

THE CRITICAL IMPORTANCE OF ASSESSING STAKEHOLDER AWARENESS OF FOOD SAFETY AND SECURITY ACROSS THE FOOD VALUE CHAIN

Yue Wu[✉], Katalin Takács-György

Obuda University, Hungary

ABSTRACT

Aim: This study aims to assess the critical importance of stakeholder awareness of food safety and security across the food value chain. A lack of awareness can hinder the development of sustainable agriculture; therefore, this research explores why awareness of food safety and security is essential for different stakeholders in the food value chain. **Methods:** A comprehensive literature review was conducted using content analysis to investigate the level of awareness among various stakeholders, from farmers to consumers, regarding food safety and security. The review focused on identifying key factors that influence stakeholder engagement and awareness throughout the food value chain. **Results:** The analysis revealed that stakeholder awareness of food safety and security significantly enhances food safety measures, promotes sustainability, ensures regulatory compliance, and improves overall efficiency. It also reduces waste, strengthens consumer trust, builds brand loyalty, and addresses global food challenges. Additionally, the study found that the awareness of farmers at the early stages of the food value chain is as important as that of end-stage players, such as food service workers and consumers. **Conclusions:** Understanding the level of awareness of food safety and security among stakeholders is crucial for promoting sustainability, improving food safety, and ensuring regulatory adherence across the food value chain. Enhancing awareness, particularly at the farming stage, is vital for improving the overall effectiveness of food safety and security initiatives.

Key words: food safety, food security, sustainability, influencer, awareness, value chain

JEL codes: Q18, Q01, D83

INTRODUCTION

Food safety and food security, together with nutrition, are vital to sustaining human life and human health. Food safety and food security are inextricably linked concepts that significantly impact human well-being, and numerous external factors influence both areas. To clearly understand the difference between food safety and food security, Oyarzabal and VanRenterghem [2020] underline the quality and quantity of

food separately. International organizations such as the World Health Organization (WHO) and the Food and Agriculture Organization (FAO) play very important roles in defining and promoting food safety and food security. WHO highlights public health, issuing guidelines to combat foodborne diseases and ensuring that food is safe for consumption. FAO ensures that international standards, guidelines, and practices for food safety are adhered to, particularly in the areas of food production and trade [Hanning et al. 2012]. There

is no consistent definition of food safety. For example, food safety can be summarized as safe (wholesome) foods because of production, manufacturing, processing, packing, or holding practices [Oyarzabal and VanRenterghem 2020]. Unsafe food containing harmful bacteria, viruses, parasites, or chemical substances is responsible for over 200 different diseases, ranging from diarrhea to cancer. This contributes to a detrimental cycle of disease and malnutrition, particularly affecting vulnerable groups such as infants, young children, the elderly, and those who are ill [WHO 2022]. Foods can be contaminated at any stage of the production process. Therefore, industries use control programs like Hazard Analysis and Critical Control Points (HACCP) to minimize food safety risks. Since the majority of foodborne illnesses are caused by microorganisms rather than foreign objects or allergens, HACCP plans often prioritize the reduction and prevention of pathogens. This targeted approach helps to effectively address the most common and harmful risks associated with food safety [Elbehiry et al. 2023].

Food security is primarily defined and prompted by the FAO, which is widely accepted by international organizations and commonly serves as a standard for developing policies and programs focused on eradicating hunger and enhancing food and nutrition security globally. The concept of food security has experienced several evolutions since the middle of the 1970s, and finally, the widely accepted definition was decided in 1996 at the World Food Summit and reinforced the multidimensional nature of food security [FAO 2006]: “Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life”. The definitions are:

- **“Food availability:** The availability of sufficient quantities of food of appropriate quality, supplied through domestic production or imports (including food aid).
- **Food access:** Access by individuals to adequate resources (entitlements) for acquiring appropriate foods for a nutritious diet. Entitlements are defined as the set of all commodity bundles over which a person can establish command given the legal, political, economic, and social arrangements of the

community in which they live (including traditional rights such as access to common resources).

- **Utilization:** Utilization of food through adequate diet, clean water, sanitation and health care to reach a state of nutritional well-being where all physiological needs are met. This brings out the importance of non-food inputs in food security.
- **Stability:** To be food secure, a population, household, or individual must have access to adequate food at all times. They should not risk losing access to food as a consequence of sudden shocks (e.g., an economic or climatic crisis) or cyclical events (e.g., seasonal food insecurity). The concept of stability can, therefore, refer to both the availability and access dimensions of food security”.

Despite the critical role of all main actors in ensuring effective food safety and security, there is a lack of comprehensive analysis of how varying levels of awareness among these stakeholders impact overall outcomes. Studies such as this one regarding food safety awareness among pre-retail (production, processing, logistics, and storage) food supply chain actors are relatively few, as most studies focus on retailers and consumption levels [Nordhagen et al. 2023]. This research addresses the problem of insufficient understanding regarding the significance of different players’ awareness of food safety and security throughout the food value chain. It aims to thoroughly examine the importance of awareness across all key food value chain participants. This review is structured by the importance of food safety and food security awareness, as well as the awareness, knowledge, and practices of food safety and food security among different players along the food value chain. In the end, we will provide possible solutions to raise awareness of food safety and food security.

