics.

The challenges presented are the low level of supervision and monitoring and the processing units that do not ensure the quality of the foodstuffs. He also noted the lack of mastery of good hygiene practices, the lack of coordination for effective actions and the insufficient sharing of data between institutions. He did not fail to praise the importance of working in synergy.

On this basis, he suggested:

- increase the control measures
- raise awareness among stakeholders along the value chain

- share information to facilitate research and monitoring in the field
- provide substantial support to strengthen the capacity of oversight structures
- strengthen the food safety governance system

6.4 Speech by Prof Zekiba Tarnagda

In his speech, he recalled the One Health, the 4 thematic commissions on zoonoses, antimicrobial resistance, endocrine disruptors and food safety. Regarding animal resources, he noted the shortage of veterinarians in Burkina Faso. This allowed him to recall the absence of a faculty of veterinary medicine in Burkina Faso.

In his intervention, he suggested that:

- focus on plant and animal source food
- make a comprehensive diagnosis at all levels of the fundamental reasons for the lack of food safety
- strengthening food inspection
- setting in motion the One Health collaboration, which in Burkina Faso has a sufficient mechanism to function
- federating efforts to work in improving the food safety
- involving municipalities, hygiene services and security services in the fight against fraud and foodstuffs unfit for consumption
- involving civil society such as the One Health (OH) association, especially in raising awareness among rural populations

6.5 Discussion session

Discussions covered a variety of topics, including questions and suggestions. The main questions and answers are presented in the following table:

No.	Questions	Answers
1	What role does the Ministry of Agriculture play in implementing the One Health (OH)?	The Ministry of Agriculture is an integral part of One Health in Burkina Faso. Among the thematic commissions of the OH is the one on food safety, which is headed by the Ministry of Agriculture, whose current president is Aissata Wereme Diagne
2	How is the communication done in the event of a food poisoning alert?	In the event of an alert, field investigation is conducted to locate and seize the offending stocks, which are then destroyed. However, in some cases, the offending foodstuffs have already been consumed at the time of the investigation. The results of investigating and managing the stocks are made public by the communication services
3	What mechanisms are in place to ensure food control, given the lack of legal coverage for inspectors?	Despite the reluctance of some actors to be controlled, inspections continue. It was pointed out that animal and fisheries inspectors are sworn in, but there are gaps in the regulatory framework, particularly regarding the law enforcement decrees Regarding the control of the chemical quality of foodstuffs, it was pointed out that ANSSEAT works closely with Customs, receiving 65% of the products it checks. In addition, food inspection can be carried out on request. The analyses carried out by ANSSEAT are based on approved international standards, covering the microbiological, toxicological and physicochemical domains. These analyses are systematic in institutional procurement and large quantities of samples have already been analysed, revealing cases of noncompliance. The main issue lies in managing these nonconformities, because although the existing texts do not contradict each other, difficulties arise on the ground

4	What about the chemical quality of food, especially heavy metal contamination?	<p>For example, an analysis of a canteen meal revealed the presence of 128 chemical residues from 36 different pesticides, including 47 substances suspected of being carcinogenic</p> <p>Regarding the analyses carried out by the National Livestock Laboratories, with regard to the analyses of the chemical quality of the products, sporadic studies carried out by students during their internships at the National Livestock Laboratory have revealed interesting results. However, these results are not published, as the laboratory is not intended for research</p>
5	Is there a risk of developing cancer by eating foods containing heavy metal residues?	<p>Heavy metals such as cadmium, mercury and lead are implicated, as excessive consumption of these substances can cause overloading in some organs, especially the liver and potentially lead to cancer. Checks on foodstuffs sometimes reveal alarming results</p>
6	What are the procedures for obtaining health approval?	<p>Obtaining health approval is crucial for various structures, from farms to slaughterhouses, butchers' shops and delicatessens. However, problems remain in the application process due to shortcomings in the current regulatory framework, which hinder effective action</p>
7	Are there animal health profiles (especially veterinary health profiles) within ANSSEAT?	<p>For the time being, there is no veterinary profile within ANSSEAT. This gives the impression that this structure is not sufficiently multidisciplinary</p> <p>There are often difficulties in collaboration between this structure and the veterinary services</p> <p>Recruiting veterinary profiles is an objective that must be extinguished</p>

