

EDITORIAL

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Challenges in the agri-food industry under global sustainability strategies

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1 Towards sustainable, safe and resilient food systems

The new Common Agricultural Policy (CAP, 2023–2027), the European “Farm to Fork” strategy, and the FAO’s “Four Betters” agenda collectively reflect a global consensus: our food systems must become more sustainable, inclusive, and resilient while ensuring food security and safety. These international frameworks emphasize fair income for farmers, competitiveness, climate action, biodiversity preservation, food safety, and innovation. This Editorial introduces the Collection ‘Challenges in the Agri-Food Industry under Global Sustainability Strategies’ which brings together twelve papers that collectively address the multidimensional challenges of food systems under the umbrella of sustainability strategies (<https://link.springer.com/collections/bhiihgbbi>). This collection is organized into four key themes: (i) Food Security and Socioeconomic Perspectives, (ii) Sustainability and Innovation in Food Systems, (iii) Food Safety and Quality, and (iv) Plant and Animal Health in Food Production Systems.

2 Food security and socioeconomic perspectives

There are four papers within the first topic, dealing with Food Security and Socioeconomic Perspectives: Gender differentials and distributional effect of climate-smart agriculture practices on farm production and welfare in Nigeria; Seasonal price variation analysis of palm oil: case study of Nigeria (2016–2022); Production efficiency of wheat farmers in the Arsi Zone, Oromia Region of Ethiopia; and, Food Security: The impact of migrants and remittances in Sri Lanka.

These four contributions went beyond isolated case studies to paint a comprehensive picture of the socio-economic drivers of food security in low- and middle-income countries. A shared insight was the central role of access—whether to resources, markets, information, or credit—as a determinant of food security outcomes. Across Nigeria, Ethiopia, and Sri Lanka, education and extension services consistently emerge as enablers of adoption and efficiency, while infrastructure and market barriers remain persistent constraints. The scientific contributions revealed contrasting policy dilemmas: while CSA adoption and mechanization clearly improve welfare, remittance-driven consumption patterns may not always lead to healthier diets. This points to the need for integrated policies that combine productivity-enhancing interventions with



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nutrition-sensitive approaches. Methodologically, the use of sex-disaggregated data, stochastic frontier models, and multivalued treatment effect models represent valuable innovations that help disentangle complex socio-economic relationships.

3 Sustainability and innovation in food systems

There are three manuscripts in this collection addressing the second topic—Sustainability and Innovation in Food Systems: Food sustainability 4.0: harnessing fourth industrial revolution technologies for sustainable food systems; Application of fruit and vegetable processing by-products as ingredients in aquafeed; and A multitrophic culture system for the production of black soldier fly larvae (*Hermetia illucens*).

These three contributions provided a forward-looking view of how innovation can drive food system sustainability. They collectively underscored the potential of circular economy approaches—such as valorisation of by-products and insect-based waste recycling—to reduce pressure on natural resources and create new value chains. The concept of Food Sustainability 4.0 was particularly significant, as it bridges digital transformation and food production, offering tools to improve traceability and transparency. Methodologically, the inclusion of experimental systems (e.g., multitrophic insect culture) alongside large-scale literature reviewed strengthens the evidence base and showed both technological feasibility and research gaps. The main challenge, shared by all three studies, lied in scaling these solutions, aligning regulatory frameworks, and ensuring economic viability.

4 Food safety and quality

Two original papers have been published in this collection which address the third topic—dealing with Food Safety and Quality: A mini cutting-edge review of the levels of polycyclic aromatic hydrocarbons and their health implications in some vegetables in Nigeria; and Multivariate investigation of physicochemical, nutritional and sensory attributes of traditional Lebanese grape molasses.

Viewed together, these studies highlighted that food safety challenges remain a significant barrier to achieving healthy diets, particularly where regulation and monitoring are limited. A common message was the need for consumer education and the implementation of hygiene and safety standards, both at the production and household levels. The mini review on PAHs emphasized preventive measures (washing, saline rinsing) that can be readily adopted, while the work on grape molasses pointed to the importance of establishing quality control frameworks to ensure safety and market competitiveness. These papers reminded readers that food security is not only about quantity and access but also about ensuring that food is safe and nutritious.

5 Plant and animal health in food production systems

There are three papers within the fourth topic, dealing with Plant and Animal Health: Comparative growth analysis of *Raphanus sativus* L. (Radish): effects of vermiwash and vermicompost applications on plant development; Status of postharvest papaya anthracnose (*Colletotrichum gloeosporioides*) in Assosa Zone, Western Ethiopia; and Perceptions of veterinary extension staff regarding poultry feed and ingredients in selected districts of Uganda: a qualitative study.

Collectively, these studies reinforced the message that plant and animal health is a cornerstone of food system resilience. They highlighted both biological and institutional challenges—from crop diseases like papaya anthracnose to systemic weaknesses in feed regulation—that threaten productivity and farmer livelihoods. Importantly, they offered practical entry points for intervention: improved soil management through organic amendments, better postharvest handling practices, and enhanced regulatory oversight. Together, these findings called for capacity-building efforts and integrated management strategies to safeguard plant and animal health while advancing sustainable production.

6 Conclusions

Taken together, the twelve papers presented in this collection provide a rich and multifaceted perspective on food security, sustainability, safety, and production health. They collectively underscore the complexity of transforming food systems in line with international agendas such as the CAP, the Farm to Fork Strategy, and the FAO Strategic Framework. Importantly, the studies highlight both the advances already being made—from digital innovations to circular practices—and the persistent gaps in policy, regulation, and knowledge transfer that require urgent attention. This collection not only offers valuable evidence and practical solutions but also reinforces the need for further interdisciplinary research. Moving forward, collaboration between researchers, policymakers, and stakeholders will be essential to ensure that food systems are not only productive and competitive but also equitable, sustainable, and resilient-leaving no one behind.

Published online: 20 October 2025

References

1. Topical Collection. Challenges in the Agri-Food Industry under Global Sustainability Strategies. *Discover Food*. <https://link.springer.com/collections/bhiihgbbi>

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