LITERATURE REVIEW

The global food system has been encountering serious challenges due to the cascading effects of COVID-19, the Russo-Ukrainian war, and global warming [Deák 2023, Wu et al. 2023]. Especially Russia and Ukraine are playing increasingly important roles in the world’s food supply in terms of main crops (wheat, maize, barley, and sunflower seed), according to our

time series analysis [Deák 2023, Wu et al. 2024], and the war between them is still ongoing from 2022 till April 2024 [Murray 2024]. Food security issues can be the cause or the effects of conflict [Ahmad et al. 2021] as the Russo-Ukrainian war brings. As our previous research found, the risks and threats in agriculture are closely linked to global security changes and trends, such as globalization, demographics and security, natural risks, health security, the international system of governments, environmental security and biodiversity, and energy and infrastructure security [Wu et al. 2023]. As the prior research has proved, knowledge and information play important roles in strengthening food security, as it impacts the entire food system from production to consumption, and raising awareness is also one of the solutions to food insecurity problems [Ahmad et al. 2021]. However, a lack of awareness can also hinder the development of sustainable agriculture and continues to pose challenges, particularly in developing countries where educational campaigns on food safety remain underfunded and inadequately implemented [Grace 2015]. For example, organic farming is regarded as sustainable farming; however, the biggest obstacle to its development is a lack of awareness in India, where a large segment of the population remains unfamiliar with its advantages [Dev and Pandey 2022].

Similarly, Bangladeshi bakery enterprises are facing a lack of knowledge and practices related to food safety. Jubayer et al. [2020] examined the food safety knowledge, attitudes, and practices (KAP) among workers in the baking industry in Dhaka, Bangladesh. They found that while training improves knowledge and attitudes towards food safety, consistent application of this training in daily practices remains a challenge. They also advocate for continuous and comprehensive training programs to bridge this gap and enhance food safety in the bakery industry.

The importance of awareness regarding food safety and food security is evident across various sectors, both globally and nationally. According to the World Health Organization (WHO), one of their key responses to enhance national food control systems is by “promoting safe food handling through systematic disease prevention and awareness,” which helps member states improve global capabilities for preventing,

detecting, and responding to public health risks linked to unsafe food [WHO 2022]. Similarly, in India, a strategic focus has been placed on “food safety awareness and nutrition education” as one of the approaches to ensure safe and nutritious diets, thereby securing nutritional safety [Dev and Pandey 2022].

In some countries, raising the population’s awareness of food security is highlighted at a national level. For example, the 5-year plan of Afghanistan’s “Food Security and Nutrition Public Awareness and Advocacy Framework and Plan” [FAO 2018] was crafted through a comprehensive, collaborative process involving various stakeholders who utilized the social and behavior change communication (SBCC) approach and indicated that lack of public awareness of food security and nutrition is one of the current problems. This method (SBCC) involves a deliberate, organized approach to identify key obstacles and incentives for change. Following this, it focuses on crafting and executing a broad array of strategies and actions aimed at promoting positive behaviors and securing essential support from social and political spheres. It drives and facilitates significant enhancements in food security and nutrition across all levels and ensures that the development of the plan is both consultative and participatory, integrating insights and feedback from multiple perspectives to address the issues at hand effectively. The national plan highlights the crucial role of public awareness in tackling food security and nutrition challenges in Afghanistan. It stresses the need for a coordinated and well-informed public awareness campaign to address food insecurity and malnutrition throughout the country. By promoting a thorough understanding among all stakeholders and the broader public, the strategy seeks to achieve lasting enhancements in food security and nutritional health nationwide.

Overall, the literature consistently highlights that enhancing public awareness is a critical factor for both food safety and food security. Without targeted and sustained educational efforts, efforts to improve food systems and ensure public health remain inadequate. This gap in awareness presents a challenge to global food security goals, particularly in low- and middle-income countries where public health infrastructures are often underdeveloped [Grace 2015]. Therefore, fu-

ture efforts must focus on integrating awareness campaigns with broader policy and infrastructure developments to achieve lasting improvements in food safety and security.

AIM AND METHODS

This study aims to explore the critical importance of stakeholder awareness of food safety and security across the food value chain, highlighting how a lack of awareness can hinder sustainable agriculture development. In order to investigate the awareness of different players on food safety and food security along the food value chain, we first conducted this review to see the necessity of conducting future primary research on the topic. We analyzed extensive research to provide a comprehensive review via content analysis as a research method. The content analysis method is a systematic research approach used to evaluate and synthesize data from diverse sources. In this study, we applied this method to comprehensively review the existing literature, identify key themes, and extract

meaningful insights to offer a well-rounded understanding of the subject. Based on secondary data and literature, the extensive secondary research offers different perspectives, contributing to this inclusive review of how important different players' awareness of the food value chain is and the potential solutions to raise awareness on food safety and food security.

RESULTS

The awareness, knowledge, and practices of different players on food safety and food security along the food value chain

In order to explore the necessity of surveying different players' awareness of food safety and food security, we first researched previous researchers' work (survey and review) on the topic and made a summary. According to Porter's value chain concept [Porter 1985], we define the food value chain (Fig. 1) as five steps in this review, and the main players in the food value chain are farmers, transporters, processors, food service staff, and consumers as Figure 2 shows.