7 Plenary session—Gaps for further research, policy implications

The plenary session on identifying research gaps was moderated by Daniel Kabore, researcher at the Centre for Economic and Social Policy Analysis (CAPES), a partner in the project. In his speech, he stressed that existing research should continue. He then opened the floor to the participants to collect their suggestions on possible new directions for future research activities.

Thus, at the end of the interventions, he summarized the different research gaps that are summarized in these points:

- Poor control of the value chain related to food safety. It is necessary to integrate all the actors in this chain.
- Waste management from the catering industry.
- Lack of coordination in food safety responses.
- Disseminating knowledge about pesticide residues to rural populations.
- Pre-intervention risk analysis.
- Designate ANSSEAT food safety focal points.

8 Key recommendations

At the end of the discussions during the two days, the recommendations that emerged were as follows:

- Ensure better coordination between institution working in food safety in Burkina Faso.
- Strengthen resource mobilization for food safety, including through the National Action Plan for Health Security (NAAP), which was developed under the International Health Regulations (IHR).
- Provide ANSSEAT with veterinary staff to solve the problem of multidisciplinary.
- Operationalize OH collaboration to better manage the food safety issue.
- Involve municipalities, hygiene services and security services in the fight against fraud and unfit foodstuffs.
- Involve civil society such as the OH association, in raising awareness among rural populations.
- Raising awareness of food safety among value chain actors.

Strengthen the food safety governance system, including the legal framework and coordination.

9 Closing the workshop

The closing of the workshop was characterized by the closing remarks by the national project coordinator, Michel Dione. In his speech, he said that a similar workshop will be organized in Ethiopia in 2 weeks as the project is also implemented in this country simultaneously. He then thanked his collaborators as well as the partner of the project. He said that a publication will be made in the future on the impact of Covid 19 on hygiene practices. He thanked the participants for the research suggestions made and apologized for the difficulties encountered by the participants, especially with the language of intervention of some actors.

Daniel Kabore was asked to prepare a policy brief based on the activities carried out and the results obtained. He ended his speech by introducing the Poultry Losses and One Health (POLOH) project, which is currently being led by ILRI and which aims to provide answers on other aspects of the poultry value chain, particularly at the farm and transporting level.

The closing speech was delivered by Henri Kabore on behalf of the Minister Delegate in charge of Animal Resources. In his speech, he expressed his satisfaction with the work that had been carried out during the two day workshop. He reassured that he would take it upon himself to plead with the minister to move things forward. He concluded his speech by wishing good luck to the ongoing POLOH project and declared on behalf of the Minister Delegate in charge of Animal Resources the closing workshop of the project '*Urban food markets in Africa—Incentivizing food safety using a pull–push approach*'.