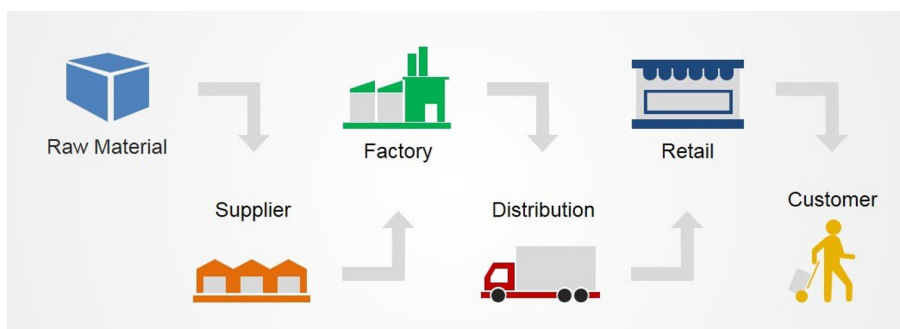


Fig. 1. Food value chain

Source: [Naina 2019].



Fig. 2. Main players in the food value chain

Source: [Nosratabadi et al. 2020].

Farmers

As the first step in the food value chain, farmers' awareness and knowledge about food safety and security are vital for effectively managing risks related to food production and enhancing the safety and reliability of the overall food supply chain. This awareness enables farmers to implement practices that minimize contamination and improve the quality of the food they produce, contributing significantly to public health and food security. The key points regarding farmers' awareness, knowledge, and practices of food safety and food security are summarized into four categories. **Climate change perception** [Harvey et al. 2018]: climate change severely impacts smallholder farmers, but their perceptions vary from different types of farmers, threatening poverty reduction, food security, and sustainable development globally. Comprehending how farmers adapt to climate change and what influences their adaptation choices is essential for crafting effective agricultural development strategies and policies to ensure food security. **Sustainable biological and chemical control** [Constantine et al. 2023]: farmers' awareness and knowledge significantly influence decision-making in pest management and food safety. The research also underscores the importance of cooperative research in improving farmers' adoption and understanding of biological control methods. Besides, the proper use of fertilizer and other nutrition supplements for crops is also of significance in food safety and food security. **Knowledge and innovation in agriculture** [Hassen and Bilali 2020]: knowledge and innovation practices can make agriculture more productive and sustainable, such as precision agriculture and smart agriculture. **Importance of biosecurity** [Li et al. 2023]: awareness of biosecurity is important for sustainable development, such as the biosecurity measures to prevent African swine fever. Currently, Chinese biosecurity policies are effective. It has also been proved that farmers' behavior regarding the adoption of biosecurity measures can be prompted by government regulations.

Besides the main points of farmers' awareness, knowledge, and practices in food safety and security, complying with regulations, participation in certifications, collaboration with other communities, and farm-

ers' awareness of market demand also can impact their decision-making, such as the increasing demand for organic products [Wu and Takács-György 2022].

Transporters

Transporters in the food value chain play a distinct and more passive role, as they have limited roles in food safety and quality, instead focusing mainly on delivering goods on time. This topic is also understudied and is given less policy attention. They generally lack involvement in food safety aspects and face significant logistical challenges such as high fuel costs and poor road conditions. Transporters are portrayed as external service providers with minimal interaction with other supply chain actors, which isolates them from broader food safety discussions and responsibilities. Clients generally do not impose penalties on transporters regarding food safety as long as there are no visible signs of spoilage or damage to the products during transit. However, this lack of direct accountability and engagement in food safety reflects a broader systemic issue within the supply chain [Nordhagen et al. 2023].

Processors

According to our research, there is an obvious lack of research on food safety and food security awareness among food processors. However, education for food processors has been paid attention to in the US. The Processors' Food Safety Toolkit, developed by the Northeast Center to Advance Food Safety (NECAFS), helps food processors in the Northeast US comply with the FSMA's Preventive Controls for Human Food Rule. NECAFS, an FDA/USDA-funded center, coordinates training and resources aimed at small to medium-sized food producers and processors to enhance food safety standards nationally [About Us... n.d.].

Food service staff

A survey about the levels of knowledge, attitudes, and practices (KAP) of food handlers in food services and restaurants conducted in Malé, Maldives, shows they generally possess adequate food safety knowledge and attitudes, with good safety practices noted except in "time and temperature control" and "food-borne pathogens". Knowledge was specifically affect-

ed by work experience, attitudes by education level, and practices by age, education, and work experience [Halim-Lim et al. 2023]. Another survey conducted in Espírito Santo, Brazil, shows similar results that food safety knowledge is regarded as sufficient, while the attitudes and practices need more education and training to be transformed from knowledge [Vitória et al. 2021], which was also proved by the survey in A1 Madinah Hospitals, Saudi Arabia [Alqurashi et al. 2019].

Consumers

Consumers' knowledge of food security and behavior of waste reduction is enhanced due to the COVID-19 pandemic, but the concerns about food safety remain the same before and after the pandemic [Erol et al. 2023]. A survey among students showed that knowledge and hygiene practices of food safety significantly impact awareness of food safety [Mohamed and Patwary 2021]. A survey about consumers' perception of food safety shows that highly educated female consumers were especially concerned about personal health risks and the safety of food content.

Gender, education level, and income significantly influence food safety perceptions. Women and educated consumers show higher food safety awareness. It also grouped the concerned food safety consumers by prioritizing hygiene and information on food content, particularly vitamins, minerals, and additives. Non-concerned food safety consumers care more about the price and bargains instead of the safety risks, and moderately concerned food safety consumers showed moderate attitudes toward food safety and health risks [Miftari et al. 2024].

Solutions to raise awareness of food safety and food security

As mentioned above about the necessity of surveying different players' awareness of food safety and food security, we accordingly provide some solutions from the different stages of the food value chain from the perspective of main stakeholders, such as education staff, governors, non-governmental organizations, media staff, scientific staff, and individuals (Fig. 3).



Fig. 3. Main stakeholders as solutions to raise awareness of food safety and food security

Source: authors' own construction.

Education

As the above proved, education has a significant role in raising awareness of food safety and food security for different players in the food value chain. The existing literature emphasizes education as a solution more extensively than other approaches. Online courses such as MOOCs [Stevens et al. 2020] can help to understand food security, promote sustainability brands, and take preventive actions against terrorist threats in the food and agriculture sector. Non-formal education and cross-sector collaboration among the youth can boost global citizenship and awareness of food security and sustainability through case study competitions and initiatives like the Young Earth Solutions competition and the Sustainable Development Solutions Network Youth division [Allievi et al. 2019]. A digital game such as the browser-based game Food Safety Quest in Canada is also an interesting format targeting the 12–18 age group [Lee and Fisher 2015] and allows players to experience food security challenges through role-playing characters in various scenarios. Food Safety Quest can also be played on mobile (Torontomu). The UN's International Day of Awareness of Food Loss and Waste effectively and inclusively advocates different sectors contributing to food loss and waste reduction [FAO 2022].

Government

The Food Security Cluster (FSC), led by the FAO and WFP, coordinates global food security responses during crises. It supports over 1000 partners to ensure effective interventions and collaborates with other clusters for comprehensive solutions. Governments lead national FSCs, implement anticipatory actions, and engage in policy advocacy. They enhance local capacity, integrate humanitarian and development approaches, and support resource mobilization and monitoring efforts (Food Security Cluster). The government's contribution to raising awareness of food safety and food security can also be indirect, such as the collaborative development of digital games [Lee and Fisher 2015], promoting food loss and waste reduction values through education [FAO 2022], and promoting sustainability through regulations, standards, and incentives for sustainable food production and marketing. A co-organized workshop between international

organizations and the government can highlight the workshop's role in raising awareness and sharing insights among policymakers. For example, a workshop in Tajikistan, organized by the FAO and local ministries, aimed to enhance government officials' skills in food security and nutrition, which includes training on international standards and improving policy decisions [FAO 2019a].

Civil society

Sustainable food production is key to food security (such as organic food), and demand for such products is growing. Brands use logos and labels (or food marketing) to highlight ethical and environmental attributes, influencing consumer willingness to buy, satisfaction, and loyalty [Franco and Cicatiello 2019]. The FAO Liaison Office in Geneva participated in the Festi Terroir festival in Geneva to raise awareness about food security, which aims to engage the community and youth with activities like sticker surveys on food waste and climate change and a quiz on food facts and the FAO's history. The event aimed to strengthen local ties and highlight the FAO's efforts in combating hunger and promoting sustainable agriculture [FAO 2023].

Media (journalists)

On February 17, 2019, the FAO conducted a two-day training course in Tsaghkadzor, Armenia, to raise journalists' awareness about food security and nutrition and aimed to improve the accuracy of their reporting. Fifteen journalists from national TV, radio, newspapers, and social media attended, learning about food security, safety, and micronutrient deficiencies. The event is part of an FAO project funded by Russia to enhance food security and nutrition in the region. Journalists found the training valuable and showed interest in further education [FAO 2019b].

Influencers

Influencers can significantly raise public awareness about food safety and food security due to their profound impact on people's daily lives. The solutions can be:

- create educational content explaining safe food practices and food security concepts; 2) collaborate with NGOs and government agencies to amplify

credible information;

- share personal stories to make the issues relatable; initiate challenges and calls to action to engage their followers;
- highlight innovations and solutions to inspire adoption and support for these initiatives.

While there isn't specific scholarly research focusing solely on the impact of influencers on raising awareness about food safety and food security, this concept can be understood as an extension of social media. Social networks, including influencers, play an important role in disseminating health information and providing support. It offers insights into applying social networking dynamics to health communication, potentially enhancing food safety and food security through increased awareness and education [Chung 2014].

Scientific staff

Research usually contributes to providing suggestions to policymakers. FAO suggests that research and academia engage in interdisciplinary research to understand the causes and drivers of food loss and waste, conduct applied research to address the complexities of reducing food loss and waste sustainably, help build the business case for reducing food loss and waste by quantifying potential benefits for food security, nutrition, and the planet, as well as identify potential trade-offs [FAO 2022].