10 Annexes

Annexe 1. Workshop agenda

Time	Activity	Responsible
Day 1: Monday, 02 October 2023		
0800–0830	Installing the participants	Fahouzia Yawa, International Livestock Research Institute (ILRI)
0830–0900	Opening and remarks	ILRI, MD–MARAH
0900–0930	Reminder about the Pull–Push project	Michel Dione, ILRI
0930–1000	Estimates of the burden and economic costs of foodborne diseases in Burkina Faso	Arie Havelaar, University of Florida (UF)
1000–1030	Interviews, family photo and coffee break	Fahouzia Yawa, ILRI
1030–1100	Knowledge, attitudes and practices of grillers, vegetable sellers and detecting pesticide residues in Ouagadougou	Guy Ilboudo, ILRI
1100–1130	Pathogen prevalence studies in tomatoes in the city of Ouagadougou	Prof Kagambèga, Université Joseph Kizerbo de Ouagadougou (UJKZ)
1130–1200	Quantitative analysis of microbiological risks of chicken dishes from vendors	James Ssemenda, Wageningen University and research (WUR)
1200–1300	Discussion session	Michel Dione, ILRI
1300–1400	Lunch break	Fahouzia Yawa, ILRI
1430–1500	Quantitative analysis of microbiological risks of tomatoes sold in Ouagadougou markets	Claudia Ganser, UF
1500–1530	Impact of washing on pathogen prevalence in chicken carcasses	Michel Dione, ILRI
1530–1600	Discussion session	Guy Ilboudo, ILRI
1600	Summary and end of the day	Kagambèga Assèta, UJKZ
Day 2: Tuesday, 03 October 2023		
0830–0900	Why a pull–push approach? The key elements of the communication plan and how we decided on them	Harriette/Tacken Gemma, WUR
0900–0930	Consumers communication campaign	Romaric, Mediacom
0930–1000	Discussion session	Michel Dione, ILRI
1000–1030	Coffee break	Fahouzia Yawa, ILRI
1030–1100	Evaluating the impact of the consumers communication campaign	Donya Madjidian, WUR
1100–1130	Evaluating the impact of chicken vendor training	Donya Madjidian, WUR
1130–1200	Discussion session	Daniel Kabore, CAPES
1200–1300	Lunch break	Fahouzia Yawa, ILRI
1300–1500	Panel of national food safety experts	Prof Nicolas Barro
1500–1530	Plenary session—Gaps for further research, policy implications	Daniel Kaboré, CAPES
1530–1600	Summary and end of the workshop	Michel Dione, ILRI

Annexe 2. Attendance list

No.	Name	Institution
1	Ouedraogo Narcisse Jerome	Maison de l'Aviculture
2	Traore Ousmane	Worldveg
3	Zoungana K. Nicodeme	MARAH
4	Sanon Mamadou	DRSPH
5	Dioma Oui	Commune de Ouaga
6	Ouoba/Dakyo Vinima	CPAVI
7	Coulibaly/Ouattara Ouou	TANAGER
8	Sawadogo Karim	ABNORM
9	Kabore P. Daniel	Consultant
10	Ouattara/Songre Laurentia	IRSAT
11	Sanfo Kadre	DGSV/MARAH
12	Tarnagda Zekiba	One Health Association
13	Dabire Nifabapouonon	DGSV/MARAH
14	Kabore Henri	MSHP
15	Tiendrebeogo W.P. Bertrand	UJKZ
16	Zongo/Tiendrebeogo P. Alice S.	ABNORM
17	Pare N. Gisele	DGSV/DSPVL
18	Yameogo Issaka	ST/One Health
19	Coulibaly Orokia	ANB
20	Ouedraogo Agnes	DGPEER/MARAH
21	Ouattara Youssouf	VSF–BF
22	Gnomou Celine	DHP/MSHP
23	Nabaloum Adlaye	Commune de Ouaga
24	Kaouolobou Saidou	UPVL
25	Sawadogo Romaric	MediaCom
26	Kagambega Asseta	UKZ
27	Nikiema Fulbert	ANSSEAT
28	Kientore Marie Claire	DPSP/SSE
29	Dione Michel	ILRI
30	Ilboudo S. Guy	ILRI
31	Ouedraogo W. Brice Armel	ILRI
32	Ouedraogo S. Eunice	ILRI
33	Ilboudo Irissa	ILRI
34	Yawa Fahouzia	ILRI
35	Gueye Abdoulaye	MSHP

Annexe 3. Photos

Opening ceremony of the workshop



Presentation sessions



- Qu'est-ce que vous allez apprendre de ce module ?
1. Les bonnes conditions de préparation et de découpe du poulet
 2. Les sources de contamination du poulet lors de la préparation et de la découpe
 3. L'hygiène des surfaces de découpe et des ustensiles utilisés
 4. Le nettoyage des équipements (table, bassine, grille, congélateur, etc.)
 5. Le nettoyage et la désinfection des ustensiles utilisés (couteaux, assiettes, etc.)

Question and response session



Panel session