Individual

Individually, we can reduce food waste at home, buy what we need, speak up to make wasting food unacceptable [FAO 2022], choose sustainable food (e.g., local food or organic food), learn basic food safety practices (e.g., food handling, cooking, and storage), keep informed about the latest food safety outbreaks via paying attention to trusted organizations (FAO, WHO, CDC [CDC 2022] or local authorities), join a food-related workshop as well as other social activities that we have mentioned above.

DISCUSSION

Awareness undoubtedly plays a crucial role in food safety and food security and in promoting sustainable agriculture as it impacts the entire food system from

production to consumption [FAO 2018, Jubayer et al. 2020, Dev and Pandey 2022, WHO 2022]. The findings of this study regarding the awareness of different players across the main food value chain stages were compared to the literature, and an importance assessment was also given according to three points, ranging from less important, important, and very important (Table 1).

Compared to the research contribution on the awareness of the food service and consumption stage, there is less focus on the beginning stages, such as production, transportation, and processing [Nordhagen et al. 2023]. In our discussion, we have extensively emphasized the significance of farmers, including their importance on climate change perception, sustainable biological and chemical controls [Constantine et al. 2023], knowledge and innovation in agriculture [Hassen and Bilali 2020], and the importance of biosecurity [Li et al. 2023]. Because of their limited roles and participation in the food value chain, transporters' and processors' awareness of food safety and food security is not well-researched [Nordhagen et al. 2023]. The awareness, knowledge, and practices of food service staff in food safety and security are often discussed, and it shows that even though the awareness is quite acceptable, the necessity of education and training in the transformation from knowledge to attitudes and practices should be addressed [Alqurashi et al. 2019, Vitória et al. 2021, Halim-Lim et al. 2023]. Consumers' awareness of food safety and security is also significantly influenced by knowledge [Mohamed and Patwary 2021] and demographic characteristics such as gender, education level, and income, as well as food prices [Miftari et al. 2024].

The solutions to raise different players' awareness of food safety and food security are proved broad and effective via different and innovative types of education [Lee and Fisher 2015, Allievi et al. 2019, Stevens et al. 2020, FAO 2022, Torontomu, n.d.], direct and indirect governmental interventions [Lee and Fisher 2015, FAO 2019a, FAO 2022, Food Security Cluster n.d.], civil society activities targeting local food markets and communities [Franco and Cicatiello 2019, FAO 2023], and training for media (journalists); [FAO 2019b], influencers [Chung 2014], scientific staff [FAO 2022], and individuals [FAO 2022].

Table 1. Comparison of findings and literature

Players and Stage	Findings	Literature	Importance level
Farmers (Production)	Farmers play a crucial role, with emphasis on climate change perception, sustainable biological and chemical controls, and innovation in agriculture.	Awareness of sustainable agricultural practices, including biosecurity, is vital but is under-researched, especially in the context of food security [Ben Hassen and El Bilali 2020, Constantine et al. 2023, Li et al. 2023].	Very important
Processors (Food Processing)	Limited focus on processors' awareness and roles in food safety/security.	Similar findings, with little research addressing the role of processors in maintaining food safety/security [Nordhagen et al. 2023].	Important
Transporters (Logistics)	Limited awareness and participation in the food value chain; under-researched compared to other players.	Research on transporters' and processors' awareness of food safety/security is scarce. Greater attention is needed on their roles [Nordhagen et al. 2023].	Less important
Food Service Staff (Retail)	Awareness is high, but there is a gap in transforming knowledge into attitudes and practices.	Staff knowledge is generally high, but consistent training is needed to convert awareness into consistent practices [Alqurashi et al. 2019, Da Vitória et al. 2021, Halim-Lim et al. 2023].	Very important
Consumers (Consumption)	Awareness of food safety/security is significantly influenced by knowledge, gender, education, income, and food prices.	Consumer awareness is strongly linked to demographic factors. Education campaigns targeting these aspects can improve awareness [Mohamed and Patwary 2021, Miftari et al. 2024].	Very important

Source: authors' own construction.

CONCLUSIONS

This study highlights the necessity of investigating the awareness of various actors in the food value chain regarding food safety and food security. Our findings underscore that understanding and improving awareness at each stage of the food system – from production to consumption – is critical for maintaining a sustainable food system, complying with regulatory standards, and enhancing consumer trust. While previous research predominantly focuses on food service staff and consumers [Alqurashi et al. 2019, Mohamed and Patwary 2021], our research uniquely advances the field by identifying the critical, yet often overlooked role of farmers at the production stage. The awareness of farmers directly impacts food safety and quality, as well as the ability to manage risks in agricultural practices, making their contribution essential for ensuring public health and food security.

Furthermore, we highlight gaps in the existing literature concerning transporters' and processors' awareness. While these actors are less emphasized in discussions of food safety, their role is not insignifi-

cant, especially in reducing food waste and ensuring the safe transportation of products across the supply chain. Our research adds value by drawing attention to the need for increased awareness and training among these groups.

This paper contributes to the existing body of knowledge in three key ways:

1. **Emphasis on Farmers' Awareness:** Unlike much of the existing research, which tends to focus on end-stage actors (e.g., food service staff and consumers), we underscore the importance of raising awareness at the beginning of the food value chain – particularly among farmers. By prioritizing awareness at the production level, we argue that public health outcomes and food security can be significantly enhanced.
2. **Addressing Underexplored Players:** We identify and advocate for more research and training focused on transporters and processors, whose roles in food safety and security, though critical, are often underestimated. This paper calls for interventions that include these actors to ensure a holistic approach to food safety across the entire food value chain.

3. Innovative Solutions for Awareness-Raising: Our research proposes novel strategies for increasing awareness besides traditional strategies. Beyond traditional education, government interventions, civil society activities, scientific work, and daily individual practices, we suggest leveraging the influence of digital media and internet influencers to communicate essential food safety messages. This “integrated communication” approach between value chain players and other stakeholders can serve as an effective model for raising awareness, particularly in a digital era.

Finally, the broader implications of this research extend to global food security and sustainability. As global citizens, we all share a responsibility to ensure a sustainable food system that supports public health and food security. The integrated communication strategies proposed in this paper emphasize the role of cross-sector collaboration and public participation in addressing global challenges related to food safety. By fostering awareness at every level of the food value chain and supporting coordinated efforts between stakeholders, we can collectively contribute to the sustainable development of our food systems and the planet.

According to our research, the research about awareness of different players in food safety and food security is not distributed evenly at different stages, and most research focuses on the retailer and consumption stages, which indicates a research gap [Nordhagen et al. 2023]. Food safety and food security are closely linked, but our research found that surveys about awareness of food security and food safety are usually two separate topics, and food security gets less attention in comparison. Therefore, we recommend that future researchers pay more attention to the survey study on food security awareness among different players in the food value chain, especially the beginning step – production.

REFERENCES

About Us, Processors' Food Safety Toolkit. (n.d.). Processors' Food Safety Toolkit. Retrieved from <https://pchf.necafs.org/> [accessed: 13.05.2024].

Allievi, F., Dentoni, D., Antonelli, M. (2019). The Role of Youth in Increasing Awareness of Food Security and

Sustainability. *Encyclopedia of Food Security and Sustainability*, 3, 39–44. <https://doi.org/10.1016/B978-0-08-100596-5.22021-0>

Alqurashi, N.A., Priyadarshini, A., Jaiswal, A.K. (2019). Evaluating Food Safety Knowledge and Practices among Foodservice Staff in Al Madinah Hospitals, Saudi Arabia. *Safety*, 5(1), 9. <https://doi.org/10.3390/safety5010009>

Ben Hassen, T., El Bilali, H. (2020). Knowledge and Innovation in Agriculture: Contribution to Food Security and Sustainability. [In:] Leal Filho W., Azul A. M., Brandli L., Özuyar P.G., Wall T. (eds) *Zero Hunger*. Springer International Publishing, Cham, 1–11.

CDC (2022). Food Safety Home Page. Retrieved from <https://www.cdc.gov/foodsafety/index.html> [accessed: 15.05.2024].

Constantine, K., Makale, F., Mugambi, I., Rware, H., Chacha, D., Lowry, A., Rwomushana, I., Williams, F. (2023). Smallholder farmers' knowledge, attitudes and practices towards biological control of papaya mealybug in Kenya. *CABI Agriculture and Bioscience*, 4(1), 18. <https://doi.org/10.1186/s43170-023-00161-7>

Da Vitória, A.G., De Souza Couto Oliveira, J., De Almeida Pereira, L.C., De Faria, C. P., De São José, J.F.B. (2021). Food safety knowledge, attitudes and practices of food handlers: A cross-sectional study in school kitchens in Espírito Santo, Brazil. *BMC Public Health*, 21(1), 349. <https://doi.org/10.1186/s12889-021-10282-1>

Deák, Z. (2023). Vulnerability of the Global Food Supply Chain. The 21st International Conference on Management, Enterprise, Benchmarking, Budapest: Óbuda University Keleti Károly Faculty of Business and Management, 207–215.

Elbehiry, A., Abalkhail, A., Marzouk, E., Elmanssury, A.E., Almuzaini, A.M., Alshahrani, M.T., Huraysh, N., Ibrahim, M., Alzaben, F., Alanazi, F., Alzaben, M., Anagreyyah, S.A., Bayameen, A.M., Draz, A., Abu-Okail, A. (2023). An Overview of the Public Health Challenges in Diagnosing and Controlling Human Foodborne Pathogens. *Vaccines*, 11(4), 725. <https://doi.org/10.3390/vaccines11040725>

Erol, I., Mutuş, B., Ayaz, N.D., Stowell, J.D., Sýrýken, B. (2023). Food Safety Awareness, Changes in Food Purchasing Behaviour and Attitudes towards Food Waste during COVID-19 in Türkiye. *Foods*, 12(24), 4396. <https://doi.org/10.3390/foods12244396>

FAO (2006). Food Security. Retrieved from https://www.fao.org/fileadmin/templates/faoitally/documents/pdf/pdf_Food_Security_Cocept_Note.pdf [accessed: 13.05.2024].

- FAO (2018). Afghanistan Food Security and Nutrition Public Awareness and Advocacy Framework and Plan 2018–2023. FAOLEX. Retrieved from <https://www.fao.org/faolex/results/details/en/c/LEX-FAOC189868/> [accessed: 13.05.2024].
- FAO (2019a). Raising awareness on coherent food security and nutrition approach in Tajikistan. Developing capacity for strengthening food security and nutrition. Food and Agriculture Organization of the United Nations. Retrieved from <https://www.fao.org/in-action/fsn-caucasus-asia/news/news-detail/en/c/1185479/> [accessed: 13.05.2024].
- FAO (2019b). FAO helps raise journalists' awareness on food security and nutrition topics in Armenia. Developing capacity for strengthening food security and nutrition. Organización de las Naciones Unidas para la Alimentación y la Agricultura. Retrieved from <https://www.fao.org/in-action/fsn-caucasus-asia/news/news-detail/es/c/1184271/> [accessed: 13.05.2024].
- FAO (2022). International Day Food Loss and Waste. FoodLossWaste. Retrieved from <https://www.fao.org/platform-food-loss-waste/flw-events/international-day-food-loss-and-waste/en> [accessed: 13.05.2024].
- FAO (2023). Fun in the Sun: FAO Spreading Awareness on Food Security. FAO in Geneva. Food and Agriculture Organization of the United Nations. Retrieved from <https://www.fao.org/geneva/news/detail/en/c/1651151/> [accessed: 13.05.2024].
- Food Security Cluster (n.d.). About Food Security Cluster. Food Security Cluster. Retrieved from <https://fs-cluster.org/page/about-food-security-cluster> [accessed: 15.05.2024].
- Franco, S., Cicatiello, C. (2019). The Role of Food Marketing in Increasing Awareness of Food Security and Sustainability: Food Sustainability Branding. *Encyclopedia of Food Security and Sustainability*, 3, 27–31. <https://doi.org/10.1016/B978-0-08-100596-5.22018-0>
- Grace, D. (2015). Food Safety in Developing Countries: Research Gaps and Opportunities. USAID White Paper.
- Halim-Lim, S.A., Mohamed, K., Sukki, F.M., David, W., Ungku Zainal Abidin, U.F., Jamaludin, A.A. (2023). Food Safety Knowledge, Attitude, and Practices of Food Handlers in Restaurants in Malé, Maldives. *Sustainability*, 15(17), 12695. <https://doi.org/10.3390/su151712695>
- Hanning, I.B., O'Bryan, C.A., Crandall, P.G., Ricke, S.C. (2012). Food Safety and Food Security. *Nature Education Knowledge*, 3(10), 9.
- Harvey, C.A., Saborio-Rodríguez, M., Martínez-Rodríguez, M.R., Viguera, B., Chain-Guadarrama, A., Vignola, R., Alpizar, F. (2018). Climate change impacts and adaptation among smallholder farmers in Central America. *Agriculture & Food Security*, 7(1), 57. <https://doi.org/10.1186/s40066-018-0209-x>
- Jubayer, F., Kayshar, S., Hossain, S., Uddin, N., Al-Emran, M., Akter, S.S. (2020). Evaluation of food safety knowledge, attitude, and self-reported practices of trained and newly recruited untrained workers of two baking industries in Dhaka, Bangladesh. *Heliyon*, 6(9), e05021. <https://doi.org/10.1016%2Fj.heliyon.2020.e05021>
- Lee, U., Fisher, S. (2015). Serious hunger games: Increasing awareness about food security in Canada through digital games. *Canadian Food Studies. La Revue Canadienne Des Études Sur l'alimentation*, 2(1), 157–176.
- Li, J., Yuan, M., Wang, H., Zhou, K. (2023). Government regulations, biosecurity awareness, and farmers' adoption of biosecurity measures: Evidence from pig farmers in Sichuan Province, China. *Frontiers in Sustainable Food Systems*, 7, 1106766. <https://doi.org/10.3389/fsufs.2023.1106766>
- Mahendra Dev, S., Pandey, V.L. (2022). Dietary Diversity, Nutrition and Food Safety. [In:] R. Chand, P. Joshi, S. Khadka (eds.), *Indian Agriculture Towards 2030*. Springer Nature Singapore, Singapore, 39–82.
- Miftari, I., Imami, D., Ahmadi Kaliji, S., Canavari, M., Gjo-kaj, E. (2024). Analyzing consumer perceptions about food safety by applying the food-related lifestyle approach. *Italian Journal of Food Safety*, 13(1), 11315. <https://doi.org/10.4081/ijfs.2024.11315>
- Mohamed, M., Patwary, A. K. (2021). Measuring Students' Awareness of Food Related Factors: The Role of Attitude, Price, Hygiene, and Food Safety. *Journal of Entrepreneurship and Business*, 9(2), 70–85. <https://doi.org/10.17687/jeb.v9i2.803>
- Murray, W. (2024). Ukraine war briefing: Kharkiv residents suffer as Russia intensifies attacks. *The Guardian*, Retrieved from <https://www.theguardian.com/world/2024/may/01/ukraine-war-briefing-kharkiv-residents-suffer-as-russia-intensifies-attacks> [accessed: 15.05.2024].
- Nafees, A., Shahnawaz, S.K., Muzafar, H., Sajid, Q., Zaid, A. (2021). Food Insecurity: Concept, Causes, Effects and Possible Solutions, *IAR J Huma Soc Sci*, 2(1), 105–113. <https://doi.org/10.47310/iarjhs.2021.v02i01.024>
- Naina, K. (2019). Primary Functions of Supply Chain Management You Must Know. *All About Finance*. Retrieved from <https://allabout.finance.blog/2019/04/15/primary-functions-of-supply-chain-management-you-must-know/> [accessed: 15.05.2024].
- Nordhagen, S., Onuigbo-Chatta, N., Lambertini, E., Wenndt, A., Okoruwa, A. (2023). Perspectives on food safety

- across traditional market supply chains in Nigeria. *Food and Humanity*, 1, 333–342.
- Nosratabadi, S., Mosavi, A., Lakner, Z. (2020). Food Supply Chain and Business Model Innovation. *Foods*, 9(2), 132. <https://doi.org/10.3390/foods9020132>
- Oyarzabal, O.A., VanRenterghem, B.B. (2020). The Meaning of Food Safety. Retrieved from <https://www.food-safety.com/articles/6545-the-meaning-of-food-safety> [accessed: 15.05.2024].
- Porter, M.E. 1985. *Competitive advantage: Creating and sustaining superior performance*. Free Press, Collier Macmillan, New York, London.
- Stevens, C.J., Whittle, R., Davies, W.J., Taylor, J.E. (2020). Raising awareness about food security using a massive open online course. *Plants, People, Planet*, 2(2), 140–143. <https://doi.org/10.1002/ppp3.10069>
- Torontomu (n.d.) *The Food Security Quest*. Toronto Metropolitan University. Retrieved from <https://www.torontomu.ca/open-learning/modules/food-security-quest/> [accessed: 14.05.2024].
- WHO (2022). Food safety. Retrieved from <https://www.who.int/news-room/fact-sheets/detail/food-safety> [accessed: 15.05.2024].
- Wu, Y., Takács-György, K. (2022). Comparison of Consuming Habits on Organic Food – Is It the Same? Hungary Versus China. *Sustainability*, 14(13), 7800. <https://doi.org/10.3390/su14137800>
- Wu, Y., Babos, T., Takács-György, K. (2023). The importance of agriculture, in the light of global security changes and trends. *Precision Agriculture*, (2), 80–99.
- Wu, Y., Hanka, L., Takács-György, K. (2023). Élelmiszerválság az Orosz-Ukrán iné war háború tükrében (Food crisis due to the Russia-Ukrainian war). *Industrial and Operational Safety*, 5(3), 107–117.
- Wu, Y., Hanka, L., Takács-György, K. (2024). Változások a termény világgpiacán: milyen lesz az élelmiszerellátás az Orosz-Ukrán háború nélkül? (Changes in the world crop market: what will the food supply be like without the Russian-Ukrainian war?). *Food Safety*, 6(1), 9–26.

KRYTYCZNE ZNACZENIE OCENY ŚWIADOMOŚCI INTERESARIUSZY W ZAKRESIE BEZPIECZEŃSTWA ŻYWNOŚCI I OCHRONY ŻYWNOŚCI W CAŁYM ŁAŃCUCHU WARTOŚCI ŻYWNOŚCI

STRESZCZENIE

Cel: Badanie ma na celu ocenę krytycznego znaczenia świadomości interesariuszy w zakresie bezpieczeństwa żywności i ochrony żywności w całym łańcuchu wartości żywności. Brak świadomości może utrudniać rozwój zrównoważonego rolnictwa. Dlatego poddano ocenie, dlaczego świadomość bezpieczeństwa żywności i ochrony żywności jest niezbędna dla różnych interesariuszy w łańcuchu wartości żywności.

Metody: Przeprowadzono kompleksowy przegląd literatury, w celu zbadania poziomu świadomości wśród różnych interesariuszy, od rolników po konsumentów, w zakresie bezpieczeństwa żywności. Przegląd skupił się na identyfikacji kluczowych czynników, które wpływają na zaangażowanie i świadomość interesariuszy w całym łańcuchu wartości żywności.

Wyniki: Analiza wykazała, że świadomość interesariuszy w zakresie bezpieczeństwa żywności i ochrony żywności znacznie zwiększa środki bezpieczeństwa żywności, promuje zrównoważony rozwój, zapewnia zgodność z przepisami i poprawia ogólną wydajność. Jednocześnie ogranicza ilość odpadów, wzmacnia zaufanie konsumentów, buduje lojalność wobec marki i rozwiązuje globalne wyzwania żywnościowe. Ponadto badanie wykazało, że świadomość rolników na wczesnych etapach łańcucha wartości żywności jest równie ważna, jak świadomość uczestników końcowych etapów, takich jak pracownicy gastronomii i konsumenci.

Wnioski: Zrozumienie poziomu świadomości bezpieczeństwa żywności i ochrony żywności wśród interesariuszy jest kluczowe dla promowania zrównoważonego rozwoju, poprawy bezpieczeństwa żywności i zapewnienia przestrzegania przepisów w całym łańcuchu wartości żywności. Zwiększanie świadomości, szczególnie na etapie rolnictwa, jest kluczowe dla poprawy ogólnej skuteczności inicjatyw w zakresie bezpieczeństwa żywności i ochrony żywności.

Słowa kluczowe: bezpieczeństwo żywności, bezpieczeństwo żywnościowe, zrównoważony rozwój, influencer, świadomość, łańcuch wartości